CONSTRUCTION STANDARDS

VERSION “2017”
(RELEASED JANUARY 2017)

TEXAS STATE UNIVERSITY
The rising STAR of Texas
TO ACCESS THE TEXAS STATE UNIVERSITY CONSTRUCTION STANDARDS GO TO THE FOLLOWING WEB ADDRESS:

http://www.facilities.txstate.edu/pdc/Projects_Documents/Construction-Standards.html

THE 2006-2017 MASTER PLAN AND UPDATE WEB ADDRESS IS:

http://www.fss.txstate.edu/cmp-update/
# Texas State Construction Standards

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I. INTRODUCTION

1.01 Guide for Design and Construction of Physical Facilities for Texas State University and Satellite Campuses

A. The following design guidelines and construction standards for planning, design and construction at Texas State University and satellite Campuses shall serve as a guide to the architects and engineers engaged by the University to plan new campus buildings or the renovation of existing buildings and site work.

B. Nothing in these standards is intended to be specific to the conditions of any particular project. It is the design professional’s responsibility and liability to determine that the specific project requirements have been included within the design and the construction documents. The design professional is liable to the extent provided by law for all design decisions regarding any specific project and neither these standards, the review by University representatives, nor the approval of the design by the University shall constitute a waiver or disclaimer of liability of the design professional.

C. These design guidelines and construction standards are not intended to be an exhaustive set of instructions of good practices for planning design and construction of University buildings.

D. These design guidelines and construction standards are, however, intended to be a set of instructions to those who will be planning designing and constructing facilities for Texas State University campus and satellite campuses. They convey the particular needs and policies of this University with regard to development of its physical facilities.

E. Because of the monumental scope of planning, design and construction, these design guidelines and construction standards will be continually expanded and updated to document changing needs so as to maintain their continued relevance.

F. There will be no variance from these Design Guidelines and Construction Standards by the A/E firm without the written approval of the Texas State University Project Representative.

1. The A/E Team shall review and conform to these design guidelines and construction standards and shall provide Texas State University written certification that these standards have been met, before the construction documents are issued for bid.

   a. If there is a variance to using a design guideline or Construction Standard on a project during the design, it is
the responsibility of the A/E to bring it to the attention of the Texas State University Project Representative in writing.

b. During the design review phase, it is the responsibility of the A/E to ensure that the facility is built in accordance with these Design Guidelines and Construction Standards.

c. The A/E is required during submittal review to specifically point out any variances to these Construction Standards that the A/E is recommending for approval.
I. INTRODUCTION

1.02 Campus Architectural Unity.

A. It is the University's philosophy that our campus will have the greatest visual appeal with a homogeneous quality resulting from utilization of the same architectural building style, with enclosing materials.

B. The same building material with a strong visual impact when repeatedly and consistently used becomes a unifying force, which can protect continuity to the Campus building style.

C. The achievement of an order and beauty through a powerful visual unity of all campus architecture is to be a paramount objective of the design of all future University buildings and satellite campuses.

D. To the greatest extent possible the same design objective is to apply to major renovations of exteriors of existing buildings and site work.

E. Refer to the Texas State University 2006-2017 Master Plan Document for the Components of the Campus Architectural Unity.

The web site link to the entire master plan and 2017 Update document is: http://www.fss.txstate.edu/cmp-update/

The summary of these Master Plan Design Guidelines are defined in these Construction Standards, III. Design Guidelines, 1.01 Master Plan Adherence, A, 2, b.
I. INTRODUCTION

1.03 Codes, Rules, Laws, & Requirements.

A. Buildings and sites are to be designed in conformance to the applicable requirements of the following:

1. The Texas Engineering Practice Act and the Texas Board of Professional Engineers Rules

2. The Architects’ Registration Law and the Texas Board of Architectural Examiners Rules and Regulations

3. Texas Health Asbestos Protection Act and Texas Asbestos Health Protection Rules

   a. A notarized affidavit signed by the project architect, stating no materials containing lead or asbestos have been used in the project must be submitted to the University prior to final acceptance of the project as per Texas State University UPPS No. 04.05.09. The A/E shall require like affidavit from the contractor

4. National Fire Codes

   a. NFPA 101, Life Safety All concept or design submittals shall address fire protection and life safety criteria and shall be submitted as separate analyses including: The following fire protection engineering provisions, where applicable to the project shall be included in this analysis.

   b. NFPA standard 170, fire safety symbols shall be used for Architectural and Engineering drawings.

   c. Areas for analysis are as follows:

      (1) Type of construction;

      (2) Classification of occupancy;

      (3) Building separation or exposure protection;

      (4) Location of all fire rated walls including fire rated doors, and fire dampers with identification as
applicable (include fire walls, fire partitions, smoke compartments);

(5) Life safety provisions (exit travel distances, exit widths based on capacity and occupant load, number of exits, exit signs, emergency lighting and secondary power requirements);

(6) Automatic extinguishing systems (identification of all sprinkled areas and other areas protected by specialized suppression systems);

(7) Smoke/Control management systems, dampers, and smoke partitions. The smoke control system shall be identified by schematic diagram, where applicable, that indicates the operation of the normal HVAC mode and the smoke removal mode;

(8) Fire alarm system (type of alarm system and location of the fire alarm equipment with fire zones);

(9) Fire detection system (type of detection system and location of detectors with fire zones);

(10) Location of fire extinguisher cabinets and standpipes/hose cabinets.

d. The State of Texas Fire Marshall’s Office, through the State of Texas Department of Insurance, 333 Guadalupe, Austin, TX 78714, 512-305-7900, is the Fire Marshall authority having jurisdiction over University projects.

(1) **State Fire Marshal Life Safety Code Rule Revision:** The Commissioner of Insurance has adopted a revision for Fire Marshal Inspections that updates the rule to the 2012 edition of the National Fire Protection Association Life Safety Code 101. The exception is Chapter 43 of the 2006 edition which deals with facility remodeling and renovation. In this case, the provisions of the 2003 edition remain in effect. This action was taken under the authority of the Texas Government Code 417.08. The rule is codified in the Texas Administrative Code 28 TAC 34.303.
(2) **Cooperation with Local Fire Departments:** All state universities and agencies depend on local fire departments for emergency response and fire suppression. These local fire departments must have confidence that state-owned buildings and fire safety systems meet state standards and are compatible with local fire department equipment and procedures so their firefighters can safely and promptly respond to emergencies.

(3) **Steps to foster positive relationships w/local fire departments:**

Universities and agencies should initiate meetings with local fire departments to open lines of communication and determine correct fire response procedures.

The Texas State University Environmental Health, Safety, & Risk Management Department involved in safety, planning, operation, and maintenance must be made aware of the responsibilities they have for the compatibility and use of campus or agency equipment by the local emergency responders. All third-party contractors, architects, and engineers providing design and construction must assure the university or agency that the Life Safety Code has been taken into consideration and addressed in the planning, design, construction and operation of facilities.

The A/E is responsible to have drawings reviewed by the Texas State University Environmental Health, Safety, & Risk Management Department, before drawings are issued for bidding. Local fire departments should be consulted for local requirements and needs in water mains, building access, fire lanes and turning radius requirements, compatibility of fire hydrants, fire department connections, fire sprinkler systems, standpipe and hose systems, alarm systems, and other emergency equipment. These systems must be designed with the local department’s operation in mind. Local fire departments should be invited to review the plans, and to participate in viewing acceptance tests of, water mains and fire
Questions concerning fire safety practices can be addressed to firemarshal@tdi.state.tx.us or by calling the Texas State Fire Marshal Office at 512-305-7900.

5. OSHA Standards

6. Texas Accessibility Standards and the Americans with Disabilities Act (ADA), (Article 9102, Texas Civil Statues).
   a. Texas Accessibility Standards and the Americans with Disabilities Act (ADA), (Article 9102, Texas Civil Statues). ADA accessibility of all buildings and facilities will be designed by the standards published by the State of Texas Licensing & Regulations Commission and the American National Standards Institute ANSI Standard A117.1, and the Americans with Disabilities Act.
   b. Texas State University requires the mounting height for “Push Button” of Automatic Door Openers, to be 36” A.F.F., no exceptions.
   c. The A/E must develop Site Plans which indicate the Accessible Way from the Project to the closest “Public Way”, to include accessible parking spaces, public or University Bus Stop.
      The A/E must design all new “Accessible Path” to meet TAS.
   d. The A/E shall submit final plans and specifications to the Department of Licensing & Regulation for review concurrently with the issue of plans for building.
   e. The A/E shall pay the required fee.
   f. The A/E shall issue addendum or change proposals as necessary to correct deficiencies detected by the Department of Licensing & Regulation at no charge to the University.

8. ASHRAE Handbooks

   a. Each new building or major renovation shall be designed to be energy efficient in accordance with the State Energy Conservation Office (SECO) requirements. SECO adopted by reference ASHRAE/IENSA Standard 90-01-2010. The code applies to any state-funded new construction or major renovation project, except low-rise residential buildings.
   b. Before beginning construction of a new state building or major renovation project an institution of higher education must submit to SECO a copy of the certification by the design architect or engineer that verifies that the construction or renovation complies with the standards that are established under 34 TAC, Chapter 19.34, including engineering documentation. A Water Compliance Certification Form is required for buildings greater than 10,000 square feet.


11. OSHA Code of Federal Regulations (CFR) Article 29 Labor Part 1926.32 (p). This code is mandatory for all Electrical Work.


13. 2012 International Mechanical Code

14. 2009 Uniform Plumbing Code

15. SMACNA Handbook

16. American Concrete Institute (ACI)

17. American Society for Testing and Materials (ASTM)

18. CRSI Handbook of Recommended Practice for placing reinforcing bars, bar supports, specification and nomenclature

19. National Ready-Mixed Concrete Association Publication: Concrete Plant Standards and Truck Mixer and Agitator Standards


22. Projects involving Site Work shall be designed to adhere to the U.S. Environmental Protection Agency’s National Pollutant Discharge Elimination System (NPDES). The University is subject to Storm Water Discharge from small municipal separate storm sewer system (MS4) under the TPDES Phase II MS4 Permit (TXR040000). The University’s Construction and Post Construction Plan contains procedures that will be followed to maintain compliance with the TCEQ small MS4 General permit.

23. MSDS
   
a. The A/E is to require the contractor to provide a copy of all MSDS sheets for all building products and chemicals used during the construction process to be forwarded to the Office of Facilities Planning, Design and Construction at the closure of the project.

b. OFPDC retains the right to withhold final payment to the A/E and contractor until such time as all MSDS sheets are received.

B. Street cutting for street under the jurisdiction of San Marcos shall require permitting in accordance with the city’s Department of Public Works.

1. Instructions for permitting and permit form available at www.ci.san-marcos.tx.us.

C. Work performed wholly within Texas State University Campus property is not subjected to permit requirements of the City of San Marcos. The A/E or Contractor as may be applicable shall acquire permits required by State and Federal agencies.

D. Where an applicable code, statute or regulation addresses the requirements set forth in these standards, the most stringent requirement shall be included in the construction documents.

E. If any requirements of these standards are deemed to be in conflict with applicable codes, statutes, regulations or other Texas State University standards, immediately notify in writing Texas State University project representative.
I. INTRODUCTION

1.04 Modification Procedures

A. The Texas State University Design Guidelines and Construction Standards are intended to be a continually evolving document.

B. As new systems, components and techniques become available and they are deemed appropriate for use as a standard at Texas State University, they will be incorporated into these Standards.

C. As standard details and systems are tested in the field and modification is deemed appropriate, those changes, refinements and modifications will be incorporated into these Standards.
I. INTRODUCTION

1.05 Status of the Design Guidelines & Construction Standards

A. The Design Guidelines & Construction Standards are the property of Texas State University at all times and are intended solely for projects on Texas State University campuses. They are not to be used on projects outside of Texas State University campus and satellite campuses.

B. These Design Guidelines and Construction Standards shall be provided to those individuals and firms who are providing planning, design and construction services to the Texas State University.
II. DOCUMENT DELIVERABLES

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2.01  Programming & Forms
2.02  Texas State BIM-FM Requirements
2.03  Schematic Design for Review by FPDC
2.04  Design Development Review and Approval Documents
2.05  Example Submittal Layout for Design Development Package
2.06  100% Detail Plan Construction Document Review and Approval
2.07  Bidding Phase
2.08  Color Selection Review and Approval
2.09  Closeout Documents
II. ARCHITECTURAL/ENGINEERING DOCUMENT DELIVERABLES

2.01 Programming

A. The programming for most large Capital Projects will be performed by an independent Program Consultant, hired by the University or the Texas State System Office. The final approved program will be delivered to the A/E for its use and review.

B. The following Program Deliverables apply when the A/E is contracted for these services.

1. The A/E shall meet and interview the Owner and all other stakeholders to document the programming, space and equipment requirements and limitations and inspect the Project site or sites.

2. The A/E shall prepare a written Building Program Document for approval by the Owner, which complies with the Owner’s latest Construction Standards. The Program is due for approval by the Owner, no more than 50 days after award of the A/E Contract.

3. The Programming Document shall be in an 8 1/2” x 11” format size, in a 3-ring binder, with necessary tabs to separate the various Departments, Groups, etc., to facilitate the Owner’s identification. Submit eight (8) copies for the Owner’s review and approval.
# TXST BIM-FM Requirements

## Table of Contents

- E.0 – Section 0 – Executive Summary
- E.1 – Section 1 – Strategy and Objectives
- E.2 – Section 2 – BIM Execution Plan
  - Exhibit 2.A – Sample Project Schedule
  - Exhibit 2.B – Close-Out Procedures
- E.3 – Section 3 – FM Data Requirements
  - Exhibit 3.A – Responsibility Matrix
  - Exhibit 3.B – Facilities Data Integrator
  - Exhibit 3.C – Asset Type Matrix
  - Exhibit 3.D – FM Model Criteria
E.0 – Section 0 - Executive Summary

Building Information Modeling (BIM) and Facilities Management (FM) Data Requirements

Section 1 – Strategy and Objectives

Knowing the strategy and objectives of Texas State University (TXST) in Building Information Management for Facilities Management (BIM for FM) is important for all project delivery teams (AEC + CxA) in order to satisfy the expectations and project requirements. The strategy and objectives section states that the BIM for FM process and documentation was undertaken by TXST in order to provide direction and to equip project teams for facilities management data specification, collection, validation, and ultimately handover to TXST. Handover deliverables shall be in a digital format and support operational objectives and efficiencies, such as import to the asset management (CMMS - Computerized Maintenance Management System) system AiM by AssetWorks.

Section 2 - BIM Execution Plan (BEP)

Developing and communicating a clear plan for carrying out BIM for FM is necessary for each project team. The BIM Execution Plan (also referred to as a BEP) section provides an outline and framework for planning how BIM for FM is to be accomplished at the project level. The overall intent is to allow and require project delivery team members to communicate to TXST how they intend to meet the BIM for FM requirements. Each member of the AEC team shall submit a plan per the stated requirements in this section. The Facilities Data Integrator (FDI) receives each plan and reviews it according to the contracted section requirements for that team member. This plan outlines items such as: company roles, contact information, AEC team collaboration procedures, information exchange schedules, quality control procedures, and others. Submitted execution plans enable the Facilities Data Integrator (FDI), an agent of the owner (TXST), the ability to better guide and manage teams to accomplish BIM for FM deliverables. The BEP allows teams to demonstrate how they will comply with the prescriptive requirements as well as the performance based requirements. This leaves room for project delivery teams to impose their own means and methods where prescriptive requirements do not exist.

Section 3 - FM Data Criteria

The FM Data Criteria is the largest section of the BIM for FM Requirements documents. It is a detailed specification and guide to understanding how project information shall be organized and delivered to Texas State. This is the most prescriptive part of the BIM for FM process due to the specific and structured data requirements for TXST’s configuration of AiM. This section outlines what data is to be collected (i.e., what do we need), in what format (i.e., how do we need it delivered), division of responsibility (i.e., who is to collect specific information), and deliverable schedules (i.e., when are...
the milestone deliverables over the project’s duration). This level of detail is required in order to properly communicate and contract these requirements with the project delivery team members in each standalone contract with the owner (i.e., AE, CM, CxA, others). In the absence of this level of detail, confusion will be present and the process for BIM for FM will break down. This section introduces a role called the Facilities Data Integrator (FDI) to the project delivery team who is chosen by the owner to manage and ensure correct execution of BIM for FM data requirements and process across the entire project delivery process. This section references attachments and specific Texas State University roles for providing the latest version of the San Marcos facilities-specific data to be incorporated into projects. Requirements for other campuses will differ for many reasons such as the CMMS platform being employed by the campus, the data configurations for the CMMS, and the content valued by the owner at that campus to name a few.
E.1 - Section 1: Strategy and Objectives

Explanation of the BIM Strategy and Objectives

Texas State University (TXST) desires to use technology to improve construction projects and the way they are handed over, keeping in mind operational objectives and efficiency. The strategy and objectives of TXST in Building Information Modeling for Facilities Management (BIM for FM) is important for all project delivery teams (AEC + CxA) in order to satisfy expectations and project requirements. This section describes the reasoning behind BIM for FM process and documentation was undertaken by TXST, and explains the intent to provide direction and to equip project teams for facilities management data specification, collection, validation, and ultimately handover to TXST. Handover deliverables shall be in a digital format and support operational objectives and efficiencies, such as import to the asset management (CMMS - Computerized Maintenance Management System) system using AiM by AssetWorks. Through the establishment of BIM for FM requirements, TXST will obtain consistent and useful handover deliverables (digitally formatted) that support operations and maintenance for many years to come. TXST’s intent is to facilitate and produce a repeatable process at the San Marcos campus that can be employed on capital projects of various sizes.

The intent of this document is not to add unreasonable scope upon individual project team members, but rather to provide a method and format for capturing useful project information that is already being managed throughout the planning, design, construction, and commissioning phases. In some cases, project team members will realize efficiencies by following these guidelines and having a consistent project repository of facility data and associated documents. For other team members that already use a thorough system for tracking project spaces, equipment, and documents, this guideline will have little impact upon their current project workflows other than to specify the owner’s requirements. By TXST investing in the development of this process, they will be able to contract for these requirements in the course of the normal project delivery process, reduce change orders, reduce rework, and allow project team members the opportunity to align their project delivery processes and data management processes in advance of the performance of work. This alignment is intended to eliminate rework situations and streamline the project delivery process for digital data and documents for handover and integration by the Facilities Data Integrator (FDI) into the owner’s operations and maintenance systems, namely AiM by AssetWorks.

TXST requires BIM to be used in a way that supports evolving and advancing operational and maintenance workflows. Some specific BIM uses that the project team will be required to support include but are not limited to: 1) record set 3D design model, 2) as-built/as-coordinated 3D trade models, 3) Federated/combined trade model (in Navisworks NWD format), and 4) FM data set (in COBie format) with associated documents to be imported to AiM by the Facilities Data Integrator (FDI). The process established and confirmed by TXST does not require each project delivery team member to be a 3D modeling subject matter expert or a COBie subject matter expert. Instead, the project team members are required to provide elements of the facilities management data set requirements over the life of the project in an open-standard format or in a manner that enables the
Facilities Data Integrator (FDI) to extract the same information using industry standard tools and software. These project details will be documented and confirmed by the approval of the BIM Execution Plan (BEP) elements for each team member. BEP revisions may be required as team members are added and as the overall plan evolves for the project team members. One of the FM Data Integrator's roles is to manage the overall BIM-FM Data process and oversee the compilation (i.e., integration) of the FM Data while ensuring that configuration control is maintained for revisions and changes over the lifecycle of the project. Thus, team members are expected to provide the same type of project information they normally produce for use at specific points in the project lifecycle. These are outlined along with the specific details of the role of FM Data Integrator in other sections of the specifications. The BIM Execution Plan (BEP) will outline and document the project specific processes to be employed and will provide a mechanism for owner review and approval of the FM Data process via submittals for review and approval by the FDI. In this manner, additional services are not expected from the project delivery team members because TXST is not asking for new deliverables but rather, the same information in a modified format in advance of contracting and work production to eliminate the occurrence of rework.

**Description of Existing Infrastructure and other Operational Interfaces**

TXST currently uses AiM by AssetWorks as its computerized maintenance management system (CMMS). AiM supports the import of COBie (Construction Operations Building Information Exchange) files, which is an industry recognized open standard data format. COBie is one “tool” that is used in this process to organize and format the FM Data for use. The data structure (i.e., Asset Groups) from AiM will help guide the assembly of COBie data at TXST. These data structure rules have guided and informed the development of these requirements, and when followed correctly, will ensure project teams have built the COBie data-set in a manner that is consistent with TXST CMMS requirements and data structures.

TXST anticipates using 3D models as a tool in facilities management. By requiring project teams to coordinate and share building models, allowance is made for immediate and future needs of the university. Therefore, all 3D Facilities Models (i.e., models from the AE (design intent) and the CM (as-built)) shall be provided in an acceptable format (see the FM data specifications) and not in any other proprietary or subscription based software. Additional requirements can be found in the FM data specifications.

As the construction industry and technology advances, TXST will make incremental changes to the BIM for FM requirements over time. The current specifications represent the first generation of FM Data specifications and changes are expected to be accepted and processed that will integrate future technologies and workflow changes over time. However, these must be evaluated by TXST for adoption from the industry and integrated into the project delivery strategy and handover requirements in light of how TXST does FM work and how they want to receive and process project information (data), documents, and models.
**Explanation of TXST Expectations**

The FM data specifications developed for and applied to this project are an evolving guideline for capturing BIM data at TXST. However, a specific set of requirements does apply to this contract per the identified Exhibit. With each new building, this specification may require the attention of an Facilities Data Integrator (FDI) to ensure current requirements are appropriate and/or are updated for additional scope that was unforeseen at the writing of the current publication. This updating process will continue to “build-out” and enhance the overall FM Data specifications in a way that creates a more robust specification based upon project scopes and building/project types at TXST. The first generation FM Data specifications have been formulated to capture as much institutional information as possible based upon past FM Data projects conducted. It should be noted that each owner has a varying array of interests and requirements that are driven by their perception of the value to the FM process. Thus, these requirements are likely to be modified over time as more operating experience is gained in the use of FM Data and associated documents.

The FM Data Integrator shall also assess each project teams’ ability to perform the scope of the BIM and FM data requirements and provide specific recommendations for implementing requirements on a project by project basis. The role and responsibility of FM Data Integrator is outlined in other sections of this guide. However, the general responsibility is to manage the BIM process and the FM Data on projects and to ensure the correct execution of these BIM for FM Data guidelines. The role of the FM Data Integrator can be performed by different parties within the project delivery team during construction or within TXST (i.e., internal direct staff or a third party consultant) throughout a project’s life cycle.

TXST expects that all large scale projects will use the current BIM for FM requirements and produce an FM data-set for import into the CMMS. However, the Director of Facilities Management will determine expectations in regard to these requirements on projects under five million ($5M) dollars. Project team members will each be expected to contribute to the project’s FM Data requirements where appropriate, contracted, and as explained through this specification.

Specific information regarding responsibility and accountability are detailed in other sections of this specification. However, some of the general expectations include but are not limited to the following: 1) the party responsible for space planning will be expected to provide a schedule of spaces with use categories and associated space attributes, 2) the A/E in the design phase will be expected to provide square footage information, equipment locations, and scheduled equipment design information, 3) the construction contractor will be responsible for providing equipment manufacturer, model, asset attribute information, and associated documents as the submittal process is completed. The construction contractor will be expected during construction to assign documents (drawings, submittals, O&M’s, and others) to equipment and serial numbers via the FM Data format as well. The contractor will produce a coordinated model prior to field installation.
E.2 - Section 2 - BIM Execution Plan (BEP)

The objective of this section is to provide a project specific plan on how the BIM for FM requirements and deliverables will be accomplished. Each member of the AEC team shall submit a plan, to the Facilities Data Integrator (FDI), conforming to the requirements set forth in this section and other parts of the BIM specifications. The intent is for the BIM Execution Plan (BEP) to clearly identify how the project team members will comply with the BIM for FM Data requirements as well as how they will cooperate and coordinate with the other team members.

Following the review of individual BIM Execution Plans, the Facilities Data Integrator (FDI) shall coordinate a meeting to provide a Team BIM Execution Plan (BEP). The Team Execution Plan shall provide considerable detail on deliverable schedules, review points and process, grading, and handover requirements. For more information on aspects of the team execution plan, see other sections and exhibits to the BIM for FM requirements.

The submittal process is employed to allow team members to respond to the requirements on two main fronts. First, the BIM and FM requirements have certain aspects that are prescriptive. That is, TXST requires certain elements of the requirements in a particular content, format, and timeframe from specific team members. See the requirements for further details. Secondly, the BIM and FM requirements have certain aspects that are performance based. That is, the owner desires and requires certain outcomes and results to be achieved. However, the owner does not want to impose means and methods of deliverable or result production that are unreasonable. Thus, the team member, for these elements of the BEP, is allowed to propose and describe their plan, approach, and means/methods for achieving the requirements and desired outcome. This is intended to provide reasonable flexibility for the team members in order to allow for workflow and deliverable production efficiency when and where an owner's need for a prescriptive requirement does not exist.

The following outline is a “framework” only and the team members are encouraged to add additional sections and subsections to the plan as needed. The framework below is intended to communicate the minimum content required (not the maximum). We recognize that many project delivery team members have prepared and executed multiple BEP's in the past. The intent in this specification is to launch the BEP development process and not to limit the BEP contents to this document. Team members are encouraged to add information to the extent needed to clearly communicate their implementation intent and plans. Several different BEP formats have been developed in the industry and this specification and framework is not intended to be a limiting factor in the team members' efforts to communicate and seek approval from the owner for the BEP. As the BEP is incrementally developed by the team members, additional details and clarifications are expected to be required to clarify how team members will interact and deliver on the entire set of requirements. It is expected that the BEP will have multiple revisions as the team iterates to a completed project and meets the overall requirements. The intent is also to eliminate rework on elements of the BEP that are approved. Team members are expected to consider downstream team members in the process and take
every reasonable measure to minimize and eliminate rework. The FM Data Integrator will assist in this determination and will be the primary party representing the owner in the BEP approval process.

Section A: Project Information

Project Data
1. Project Owner:
2. Project Name:
3. Project Location & Address:
4. Contract Type/Delivery Method:
5. Concise Project Description: [number of facilities, general size, etc.]
6. Additional Project Information: [unique BIM project characteristics and requirements]
7. Project / Contract Numbers: [Contract Number, Task Order, Project Number, etc.]
8. Project Schedule / Phases / Milestones: [include BIM milestones, pre-design activities, major design reviews, stakeholder reviews, and other major events which occur during project lifecycle]

Project Schedule

<table>
<thead>
<tr>
<th>Project Phase / Milestone</th>
<th>Estimated Start Date</th>
<th>Estimated Completion Date</th>
<th>Project Stakeholders Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>X% Schematic Design</td>
<td></td>
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<tr>
<td>X% Design Development</td>
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<tr>
<td>X% Construction Documents</td>
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<tr>
<td>Buy-out</td>
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<tr>
<td>Submittals</td>
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<tr>
<td>Install</td>
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<tr>
<td>Close-Out</td>
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<tr>
<td>Handover</td>
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</tbody>
</table>
Key Project Contacts
List of lead BIM contacts for each organization on the project.

<table>
<thead>
<tr>
<th>Role</th>
<th>Organization</th>
<th>Contact Name</th>
<th>Location</th>
<th>E-Mail</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager(s)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BIM Manager(s)</td>
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<tr>
<td>Discipline Leads</td>
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<tr>
<td>Other Project Roles</td>
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</tbody>
</table>

Section B: Project Goals

Acknowledgment of BIM and FM Data Requirements
1. Identify Major BIM and FM Data Goals / Objectives: [state major BIM & FM data goals, actions to implement, evidence the goal has been achieved, and participants involved]

Section C: BIM Uses

Acknowledgment of BIM and FM Data Requirements
1. Identify Major BIM uses on the project: [state major BIM use cases, their author, other users, and file types (if applicable)]
2. Identify Project Assets: [see ‘Asset Requirements Matrix’ and indicate project assets]
3. Identify Elements to be Modeled and the responsible party to model such elements
4. Identify other areas of particular interest in BIM that require clarity: [origin point, scale, model maintenance, other CAD/BIM Guidelines applicable, etc.]

Section D: BIM Use Staffing

Organizational Roles / Staffing
1. BIM for FM Roles and Responsibility:
2. BIM Use Staffing: [for each BIM & FM use selected, identify the team within the organization(s) who will staff and perform that use and estimate the personal time required.]
This helps the owner understand the level of effort (i.e., staffing plan) expected by the team members in delivery of the requirements.

<table>
<thead>
<tr>
<th>BIM for FM Use</th>
<th>Organization</th>
<th>Number of Total Staff for Use</th>
<th>Estimated Worker Hours</th>
<th>Location(s)</th>
<th>Lead Contact</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**Section E: Collaboration Procedures**

1. Collaboration Strategy: [describe how the project team will collaborate. Include items such as communication methods, document management and transfer, file naming structure, and record storage, etc.]

2. Meeting Procedures: [the following are examples that should be considered]

<table>
<thead>
<tr>
<th>Meeting Type</th>
<th>Project Stage</th>
<th>Frequency</th>
<th>Participants</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIM for FM Requirements Kick-Off</td>
<td></td>
<td></td>
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<tr>
<td>BIM for FM Execution Plan Demonstration</td>
<td></td>
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<tr>
<td>Design Coordination</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Construction over-the-shoulder progress reviews</td>
<td></td>
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<tr>
<td>Any other BIM meetings that occur with multiple parties</td>
<td></td>
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</tbody>
</table>
3. BIM for FM Delivery Schedule of Information Exchanges for Submission & Approval:
   [document the exchange of COBie and Model data that occurs during the project:]

<table>
<thead>
<tr>
<th>Information Exchange</th>
<th>File Sender</th>
<th>File Receiver</th>
<th>One-Time or Frequency</th>
<th>Due Date or Start Date</th>
<th>Native File Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design COBie</td>
<td>Architect</td>
<td>Contractor</td>
<td>One-Time</td>
<td>NTP</td>
<td>.xls</td>
</tr>
</tbody>
</table>

Section F: Process for Data Verification – QA/QC

1. Overall Strategy for Quality Control: [describe the strategy to control the quality of the data and model delivered]
2. Quality Control Checks:[the following check should be performed to assure quality]

<table>
<thead>
<tr>
<th>Checks</th>
<th>Definition</th>
<th>Responsible Party / Parties</th>
<th>Software Program(s)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Check</td>
<td>Ensure that the model and data have not excluded field items and requirements have been followed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COBie Compliancy Check</td>
<td>Ensure that the COBie standard has been followed in the building of Facilities Data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standards Check</td>
<td>Ensure that the BIM for FM Format Requirements have been followed (naming standards, all data points collected, etc.)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Accuracy

Ensure that all Facilities Data provided is 100% accurate

3. Accuracy and Tolerances:
   a. Note: At any time during the project where the data errors grow to a point above 10% of the entire data set; the owner reserves the right to take appropriate corrective action such as having another party finish the BIM for FM deliverable at the expense of the responsible party in error. The FDI’s role is to take preliminary steps to preclude this action. However, if timely completion of the FM data process is delayed by an unreasonable amount of time, the owner may direct such corrective actions be taken.

**Section G: Technological Infrastructure Needs**

1. Software [List software that COBie data and Model will be created and maintained in]
2. Modeling Content (conforming to TXST Asset Requirements Matrix)

*Project Deliverables [list the BIM for FM deliverables for the project and the format in which the information will be delivered]*

<table>
<thead>
<tr>
<th>BIM for FM Submittal Item</th>
<th>Stage</th>
<th>Approximate Due Date</th>
<th>Format</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record Design Model</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Coordinated/Combined Model</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As-Coordinated/As-built Trade Models</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>COBie</td>
<td></td>
<td></td>
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<tr>
<td>COBie Docs</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Section H: Process for Data Collection

1. Describe methods for collecting data during the project and how the team member intends to coordinate and collaborate with the Facilities Data Integrator (FDI).

Section J: Update of the BEP

1. Provide Plan for revising BIM Execution Plan at each stage.

Attachments to Section 2 – BIM Execution Plan (BEP)

These are not attachments to the BEP but are critical parts of the requirements that must be considered in the development of and updates to the BEP.

- Exhibit 2.A - Grading Fields and Procedures
- Exhibit 2.B - Sample Project Schedule
- Exhibit 2.C – Close-Out Procedures

Coordinate the BEP development with each of the following and all parts of Exhibit E.

Section 3 – FM Data Requirements

- Exhibit 3.A – Responsibility Assignment Matrix (RAM), Data Collection and Schedule (XLS File)
- Exhibit 3.B – Facilities Data Integrator (FDI) Role
- Exhibit 3.C – Asset Type Matrix
- Exhibit 3.D – FM Model Criteria
## TXST - SAMPLE PROJECT SCHEDULE

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### Notes:
- Zone & System row count based on COBie 2.24 method of one system(zone) per row.
- See Section 2: BIM Execution Plan with Exhibit 2.A.
- Required Categories (see Section 3 FM Data Specifications)
- Required Fields/Columns (See Section 3 with RAM Exhibit 3.A)
- Proposed Quantity (Rows)
- Yellow milestone represents AE handover to Constructor

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E.2.B - Sample Project Schedule (Rev 03 - 9.24.15)
Exhibit 2.B – Close-Out Procedures

End User Review & Acceptance

Test imports of the COBie data and documents may be performed leading up to final acceptance and review. However, once the COBie file has been successfully test imported into AiM, the Facilities Data Integrator (FDI) shall notify the Owner. The Owner then shall notify each end user to review assets identified as belonging to their respective department (organization). Areas of particular interest in review shall include those items that are shared between multiple end users/departments; ex: large Utility Water Valves should be reviewed by both Facilities Plumbing and Utilities Water Distribution.

This review exercise will ensure that all assets are accepted and are being maintained after handover. This also provides the owner’s personnel an opportunity to become familiar with the new assets being added to their stewardship and to establish preventive maintenance (PM) procedures and/or to apply standing PM’s to these newly uploaded assets.

Following notification to the owner, each end user shall have thirty (30) calendar days to review assets and schedule a meeting with the Facilities Data Integrator (FDI) and Owner to address any concerns and/or corrective actions that may be needed. If data concerns/issues have not been provided in writing to the Facilities Data Integrator within this 30 day period, acceptance by the end user shall be considered to be confirmed. The Facilities Data Integrator will be responsible to develop and submit a schedule to the Owner for how end user concerns (if any) will be resolved.

Owner Review and Acceptance

Following End User Review and Acceptance, the Owner is responsible to review and provide final comments for the Facilities Data Integrator to address with AEC team. If no comments have been received by the Owner within thirty (30) calendar days of end user acceptance AND completion of final punch list items, Owner acceptance shall be granted to the FDI. This process should generally follow overall project substantial and final completion to ensure that all team members remain engaged in the FM data process.

AEC Team Final Handover

Per the BIM Execution Plan, regularly scheduled COBie data and document submissions will be reviewed and reported on by the Facilities Data Integrator at the agreed upon review intervals.

At the final scheduled COBie report, the Facilities Data Integrator shall provide the AEC team and Owner a final punch list to address all outstanding items in the COBie data to be corrected. If all outstanding items have not been completed within the subsequent fourteen (14) calendar days, the owner may elect to take reasonable corrective actions as outlined in other parts of these specifications.
AEC team members that are contracted for COBie deliverables are responsible to validate (i.e., verify by their own means and methods) their own work prior to regularly scheduled submissions to the FDI. This will greatly shorten Corrective Action reports provided by the Facilities Data Integrator and the meetings allocated to review these reports with the AEC team on a prescribed and regular basis. The basic premise here is that progressive elaboration and “building up” of the FM data occurs over multiple phases of the project duration.

**Final Handover Deliverables Include (but may not be limited to):**

- Project team compliance and conformance to the FM Data requirements (the FM Data Specification).
- COBie Version 2.24 file (latest approved version) with all documents in one folder.
- Record Set Design Model (native files)
- As-built trade models (including all native files and one federated NWD file).
- Facilities Model with saved viewpoints of all COBie components per the FM Data requirements (the FM Data Specification).
Continue for the following Section 3 Exhibits:

Exhibit 3.A – Responsibility Matrix

Exhibit 3.B - Facilities Data Integrator

Exhibit 3.C - Asset Type Matrix (Full and Summary)

Exhibit 3.D - FM Model Criteria
### Exhibit 3.A: Responsibility Matrix

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**Description:**
- **Architect** is responsible to provide information for all green cells indicated with "X", per Section 3 (FM Data Requirements). See below for scheduled delivery milestones.
- **Contractor** is responsible to provide information for all orange cells indicated with "X", per Section 3 (FM Data Requirements). See below for scheduled delivery milestones.
- **Facilities Data Integrator** will be responsible to provide information for all purple cells indicated with "X", per Section 3 (FM Data Requirements). See below for scheduled delivery milestones.

**Update if necessary:**
- Information for all orange cells indicated with "X", per Section 3 (FM Data Requirements). Facilities Data Integrator is responsible to provide information for all purple cells indicated with "X", per Section 3 (FM Data Requirements). See below for scheduled delivery milestones.

**Contact Information:**
- Enter the contact's name (provider) as applicable. If contact is a contractor, provide contractor company name in this field.
- This is the contact name (builder) of the contact (or provider).
- Enter the contact's phone number or a main company phone number. Format in the United States shall be 123-456-7890. For international phone numbers, include the international exchange, as applicable, before the local number.
- This is the name of the contact (Provider). Providers are people/companies that have provided labor and/or material to build the project. Providers will be discussed in Tab 6 (Types) in more detail.
- This is the name of the company that the contact (or provider) works for during the project. Note: Use Owner provided vendor names for manufacturers/suppliers and contractor codes for contractors.
- Enter a department code or name (description), as applicable, for the contact (provider). If contact is a contractor, provide contractor company name in this field.
- Enter the contact's country. If in the United States, then use "USA".
- Enter the contact's postal code for the applicable address. Typically, a five (5) digit code applies (i.e. 77840). If a four (4) digit extension is applicable then include that information as well in the following format (i.e. 77840-0723).
- Enter the contact's state or region for the applicable address. For addresses in the United States, use the two character identifier for the state name.
- Enter the contact's postal address or business address, as applicable.
- This is the last name of the contact (provider).
- Enter the contact's street address or business address, as applicable.
- Enter the contact's e-mail address. Where a specific person is not available, the company's e-mail address or URL is provided (http://www.example.com/html).
### Floor

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The floor worksheet is associated with floors within a specific facility. Floors can be vertical floors (ground, 1, 2, 3, other, etc.) as named by the designer. Floors can also include basements, crawl spaces, roofs, and site areas outside of the buildings when these areas have assigned components. Floors are horizontal planes that include specific "spaces". This is a unique "floor" name for the facility and the primary key for all floors. Choose from owner designated list for floor names. Floors shall be named as integer 1, 2, 3, 4, 5, etc.

*See NOTE 1 Below for more information*

### Space

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The space worksheet includes the project's space names. Spaces are cross-referenced to floors from Tab.3. Space data also includes the following: space function, floor identification, area measurement, and the owner's room number (final way finding nomenclature), if different from the contract document space naming protocol. This is a unique "space" name for the. This field will be the room numbers indicated on the final way finding. For external spaces, provide location in reference to the building name (ex: 999-South, 999-East, 999-North, 999-West)

Note: The current maximum number of allowable characters for a space name is 15. Also, commas are not allowed in space names.

### Zone

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This zone worksheet is used to assign spaces (see Tab.4) into specific groups, as needed by the Owner. The following shall be assumed the maximum amount of zone types per COBie; however, the FDI shall confirm each with the owner per facility.

### Instructions / Comments

- This unit of measure is "feet". Use decimal format (i.e., 10 feet 6 inches).
- Provide usable net area in each space, which shall be measured from edge of finish wall to edge of finish wall. This unit of measure is "square feet". Use decimal format to two places (i.e., one hundred fifty six feet two and one tenth). The maximum number of allowable characters for a space name is 15. Also, commas are not allowed in space names.
- The current maximum number of allowable characters for a space name is 15. Also, commas are not allowed in space names.
- The floor worksheet is associated with floors within a specific facility. Floors can be vertical floors (ground, 1, 2, 3, other, etc.) as named by the designer. Floors can also include basements, crawl spaces, roofs, and site areas outside of the buildings when these areas have assigned components. Floors are horizontal planes that include specific "spaces".
- This is a unique "floor" name for the facility and the primary key for all floors. Choose from owner designated list for floor names. Floors shall be named as integer 1, 2, 3, 4, 5, etc.

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**Note:** Components that are scheduled on the contract documents shall have the same name (i.e., mark number) as the equipment schedule. See below for specific naming conventions and content for those components that are not uniquely named on contract drawings. **See NOTE 3 below for more information**.
### System

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<td>Provide a unique name for each building system. Refer to Exhibit 3c: Asset Type Matrix for building systems. For Parent/Child Systems provide the component name in the System name. Named by Building System and Building Number, Example: HVAC-866. For Parent/Child relationships, systems shall be named by the parent asset. Maximum number of characters = 25</td>
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#### Pre-Fields

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### Job

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<td>Provide a unique name for each job record</td>
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#### Pre-Fields

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### Document Sheet

<table>
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<th>Document</th>
<th>Submittals</th>
<th>Install</th>
<th>Close Out</th>
<th>Hardover</th>
<th>Instructions / Comments</th>
</tr>
</thead>
</table>

**Submittals**

- **CreatedOn**
- **Contractor**
- **Facilities Data Integrator**

**Install**

- **Category**
- **CreatedBy**

**Close Out**

- **Reference**
- **RowName**

**Hardover**

- **Update if**
- **File**
- **ExtSystem**
- **ExtObject**

**Instructions / Comments**

- **Provide** the directory or location where the document can be found.
- **Specify** the document category from the list below.
- **Add submittal data**
- **SheetName**

**SheetName**

- **x**

**RowName**

- **x**

**Directory**

- **x**

**File**

- **x**

**ExtSystem**

- **x**

**ExtObject**

- **x**

**Description**

- **x**

**Name**

- **x**

**Stage**

- **x**

**Notes**

- **Add** submittal data
- **Update if**
- **Update If Necessary**
- **Reverse system & zones**

### Attribute Sheet

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<th>Update if Necessary</th>
<th>Update If Necessary</th>
<th>Reverse system &amp; zones</th>
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</thead>
</table>

**Name**

- **x**

**CreatedBy**

- **x**

**CreatedOn**

- **x**

**Stage**

- **x**

**SheetName**

- **x**

**RowName**

- **x**

**Directory**

- **x**

**File**

- **x**

**ExtSystem**

- **x**

**ExtObject**

- **x**

**Description**

- **x**

**Name**

- **x**

**Stage**

- **x**

**Notes**

- **Add** submittal data
- **Update if**
- **Update If Necessary**
- **Reverse system & zones**

### Coordinate Sheet

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**Name**

- **x**

**CreatedBy**

- **x**

**CreatedOn**

- **x**

**Category**

- **x**

**SheetName**

- **x**

**RowName**

- **x**

**CoordinateAxis**

- **x**

**CoordinateAxis**

- **x**

**ExtSystem**

- **x**

**ExtObject**

- **x**

**Notes**

- **Enter **point**.
### NOTE 1: Floor

Special instructions for below:
- All valves identified in Tab 4 (Space) Column A are brass tagged and shall be included in the data file. Include all chilled & heating hot water valves that are above 1" and are not located on another asset.
- All brass tagged valves 1 inch and above and any isolation valves of specialty systems which are above 1" and are not located on another asset.

Where:
- **A** = Abbreviation for the system served by the valve (HVAC, Fire, etc.)
- **B** = Level of Isolation
- **C** = Area of Isolation (N for North, S for South)
- **D** = Sub-System Type (HWS&R and CHS&R)
- **E** = Unique Identifier (A, B, C, etc. for multiple components in same space)

### NOTE 2: Zones

Special instructions for below:
- All zones which are rooms identified in Tab 4 (Space) Column A.
- All zones which are rooms identified in Tab 4 (Space) Column B.
- All zones which are rooms identified in Tab 4 (Space) Column C.

### NOTE 3: Component Naming

**Description**

- **Name** = Short general name of equipment
- **Equipment Name** = Equipment code that matches the specifications
- **A** = Equipment code that matches the specifications
- **B** = Space name identified in Tab 4 (Space) Column A
- **C** = Modifier to identify multiples of the same device in the same room. (a,b,c,d,etc.)
- **D** = Modifier to identify multiples of the same device in the same room. (a,b,c,d,etc.)

**Examples**

- Fire-Horn-1-80
- Fire-Duct-2-5
- Fire-Pipe-1-16
- Fire-Tamper-1-80
- Fire-HornStrobe-2045
- Fire-HornStrobe-2045-b
- Fire-HornStrobe-2045
- Fire-Tamper-1-16
- Fire-Flow-1-16
- Fire-Duct-2-5
- Fire-Heat-1-90
- Fire-Smoke-1-90

### Mechanical, Electrical, and Plumbing Components

All equipment (ex. valves) that have a unique name and/or is tagged (i.e., labeled or brass tagged) shall be named consistently.

### Scientific Equipment

**Naming Standard:**

- **Equipment Name** = A-B-C

Where:
- **A** = Space name identified in Tab 4 (Space) Column A
- **B** = Space name identified in Tab 4 (Space) Column B
- **C** = Modifier to identify multiples of the same device in the same room. (a,b,c,d,etc.)

### Security Components

**Description**

- **Cameras**
- **Access Control Panel**
- **Card Reader**
- **Emergency Phone**
- **Door Contact**

Where:
- **A** = Space name identified in Tab 4 (Space) Column A

**Examples**

- See Camera-B
- See Access Control Panel
- See Card Reader-B
- See Emergency Phone-B
- See Door Contact-B

### Valve Components

All brass tagged valves 1 inch and above and any isolation valves of specialty systems which are below 1" shall be included in the data file. Include all chilled & heating hot water valves that are above 1/2" and are not located on another asset.

Where:
- **A** = Abbreviation for the system served by the valve (HVAC, Fire, etc.)
- **B** = Level of Isolation
- **C** = Area of Isolation (N for North, S for South)
- **D** = Sub-System Type (HWS&R and CHS&R)
- **E** = Unique Identifier (A, B, C, etc. for multiple components in same space)
**NOTE 4: Documents**

All project drawings will be assigned to spaces represented in them. For example, if A101 is seen in Architectural, Electrical, Plumbing, & Mechanical floor plan drawings, each of those drawings should be attached to A101 as a COBie Document. Documents to be provided are Architectural, Electrical, Plumbing, Mechanical, A/VIT floor plans attached to spaces, and Equipment schedules attached to components. Submittals and O&M documents shall contain only information that is pertinent to the type that the document is being attached to. For example, it is not acceptable to attach a submittal on air handlers to all air handlers on the project, unless they happen to be all of the same manufacturer and model and type. Field images are taken for each asset immediately prior to cover up (excluding interior lighting, the alarm devices, & HVAC controls).

**NOTE 5: Documents**

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<td>CX - FPR</td>
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<td>Submittals</td>
<td>SUB - Equipment</td>
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<td>Painting / Name</td>
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<td>Operations &amp; FM</td>
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<td>Training – Unique</td>
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<tr>
<td>TAB</td>
<td>TAB – Unique</td>
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</tbody>
</table>

- **Document Examples:**
  - Drawings
  - Submittals
  - Schedule
  - Test Reports
  - Operations And
  - Warranties
  - Model
  - Training Videos
  - TAB
  - Image

**NOTE 6: Attributes**

Some attributes have been included per owner’s request. These include attributes for spaces (recording the VAV that feeds into the room), VAV boxes (recording which space it will feed into). Where there are multiple attributes surrounding a single object, like a motor, attributes will be numbered (1,2,3, etc.).
Exhibit 3.B - Facilities Data Integrator Role

Role: Facilities Data Integrator (FDI)

Description: Manager of BIM for FM Process on Design/Construction Projects

Overall Responsibility: Ensure correct execution of the TXST BIM for FM Requirements

Specific Responsibilities Include (but are not limited to):

Planning / Programming Phase

- Determine feasibility of FM data collection for proposed projects.
- Confirm FM data requirements are to be employed on certain design/construction jobs.
- Update (if needed) and provide latest BIM for FM requirements to new projects.
- For unique projects, reconcile the FM requirements and update the FM requirements.
- Setup project responsibilities and roles per Owner’s directives and BIM for FM requirements.
- Integrate FM data requirements into the project delivery process for RFQ, RFP, and other contracting processes for the design, construction, commissioning, and other team members.
- Establish budget allocations in the capital budget for FM data functions on the project.
- Review and assess project team members (i.e., AEC teams) for their ability to comply with requirements (via RFQ and RFP activities) and the review of “draft” BIM Execution Plans.
- Other duties as required to implement the TXST BIM and FM requirements and specifications.

Design / Construction / Commissioning Phases

- Hold kick-off and orientation meetings detailing BIM for FM requirements.
- Review and assess submitted BIM Execution Plans from AEC project team members.
- Hold meetings for BIM for FM Execution Plan review and project coordination planning including deliverable schedules.
- Adjust AEC team BIM for FM scope, if necessary, and in accordance with Owner’s directives and specific or unique project requirements not listed in the latest FM data specifications.
- Monitor progress, assess quality, and confirm accuracy of ongoing data collection and validation process.
- Hold regular project meetings with project team members to discuss the progress and quality of the deliverables and the schedule for incremental deliverable development.
- Conduct payment application reviews of the FM data deliverables for AEC payment process.
- Inspect and evaluate (i.e., grade) deliverables in accordance with BIM for FM requirements and project schedules.
- Integrate owner data into project data set, as applicable for OFOI / OFCI assets.
- Integrate project team data deliverables into latest acceptable COBie format for test uploads to CMMS (AiM).
● Conduct several incremental / test uploads to AiM to confirm data migration is functional. If not functional, take corrective actions as needed.
● Ensure facility models are setup for O&M facility viewer and integration with CMMS model linking functions.
● Provide necessary minor adjustments to models to make them lighter and user friendly for O&M purposes (ex: transparent ceilings and site ground, contrast colors appropriately, etc).
● Other duties as required to implement the TXST BIM and FM requirements and specifications.

Qualifications for the Facilities Data Integrator (FDI) Role

● Any team member (Architect, Engineer, General Contractor, Consultant, Commissioning Agent, or Owner's Representative, etc.) that can show successful management of past FM Data (specifically, the COBie 2.24 format) projects that have been imported to a client’s (i.e., owner's) CMMS and are currently in use for Asset Management functions.
  ○ provide references of qualifying projects
  ○ provide references of owners/clients currently using the imported COBie formatted data for Asset Management

● Any team that can demonstrate understanding of the TXST BIM for FM requirements and provide an example for how each section is carried out using a sample higher education project of their choice. Samples should include the following, at a minimum:
  ○ COBie sample files shall successfully import to TXST AiM and include a minimum of the following for sample data sets: 10 contacts, 5 spaces, 1 zone, 5 types, 10 components, 2 systems, 10 documents, and 15 equipment attributes matching the most current TXST requirements.
  ○ Ability to complete the TXST BIM Execution Plan outlining their role as a Facilities Data Integrator on the sample project.

● It is recommended that the Facilities Data Integrator (FDI) chosen for a specific project not be someone who already has a substantial responsibility with BIM for FM data production (authorship) on that project. This would typically exclude the AEC team from functioning as the FDI. This criteria allows for objectivity (independent verification) and helps to prohibit a conflict of interest in the evaluation (grading) functions by the FDI. Since the FDI's role is essentially data commissioning, independent quantity and quality verification is desirable since the information will be used in operational workflow processes.
| Asset Group / COBie "Type Category" | Classification | Abbreviation | Comments | System | Review | Attribute Sheet "Attributes"
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**Annunciators**

- Uniformat Code: 0750:10
- Manufacturer:
- Notes: Util Tech Services

**Auditorium Seating**

- Uniformat Code: 02010:70
- Manufacturer: Omni-class
- Notes: Furnishes: Furnishings

**Automatic Doors**

- Uniformat Code: 02050:10
- Manufacturer: Omni-class
- Notes:

**Automatic Transfer Switch**

- Uniformat Code: 05070:10
- Manufacturer: Omni-class
- Notes: Utilities: Electric & Facilities

**Auxiliary Water Pump**

- Uniformat Code: 02010:20
- Manufacturer: Omni-class
- Notes: Facilities: Plumbing

**Backflow Preventor**

- Uniformat Code: 03010:10
- Manufacturer: Omni-class
- Notes: Facilities: Plumbing

**Battery Systems**

- Uniformat Code: 05010:20
- Manufacturer: Omni-class
- Notes: Utilities: Electric & Facilities

**Blue Lights & Phones**

- Uniformat Code: 04010:20
- Manufacturer: Omni-class
- Notes: Facilities: Electric

**Boiler**

- Uniformat Code: 02020:10
- Manufacturer: Omni-class
- Notes: Facilities: HVAC, AC, Utilities
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*All values are approximate and subject to change. Please refer to the original document for the most accurate information.*
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E.3.C - Summarized (Rev 03 Dated 9.24.15)
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Exhibit 3.D - FM Model Criteria

A valuable part of the BIM process, models provide opportunity to improve communication during planning, design, construction, and operations. Outstanding implications exist for the use of models in facilities management; however, model integration is not currently a common management tool at Texas State University (TXST). Desiring to always improve, TXST is committed to the innovative use of tools such as models that help staff to better steward facilities. A continued improvement of operational workflows is an expected result from the use of model deliverables.

The intent of this section is to include the minimum criteria for 3D models as they relate to the BIM for FM Deliverables alone. This section does not replace or lessen modeling criteria in other sections of TXST specifications or contract requirements related to other BIM Use Cases (applications of BIM for other objectives).

Native Files from As-Built / Field Coordinated Model
The construction contractor shall provide two versions of the native files that support the as-built / field coordinated model at multiple times before project closeout and at substantial completion. These files are the model instances that build the federated coordination models. One version shall be the native files saved from the design / trade software it was created in. The other version shall be the interoperable / sharing formats from the design / trade software it was created in. Examples of interoperable formats include: LandXML, gbXML, DWG, ASCII, etc. The intent for design / trade files and interoperable formats is to allow opportunities for integration in future design work, allowing for record update with field changes, and much more.

FM Model
The construction contractor shall provide two versions of the as-built / field coordinated model in re-savable NWD format at multiple times before close-out (per the BIM Execution Plan) and at substantial completion of the project. As-built models shall at a minimum include all components represented in the COBie deliverable for spaces and components (named equipment). Exception to this shall be all building level assets (clocks, seating, faucets, etc.), fire initiating and indicating devices, and BAS sensors.

One version of the NWD provided model shall be the final as-built model per the field coordination effort.

The second version of the NWD model shall be optimized (stripped down and lightweight) for Facilities Management use. Optimization shall allow for easy navigation and viewing of assets. Particular optimization shall include, but not be limited to, ceilings at fifty percent transparency and the hiding of all doors. Also, included shall be the unique color-coding of all building systems (electrical, chilled water, heating water, domestic water, etc.) per the current TXST coloring schema. The coloring schema shall be documented in the BIM Execution Plan as well.
Each component in COBie shall have a minimum of one saved viewpoint in the model. Exception to this shall be all building level assets (clocks, seating, faucets, etc.), fire initiating and indicating devices, and BAS sensors. These saved viewpoint files shall be attached to the component in the documents portion of the COBie file.
II. ARCHITECTURAL/ENGINEERING DOCUMENTS DELIVERABLES

Purpose

The purpose of the following guidelines is to provide the A/E consultant with guidance in the preparation of Schematic Design Plans for construction and renovation projects at Texas State University.

2.03 Schematic Design Plans for Review by the Facilities Planning, Design and Construction (FPDC)

A. Usage of the University’s Logo and Inclusion of the System Statement:

1. Any Texas State logo used in any document published or produced by the consultant for the University shall be the “Primary” logo as listed on the University’s web site. At times, the University might change the logo or the policy for its use. **It is the responsibility of the document preparer to link to the web sites to determine the current logo and the policy for its use.** The policy for the use of the University’s logo and inclusion of the Texas State University System Statement is UPPS01.04.11. The web link to the current university logo information is www.txstate.edu/logos.

B. Usage of the Texas State University name:

1. As of September 1, 2013, the University’s name is changed to Texas State University. The University’s full name, ‘Texas State University’, must be used when referencing the University. **The use of ‘TSU’ is not acceptable in any written format (i.e. email, report, etc.).** Such use will result in the rejection of the document(s) to be corrected and re-submitted, at the expense of the submitter. If space is an issue, it is appropriate to use ‘Texas State’.

C. Schematic Design Plans Booklet Development and Submission to the Office of Facilities Planning Design and Construction (FPDC):

1. The following guidelines are the requirements for submission of the Schematic Design Booklet; refer to 2.02 D.

   a. Schematic Design Plans Development:

      1). The Architect-Engineer shall meet with the University Project Planning Committee as many times as necessary and shall be furnished a copy of the Program of Requirements to develop the
Schematic Design Plans. The Schematic Design Plans should include the following:

a) Building Code Analysis Report (81/2” x 11”) format.

b) Site Plan: (showing building footprint with entrances, site improvements, and interface with the surrounding campus)

1. The TAS “Accessible Path” must be designed to the closest “Public Way”.

c) Floor Plans: (including Fixed Equipment)

d) Elevations and appropriate Sections: (of the proposed improvements, as appropriate)

e) Pictorial Drawings, Prospective Color Renderings and/or Model: (typical on projects which change the appearance or new facilities)

f) Outline Specifications

g) Statement of Energy Conservation and Sustainability

h) Project Schedule

i) Estimate of Cost to confirm CCL:

The Architect’s Cost Consultant shall include an itemized construction cost estimate separated into all the required CSI Divisions, no later than 2 weeks after SD review submitted in C.j below.

If the construction delivery system is a Construction Management at Risk (CM@R), the CM will also provide a detailed cost estimate for comparison with the Architect’s cost estimate, no later than 2 weeks after SD review submitted in C.j below. 
j) Three (3) copies of the Schematic Design documents above will be presented to the Facilities Planning, Design and Construction office (FPDC), for draft review.

2). After the approval, nine (9) copies will be presented. Eight (8) delivered to the (ODSR), Facilities Planning Design and Construction office (FPDC), and (1) copy to the (ODR), the Texas State University System office (TSUS), in Austin, Texas. Two electronic copies, in the original application (i.e. Word, Excel, AutoCAD, etc.), via CD or email, will also be submitted to the (ODSR), FPDC. The CD shall include all drawings, specifications, product data, and cost estimates, etc.

3). After the approval of the Planning and Construction Committee, the A/E consultant shall provide the Facilities Planning, Design and Construction (FPDC) with eight (8) hard copies of the Schematic Design Plans with an electronic copy, in the original application (i.e. word, excel, AutoCAD, etc.), (via CD or email).

D. Schematic Design Plans Booklet Layout:

1. The Schematic Design Plans are to be written in Times New Roman size 12 fonts, contain a cover page, a table of contents, each section tabbed, and spiral bound. The plans shall be bound in the order as follows:

   a. **Front Cover:** The front cover of the Preliminary Plan Booklet shall contain The University’s logo with the statement ‘Texas State University is a member of the Texas State University System’, that it is Schematic Design Plans, the project name, the month and year of the Board of Regents meeting that the plans will be presented and the preparing firms’ information.

   b. **Table of Contents:** A Table of Contents shall be placed after the Cover Page and list the following sections by section title. The contents of each tab noted below are for the consultant’s clarification and are not to be listed in the Table of Contents.

      1). **Tab 1:** Design Narrative and Program Scope. Narrative grammar must be positive (i.e. “will be”, “is”).
2). **Tab 2:** Site Plan: (showing building footprint with entrances, site improvements, and **interface** with the surrounding campus)

3). **Tab 3:** Floor Plans: (including Fixed Equipment)

4). **Tab 4:** Elevations and appropriate Sections: (of the proposed improvements, as appropriate)

5). **Tab 5:** Pictorial Drawings, Prospective Color Renderings and/or Model: (typical on projects, which change the exterior appearance or new facilities).

6). **Tab 6:** Outline Specifications

7). **Tab 7:** Statement of Energy Conservation and Sustainability

8). **Tab 8:** Project Schedule

9). **Tab 9:** Estimate of Cost: (including itemized construction cost estimate by CSI Division, site clearance and development cost, landscape cost.

c. An example of the Schematic Design Plan Booklet is as follows:
E. Front Cover Example:

TEXAS STATE
The rising STAR of Texas ™

SCHEMATIC DESIGN PLANS

FOR THE

PROJECT NAME

AT

TEXAS STATE UNIVERSITY
A member of The Texas State University System

PRESENTED TO
TEXAS STATE UNIVERSITY

MONTH YEAR

FIRM’S INFORMATION
F. Cover Sheet Example

Schematic Design Plans  
for the  
Project Name  
at  
Texas State University  
Month Year

The Texas State University System Board of Regents (MUST verify prior to final)

Bernie C. Francis, Chairman          Carrollton
Trisha S. Pollard, Vice Chair        Bellaire
Dora G. Alcalá                      Del Rio
Charles Amato                       San Antonio
Ron Blatchley                       Bryan
John E. Dudley                      Comanche
Michael Truncale                    Beaumont
Greg Wilkinson                      Dallas
Donna N. Williams                   Arlington
Magdalena Manzano-Student Regent    Huntsville

The Texas State University System Administration

Dr. Brian McCall                   Chancellor
Peter E. Graves                   Vice Chancellor for Contract Administration
Rob Roy Parnell                   Associate Vice Chancellor for Facilities

Texas State University Administration

Denise M. Trauth                    President
William A. Nance                   Vice President, Finance and Support Services
Nancy Nusbaum                      Associate Vice President, Finance and Support Service Planning
Juan Guerra                        Associate Vice President, Facilities
Michael Petty                     Director, Facilities Planning, Design and Construction

Design Team

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Revised Jan-15       A/E Deliverables-2.03-6
II. ARCHITECTURAL/ENGINEERING DOCUMENTS DELIVERABLES

2.04 Design Development Review and Approval Documents

A. The A/E shall submit Design Development Documents, at approximately 35%-40%, total completion of the design/construction document process, to The Texas State University System Office, for approval.

B. Design Development Drawings & Specification

1. The A/E shall submit a 90%-100% complete set of Design Development AutoCAD Document and Specifications for review and approval by Texas State University, including a detailed cost estimate, a minimum of 9-10 weeks prior to the Board of Regents meeting.

In addition to documents submittal, the Design Development Package approval booklet is also required for review by the Board of Regents.

The A/E shall also provide a set of final 100% Complete Coordination Documents, with colored overlays of the various design disciplines, to include, but not be limited to: mechanical, electrical, plumbing, sprinkler, slab penetrations, telecommunications, and instructional technologies support for Classrooms.

2. The drawing format shall be no larger than 34” x 44”. Provide nine (9) full size sets and two (2) ½ size sets of drawings, and nine (9) sets of program scope, specifications and cost estimate.

C. Design Development Package for Board of Regents Approval:

1. Obviously, much more than this is needed from the A/E for a complete Design Development/35% Design submittal. The following information must be extracted from the submittal or supplied design/construction review documents and will be presented to the Board of Regents for their decision making. Non-building projects will be different and will be decided by Component/System Administrative Office based on the uniqueness of each project.

2. These Design Development Documents are to be packaged in a bound tabulated 8 ½” x 11” format booklet.
3. The A/E shall submit 3 Design Development Packages to the Facilities Planning, Design & Construction for review, 6-7 weeks before the Board of Regents’ quarterly meeting.

4. After the Facilities Planning, Design & Construction review, with approval the A/E shall submit sixteen (16) copies of the Design Development Package to the Texas State University (FPDC), 4-5 weeks before the Board of Regents’ Quarterly Meeting.

5. The Design Development are to be typed in Times New Roman size 12 font, contain a cover page, a table of contents, each section tabbed, and in a 3-ring binder.

   a. **Front Cover:** The front cover of the Design Development Booklet shall contain The University’s logo with the statement ‘Texas State University is a member of the Texas State University System’, that it is Design Development, the project name, the month and year of the Board of Regents meeting that the plans will be presented and the preparing firms’ information.

   b. **Table of Contents:** A Table of Contents shall be placed after the Cover Page and list the following sections by section title. The contents of each tab noted below are for the consultant’s clarification and are not to be listed in the Table of Contents.

   c. **Tab 1:** Architectural Rendering or a complete set of Architectural Exterior Elevations reflecting a complete architectural design concept (by prior Component/System Administrative Office agreement).

   d. **Tab 2:** Complete set of Architectural Site Plan, Floor plans, 90%* complete.

      1) Site Plan to include the “Accessible Path” to the closest “Public Way”.

      *90% Complete means the actual floor plans are frozen and will not change. There can be minor dimensioning missing and incomplete referencing to supporting detail drawings needed to complete the architectural design.

   e. **Tab 3:** Enlarged Architectural Floor plans showing major core areas such as entryways, elevator lobbies, typical
functional rooms (like classrooms), utility room layout, etc. (90% complete).

f. Tab 4: Complete listing of all major building systems with no selection choices left unmade (i.e. drilled caisson foundations, reinforced concrete frame, two-way slab construction, brick façade with precast elements, built up flat roof, chilled water/hot water HVAC fed from central plant, etc.). NOTE: All summaries MUST BE in the positive tense! No “proposed to be” wording. All designs must be decided & finished.

g. Tab 5: Detailed Cost Estimate, prepared by independent estimator and/or CM@R, in CSI, 34 Division format taken off the DD set of drawings with very few Lump Sum/$$ per gross square foot estimate. Additionally, a summary cost estimate with one cost item per CSI Division and with owner approved design, estimating and escalation contingencies.

h. Tab 6: A summary showing the cost estimate of this project compared to a minimum of five (5) similar size and type projects recently built in the region under similar conditions. The comparison shall list description, size, completion date, cost, and cost per square foot.

6. The following information is provided separately to the Board of Regents by the University Facilities Planning, Design and Construction (FPDC), with A/E assistance as requested by FPDC.

   a. Information regarding projected operating and maintenance costs of the facility or (in the case of renovation) the projected impact of the project on operating and maintenance costs. Information regarding the projected environmental impact of the project.

   b. Certification by Component and System Administrative Office that the submittal has been reviewed and found to be a complete and satisfactory Design Development/35% Design submittal. (This will be based partially on informal certification by Architect/Engineer of Record for every discipline that the design is complete, all calculations are completed, all major equipment has been sized, etc….there is nothing left to do but provide and prepare construction documents).

   c. The FPDC will provide separately all soft costs estimates for the Project, and a Total Project Cost Estimate.
II. ARCHITECTURAL/ENGINEERING DOCUMENTS DELIVERABLES

2.05 Example Submittal Layout for Design Development Package:

A. Front Cover Example:

![Example Front Cover](image-url)

DESIGN DEVELOPMENT PACKAGE

FOR THE

PROJECT NAME

AT

TEXAS STATE UNIVERSITY

A member of The Texas State University System

PRESENTED TO

THE TEXAS STATE UNIVERSITY SYSTEM

BOARD OF REGENTS

MONTH YEAR

FIRM’S INFORMATION
B. Cover Sheet Example

Design Development
for the
Project Name
at
Texas State University
Month Year

The Texas State University System Board of Regents (MUST verify prior to final)

Charlie Amato, Chairman San Antonio
Donna N. Williams, Vice Chairman Arlington
Jaime R. Garza, M.D., D.D.S San Antonio
Kevin J. Lilly Houston
Ron Mitchell Horseshoe Bay
David Montagne Beaumont
Trisha S. Pollard Bellaire
Rossanna Salazar Austin
Michael Truncale Beaumont
Christopher Covo-Student Regent San Marcos

The Texas State University System Administration

Brian McCall, Ph.D. Chancellor
Peter Graves Vice Chancellor for Contract Administration
Rob Roy Parnell Associate Vice Chancellor for Facilities

Texas State University Administration

Denise M. Trauth President
William A. Nance Vice President, Finance and Support Services
Nancy Nusbaum Associate Vice President, Finance and Support Services Planning
Juan Guerra Associate Vice President, Facilities
Michael Petty Director, Facilities Planning, Design and Construction

Design Team

xxxxxxxxx

Revised Jan-15

A/E Deliverables 2.05-2
C. Documents required for Tabs 1-6.


E. After Facilities Planning Design & Construction review, with approval the A/E shall submit Sixteen (16) copies of the Design Development Package to the Texas State University (FPDC).

F. Facilities Planning, Design & Construction will deliver Thirteen (13) copies to Texas State University System, and keep Three (3) for Texas State University distribution.
II. ARCHITECTURAL/ENGINEERING DOCUMENTS DELIVERABLES

2.06 100% Construction Document Review and Approval

A. The A/E shall submit at the 50%, 100% and Final Completion stages, a complete set of Construction Document and specifications for review and approval by Texas State University, including a detailed cost estimate, showing costs reconciled with the CM@R and with the CCL at each state, and a minimum of twenty one (21) days prior to the Bidding Phase of the Project.

B. The A/E shall provide 100% Complete Furniture and Equipment location plans.

   1. The Owner will finish the Furniture and Equipment Design, which is defined as Interior Design in the A/E Agreement.

C. The A/E shall also provide a set of final 100% Complete Coordination Documents, with colored overlays of the various design disciplines, to include, but not be limited to: mechanical, electrical, plumbing, sprinkler, slab penetrations, telecommunications, and instructional technologies support for Classrooms.

D. The drawing format shall be no larger than 34” x 44”. Provide nine (9) full size sets and two (2) ½ size sets of drawings, and nine (9) sets of program scope, specifications, and cost estimate. Also, provide two (2) compact discs of the entire package.

E. The A/E shall provide a written Summary of Code data relative to the Project.

F. The A/E shall provide a written certification that the documents meet all required Codes and requirements of the local Campus Standards.

G. The A/E shall provide written certification that no asbestos or lead containing materials have been specified.

H. The A/E and consultants shall provide written certification that the building design meets the provisions of the Energy Conservation Design Standards for new or renovated State Buildings administered by the Energy Management Center of the Office of the Governor of the State of Texas.
I. The A/E Agreement includes the design & documentation of interior building finishes and colors, including door finishes, floor finishes, wall finishes, ceiling finishes, and built-in mill work finishes. The A/E shall select and present all building materials and finishes (including color selections) to Texas State University, for approval before the 100% final Construction Documents and specifications are completed. Several presentations may be required.
II. ARCHITECTURAL/ENGINEERING DOCUMENT DELIVERABLES

2.06 Bidding Phase

A. The A/E shall furnish to the Owner, (2) compact discs containing both the Final Revised Construction Documents, in AutoCAD format, and Specification Manual, in Word format.
II. ARCHITECTURAL/ENGINEERING DOCUMENT DELIVERABLES

2.08 Color Selection Review and Approval

A. The A/E shall prior to award of the construction contract, provide for the Owner’s approval a color selection board, including all building material colors along with recommendations on the type and color of fixed and loose furniture.

B. After material approvals, the A/E shall provide two (2) final material color boards, as well as, two (2) sets of final material samples, on 8 ½” x 11” formats in 3-ring binders, to the Owner.
II. ARCHITECTURAL/ENGINEERING DOCUMENT DELIVERABLES

2.09 Closeout Documents

A. The A/E, no later than six (6) months prior to substantial completion, shall insure that the General Contractor provides one (1) preliminary set of mechanical, electrical, plumbing O&M Manuals for review by the Project Representative, and the University's Operation Personnel; and provide instructions on adjustment and maintenance of products.

B. The A/E, no later than 60 days after the Substantial Completion, shall make reasonable changes including all work incorporated by addendum, change orders and modifications by the contractor on the original documents to serve as Record Drawings for the Work, and shall generate a spec book from these record documents.

C. A/E shall deliver to owner all required closeout documents, including two (2) copies of each of the following: O & M manuals, test reports, photo records, warranties, specs, product submittal data if not included in maintenance manuals. A/E shall also provide one copy of final record documents in digital form (AUTOCAD), and one copy printed on paper. The original contractor as-built drawings shall also be submitted to the University.

D. All close-out documents shall be delivered as soon after substantial completion as possible, but no later than 60 days after substantial completion.

E. Cad File Delivery

1. AutoCAD Standards: All files should utilize AIA AUTO CAD standards.

2. CD Label: The delivered CD should be clearly labeled with contents.

3. Delivery Format: All AutoCAD files should be included on a CD with a relative directory structure. Please verify that all file references (blocks, fonts, etc.) work properly within the context of the CD and do not reference network drives or local directories which are not included on the disk.
4. File Format: All drawing files should be in AutoCAD (latest version of .dwg) format or older. Files produced in other applications should be verified for compatibility and formatting within AutoCAD prior to delivery.

5. X-Refs: All x-ref files shall be bound to the drawings.

6. Purged Files: All files should be purged of any unused data as well as any references to unused x-ref files.

7. Custom Files: All custom files (fonts, *.shx files, linetypes, hatch patterns) not included with the standard AutoCAD installation should be included and properly referenced.

8. Plot Files: Include any plot files (*.CTB, *.PC2, *.PCP) used in the drawings on the CD.


F. The A/E, to the best of his knowledge, shall provide written certification that no asbestos or lead containing materials have been installed on the Project. Certified Asbestos Letter with CSI breakdown of specifications as backup.

G. The A/E shall also deliver to the Owner Two (2) complete computer (AUTOCAD) generated CD ROM files on disk of the above drawings, and specifications, O&Ms, submittal data, ect shall be submitted in MS Word.

H. The floor plans shall have correct room names and room numbers as designed in the interior sign documents, as well as, each room shall have the indicated square footage.

I. A/E shall not be relieved of responsibility when files are delivered, if the files do not meet established requirements or are defective. The University shall verify all materials received and the A/E shall be notified if not complete.

J. A/E to deliver the RAS Final inspection report to the University.
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
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<td>3.05</td>
<td>Building Custodial Design Standards</td>
</tr>
</tbody>
</table>
III. DESIGN GUIDELINES

3.01 Master Plan Adherence

A. All site improvements, new building construction, building exterior renovations, building additions, and shall adhere to the Texas State University Campus Master Plan and Guidelines 2006-2015 with 2012-2017 Campus Master Plan Updates.

1. The web site link to the entire master plan document is:


2. The web site link to the design and construction guidelines is:

http://www.facilities.txstate.edu/pdc/Projects_Documents/Construction-Standards.html

a. The summary of these Master Plan Design Guidelines are defined in the Campus Master Plan Design Guidelines Checklist, located in these Construction Standards under Design Guidelines, Introduction, 1.02 Campus Architectural Unity.

b. The web link to this Campus Master Plan Design Guidelines Checklist follows on the next pages, Sections 3.01-3 through 3.01-27.
PURPOSE OF CHECKLIST

The purpose of the Campus Master Plan Design Guidelines Checklist is to summarize the Master Plan Guidelines, for the planning and design of buildings, renovations, and landscaping. Architectural and Engineering (A/E) consultants providing professional services to the Texas State University campus shall use this Checklist, the Campus Master Plan Guidelines, the Campus Design Guidelines and Construction Standards to develop appropriate additions and alterations for the campus locations listed above.

There shall be no variance from (1) the Campus Master Plan Design Guidelines and (2) the Campus Design Guidelines and Construction Standards, without the prior written approval from Texas State University. The A/E shall provide a written certification that these guidelines and standards have been met before the A/E’s final designs can be approved for construction. If the A/E chooses to propose variances during the design process, the A/E shall specifically point out these variances and make a formal written request for approval.

The primary goal and intent of the campus guidelines is to knit the campus together with a homogeneous blend of the Spanish Colonial influence from some buildings of the historic campus with the materials used on the more modern buildings. As a result, there will not be one overriding “pure” architectural style. The general architectural style to be used in the design of new construction and major additions shall have a strong Spanish Colonial influence. Common motifs from the Spanish Colonial style such as arches, colonnades, terra cotta tile pitched roofs, cornice ornamentation, etc. may be used instead of reverting back to the Spanish Colonial style in total. Good practices will be followed in building massing and scale, such as designing a distinctive base, middle, and a top. Large glass expanses shall not be prominent, but must be recessed and framed by the common motifs from the Spanish Colonial style.

Included for reference with this Checklist are a limited number of renderings and photographs of architectural designs of structures, which illustrate some of the styles and features discussed herein.
ARCHITECTURAL DESIGN GUIDELINES CHECKLIST

Site and materials checklist

☐ Follow nationally recognized environmental stewardship by achieving Green Building Council objectives. Where possible LEED certification will be achieved, if it does not adversely affect overall design, budget and occupancy.

☐ Site utility structures such as HVAC equipment, utility meters, satellite dishes, transformers, and other mechanical equipment shall be located in screened designated service areas, so as not to be visible from open spaces on campus, pedestrian corridors, or primary streets. Projects designs must include relocation of any existing utilities, streets, etc. and all site improvements to provide a compatible and homogeneous interface with the surrounding campus.

☐ Although not recommended in the Construction Standards, service and mechanical units located on the roof of buildings should not be visible from the pedestrian perspective. They should be shielded with parapets, mansards or other appropriate screening. (Photo 17)

☐ Build-to-lines must have a minimum 60% of their frontage occupied by the building façade.

☐ When the build-to-line is fronting a public space, major pedestrian corridor or street, the façade must occupy 90% of the build-to-line.

☐ Adjacent building facades should align with one another to form a continuous edge when facing open spaces, pedestrian corridors, and streets. (Photos 1,2,3,4,5) The suggested site layout, disposition and suggested entrances (primary, secondary and service) for each new building recommended in the Campus Master Plan are discussed in the chapter entitled “Urban Design Guidelines.”

☐ Exterior materials of new buildings should include the campus standard tan brick (Acme Brick Co. "Elgin 186 Blend with contrasting accents and/or wall materials. Recommended accents are a lighter cream of limestone, brick or cast stone. Additional accents could include terra cotta consistent with the roof. (Photos 5, 6, 8, 12, 14, 21, 23).
Painting the exterior of buildings is discouraged. New buildings and additions shall be primarily of masonry materials requiring minimal maintenance. Limited painting of existing structures will only be considered on a case-by-case basis.

**Building and roof forms**

Building massing should be composed of simple rationale forms. Height and massing for each new building recommended in the master plan is reflected in the chapter entitled “Urban Design Guidelines.”

Simple roof and building forms are encouraged, but must be designed to avoid the appearance of a large simple box shape. (Photos 2, 3, 4, 5, 7, 10)

The predominant roof plan should be a rectangle or a combination of rectangles.

Roof forms should be pitched, gabled, or hipped. Roofs are encouraged to have liberal overhangs, with motif detailing. On large span roof buildings, pitched mansard roofs are encouraged. Long expansive, large span flat roof facades should be reduced in scale with pitched roof tower elements and other detailing. The flat roof parapets, between the tower elements, are encouraged to have motif detailed cornices. (Photos 5, 6, 7, 8, 9, 10, 14, 17)

Flat roofs are generally discouraged, except in the case of parking garages as reflected in the last example below. Long expansive, large span flat roof facades should be reduced in scale with pitched roof tower elements. (Photos – above)

All pitched roofs shall have terra cotta clay tile, with a blend of 30% dark terra cotta, and 70% red color, in an interlocking type S-Shape tile, or a mission-style tile. Where flat roofs are required in long span structures, the ballast aggregate gravel color shall be terra cotta to match the clay tile roofs and other adjacent building cap roof color. Match Johns-Manville “Brick Red” cap sheet.

Painted metal roofs (i.e. standing seam, etc.) are not recommended and will require approval for consideration.

Roofs shall be fairly uniform in color and no speckled or mottled texture is permitted.
RECOMMENDED BASIC BUILDING AND ROOF SHAPES

Facade articulation

- Facades that address an open space, pedestrian corridors, or streets, should not have blank unarticulated wall surfaces. (Photos 2, 5, 6, 8, 10, 13, 23)

- Brick articulation is encouraged as a way to create visual interest and hierarchy.
Door and window lintels, sills and floor coursing (only to define the master plan tri-partite vertical organization of the building) should be articulated. If the flooring coursing is used, it shall not dominate or emphasize a horizontal architecture; buildings will have a vertical architectural appearance. (Photos 5, 6, 7, 8, 9, 10, 13, 23)

Ground level floor-to-floor dimension should be greater than upper level floors.

Buildings should mediate the slope of the site. The first story (“base”) of a building shall be accessible from all sides and may be as high as 20’ on the lower slope side.

Maximum height of non-parking structure buildings shall be five stories, except for figural elements or architectural embellishments, such as a tower.

The façade should clearly express the distinction between the ground level and the upper floors of a building to create a clear base. (Photos 2, 5, 7, 10, 24)

The façade of a building should clearly indicate the location of the main entrance. (Photos 5, 6, 7, 10, 14, 21, 22, 24)

To avoid a monolithic appearance, facades should be vertically articulated with bays no larger than 24 feet with width. (Photos 2, 3, 5, 7, 19, 22, 23, 24)

**Fenestration and encroachments**

Carefully articulated architectural elements help to define and beautify buildings and in turn enliven the public realm. The following architectural elements are encouraged in building designs:

The use of arcades and colonnades (a series of arches supported by columns) are encouraged, to provide shelter from the sun and weather as well as enhance building facades. Provide a minimum width of 10 feet clear for pedestrian passage. (Photos 3, 9, 13, 15, 16, 18, 19, 24)

Openings in walls and windows should be vertically proportioned. Horizontally proportioned openings and windows shall be discouraged. Several examples of the undesirable window style can be seen on the San Marcos campus. (i.e. J.C. Kellam Building, Education Building)
Major features of buildings, such as entries and building connections, may have a limited amount multi-story glass. Large glass expanses shall not be prominent, but must be recessed and framed by the common motifs from the Spanish Colonial style. The height and expanse of glass shall be reduced in scale visually with horizontal and vertical banding.

Door frames, window frames, handrails and hardware shall have a dark bronze color.

Primary building entry doors shall be aluminum storefront type with a dark bronze finish. Other proposed door designs will be reviewed for approval.

Service exterior doors shall be hollow metal and painted dark bronze or painted to match the adjacent brick color.

Upper story windows may be smaller and have less detail and embellishment than windows on lower levels. (Photos 2, 5, 14, 24)

Windows shall be recessed from the exterior plane of the façade and have the appearance of a punched opening in the wall surface.

Lintels above windows should be expressed, especially in exposed masonry construction. Lintels shall extend beyond the face of the jambs aligning with jambs is not allowed. (Photos 2, 4, 5, 6, 10, 11, 23, 24)

Window sills must be expressed on the façade and shall protrude beyond the plane of the facade so as to form a drip edge. Sills shall extend beyond the face of the jambs; aligning with jambs is not allowed. (Photos 2, 4, 5, 6, 10, 14, 18, 20)

On the ground level, when a façade faces an open space, pedestrian corridor, or street, the minimum percentage of surface that is glazed shall be 60%. No reflective or tinted glass is permitted. (Photos 2, 4, 5, 13, 24)

Arcades, balconies, cupolas, bay windows, entry elements, eaves, awnings, figural elements, and other similar uses and structures may encroach beyond the build-to-line. (Photos 3, 5, 6, 8, 13, 22, 24)
Parking LOTS AND GARAGES

☐ The visual impact of parking should be minimized. Surface parking lots should be screened from view by vegetation, brick or stone walls, or metal railings.

☐ The building façade of the parking structures should be designed to screen views of automobiles and sloped parking decks.

☐ Place level parking decks against exterior walls with sloped decks in the center of the structure, where possible with the available site.

☐ Safety and security should be primary considerations. Location and visibility of stairs, elevators, graphics, vehicle access control, call boxes, lighting, and any camera surveillance should enhance safety. 1) Garage structural ceilings to have a light color to reflect light fixture light to reduce shadows and enhance safety. The metal halide light fixture shall be a combination up light and down light. 2) Where garages are designed with 20% or more open factors, stairways do not need to be enclosed with walls or doors; leave open for aesthetic and safety effects.

☐ Garage design should include way finding for pedestrians and disabled, with measures such as color coding by floor, easily identifiable entrances/exits and elevators, and legible signage.

☐ Non-slip materials selection and sloping of the structure design should reflect the all-weather nature of most structures, especially control of water and drainage, to prevent ponds of water.

☐ Parking structures should be planned to have a minimum of a least two access and egress points.

☐ Street turn lanes are recommended for left turns from adjacent streets into the structure.

☐ It’s important to note the impact on traffic-flow patterns when placing the entrance to the garage, as this may either alleviate or create traffic congestion issues.

☐ Incorporating pedestrian-oriented uses at street level can reduce the visual impact of parking structures. A depth of 12 feet along the front of the building is enough to
provide space for newsstands, service retail and other viable uses.

Design strategies such as similar materials, a continuous frieze, cornice, canopy, overhang, trellis, or other devices on the facade of the building can visually integrate the parking structure with adjacent buildings.

The structured parking garage should incorporate a well-lit pedestrian walkway, stairway or ramp from the sidewalk to the upper level of the building.

Parking structures tend to be massive therefore; special consideration should be given to building materials, detailing, landscaping, and topographic changes.

Parking structures should be built into the topography whenever possible. Working with the topography, such as grade changes, may reduce the cost and enhance the design of the parking garage.

The height of the parking garage should be no greater than that of the adjacent buildings or tree canopy. A building lining a parking garage should always be taller than the garage it is shielding. Lowering the ground level of the garage helps to minimize its appearance.

Where possible, such as the Master Plan proposed Fine Arts Parking Garage, the parking structure should be surrounded at the ground level with occupied space, either by setting back the parking structure to allow a 50 foot liner building in front, or locating parking underground to allow building on top.

Articulating a simulated window pattern with vertical rather than horizontal patterns reduces the perceived mass of a garage. The design for all new parking garages shall reduce the long horizontal look of a typical garage structure and replace it with the more vertical visual appearance of an occupied building.

The facades of the Garage shall have the same architectural appearance as an academic building, using the Master Plan motifs and tri-partite vertical organization, such as tan brick, arches, contrasting cream accents, cornice enhancements and/or terra cotta clay tile roof treatments. These Master Plan motifs are required on the facades exposed to major public views of the building. The secondary, less public, facades may have a reduced amount of these motifs, to reduce costs. Overall the structure shall have a homogeneous architectural design, compatible with its surrounding campus setting.
Historic resources DESIGN GUIDELINES CHECKLIST

Care and maintenance of historic campus properties

☐ Examine the integrity of building materials including roof and drainage systems, paint films, masonry and mortar conditions, metalwork, windows and doors. Use this information to implement a repair and renovation to ensure the long term sustainability of the historic properties.

☐ Clean masonry to halt deterioration or heavy soiling. Clean buildings using the gentlest means possible. Do not use sandblasting or high-pressure water blasting to clean masonry under any circumstances.

☐ Repoint deteriorated masonry using new mortar that matches the historic mortar in color, composition, texture and tooling.

☐ Design and adjust landscape irrigation to avoid spraying building foundations. Design planting beds away from building foundations to the extent possible.

☐ Design, repair, and/or renovate building gutters and downspouts for ease of inspection and cleaning.

Retaining and preserving historic features and design elements

☐ Maintain and preserve the original building materials that define the character of the historic buildings on campus, including the masonry wood, steel window sash systems, copper gutters and downspouts, solid and paneled wood entry doors, original door and window hardware, ceramic and concrete tile, clay tile roofs, and other features as identified in the 2005 historic resource survey.

☐ Replace severely deteriorated materials in-kind, matching the historic building fabric in shape, dimension, color and material.

☐ Preserve existing trees and landscape features, with particular attention to the mature oak trees throughout campus.
Reconstructing missing historic features and design elements

☐ Where original building materials are deteriorated beyond repair, replace in-kind to match the historic material, dimensions, detailing, and installations methods. Salvage and archive samples of removed building materials for the historical record.

☐ Prior to any substantial rehabilitation of a historic building on campus, review original documents for the building on file at Texas State to determine where missing historic features may be reconstructed, including open loggias, windows, doors, balconettes, gutters and downspouts, and other architectural detailing.

☐ Remove modern infill of exterior porches and loggias to restore the original appearance of the historic building.

New additions to historic properties

☐ Make additions to the secondary or tertiary facades of historic buildings in a manner that does not overshadow the historic building.

☐ Avoid replication of historic details in new construction. The new work should be differentiated from the old, and should be compatible with the massing, size, scale, and architectural features of the historic building.

☐ New additions and building alterations should be undertaken in a manner that does not remove or irreversibly obscure character defining features of the historic building.

☐ All additions and alternations to historic properties shall be reviewed by the Texas Historical Commission by formal notification.

Documentation of removal

☐ Adaptive and sensitive reuse of historic campus buildings is strongly encouraged whenever possible.

☐ If it is determined that a historic building must be removed from campus, the University is required to contact the Texas Historical Commission to determine the appropriate
level of recordation of the building prior to demolition.

☐ This recordation typically follows the guidelines developed by the Historic American Buildings Survey, and ranges from photographic documentation to full plans and elevations of the buildings.

☐ This documentation should be safely stored in the university archives to preserve the historical record of the university.
PLANTS AND landscape zones

☐ The plant palette is structured to reflect the three landscape zones (plateau, prairie, and wetlands) on the Texas State campus with a predominance of native plants. Plant material should be selected from the plant list provided in the Master Plan. Variations from this list must be submitted to the Building Advisory Committee and approved by the President.

Products

☐ FINISHES:
All exterior products below shall have a powder coating of black.

☐ TABLES AND CHAIRS:
Victor Stanley Steelsites Series RND-363 in designated study or relaxation areas. Victor Stanley Steelsites Series PRSCC-* with PRSCT-36R or Equivalent for use near dining facilities with outside seating. (e.g., The Den at LBJSC)*

☐ BENCHES:
Victor Stanley Steelsites RB Series RMFC-24, 6 foot bench. Benches should be placed over a pad of the same material as the adjacent paving and anchored with concrete footings.*

☐ BOLLARDS:
Landscape forms “Annapolis” 6 inch bollard, without light, removable or embedded. **

☐ BIKE RACKS:
Dero Hoop Rack or Owner approved equivalent.
Bike racks to be spaced 36 inches on center.
Allow minimum 3 foot aisles if arranged vertically.

☐ RECEPTACLES:
Exterior:
Victor Stanley Ironsites Series SD-42, with “Rain Bonnet” lid.
All receptacles will have the Texas State logo on their top horizontal band.
The recycling containers will have a designated recycling lid.*

Parking Garages Interior:
Victor Stanley S-45, with “Standard Tapered Formed” lid.

PEDESTRIAN LIGHTS:
The Texas State pedestrian light is the PROV T5 32LED-5K-700 BLK Medium Head, Banner Arm BBD4-24-DB8. Installation shall follow Texas State Design Construction Standards.

A lighting consultant (not a lighting manufacturing vendor) shall be used to determine the bulb wattage and pole spacing to meet the photometric design modeling and foot-candle levels as defined by the Texas State University-San Marcos Construction Standards.

VEHICULAR LIGHTS:

A lighting consultant (not a lighting manufacturing vendor) shall be used to determine the bulb wattage and pole spacing to meet the photometric design modeling and foot-candle levels as defined by the Texas State University Construction Standards.

*Victor Stanley products are in the application process for the federal government program and the company is investigating the TEXMAS program.

**Landscapeforms is a TEXMAS vendor.

Paving

The walkway paving standard on the Texas State campus shall be Pavestone antique terra cotta colored concrete pavers, edged with bands of Pavestones 12” x 12” City Stone Pavers. Refer to Construction Standard specifications, Section 03 33 00 Architectural Concrete Sidewalk Paving.

Pavestone antique terra cotta colored concrete pavers shall be the dominant material for primary and secondary walkways and plazas.

During campus conversion to the new standard, there may be some areas where
aggregate concrete shall be edged with the standard smooth concrete.

☐ If possible, no aggregate concrete square shall be larger than 3 feet by 3 feet.

☐ Bike parking zones are paved with the Eco pavers filled with gray stone chips to increase on-site water infiltration. Eco pavers are 4 ½ inch by 9 inch by 3 1/8 inch thick, with 1 inch sand setting bed, filter fabric and 6 inch aggregate base and have gray gravel chips in the exposed crevasses. Concrete paving is 4 inches thick over a 6 inch aggregate base.

☐ Primary walkways are major pedestrian routes and should be a minimum of 19'-0" wide. Refer to Construction Standard specifications, Section 03 33 00 Architectural Concrete Sidewalk Paving.

☐ Secondary walkways should be 11'-0" wide. Refer to Construction Standard specifications, Section 03 33 00 Architectural Concrete Sidewalk Paving.

☐ Tertiary walkways should be 7'-8" wide. Refer to Construction Standard specifications, Section 03 33 00 Architectural Concrete Sidewalk Paving.

☐ Pedestrian only walkways are any path less than 5'-8" in width. Construct pedestrian only walkways with Pavestone concrete pavers (4 inch by 8 inch by 2 3/8 inch thick) placed on 1 inch sand setting bed, filter fabric and 6 inch aggregate base. Refer to Construction Standard specifications, Section 03 33 00 Architectural Concrete Sidewalk Paving.

☐ Primary, secondary, and tertiary walkways shall accommodate service vehicles. Refer to Construction Standard specifications, Section 03 33 00 Architectural Concrete Sidewalk Paving. Construct with Pavestone concrete pavers (4 inch by 8 inch by 2 3/8 inch thick), on a 1 inch sand setting bed, and 8 inch aggregate sub-base.
Student Recreation Center Addition
Matthews Street Parking Garage
Edward Gary Street Parking Garage
Performing Arts Center
III. DESIGN GUIDELINES

3.02 Sustainable Design Principles:

A. **High Performance Campus:** Texas State University is committed to building a campus of architectural, engineering and environmental excellence. The University will strive to demonstrate good environmental stewardship by achieving Green Building Council objectives and following other nationally recognized sustainability principles and practices to achieve a high performance campus cultivating a milieu for educational excellence. High performance campus building designs for new and existing buildings shall foster an enhanced sense of pride and excellence in higher education by creating efficient human scale facilities designed for a collaborative working and learning environment. Through careful planning and design, high performance new and existing buildings will contribute to producing a high performance educational environment that:

- Engages students in learning
- Leads and teaches by example
- Instills a sense of pride and ownership
- Fosters positive environmental stewardship
- Promotes a sense of safety and security for students, faculty and staff
- Promotes pedestrian-friendly, multi-modal transportation alternatives
- Builds connections between the University and the community

The high performance campus building designs shall implement energy conservation strategies, which save the University money, exhibit sound sustainability principles for students, and create enhanced learning environments. The University will lead and educate by example, demonstrating good environmental stewardship by adopting design standards and maintenance practices that reduce energy consumption, preserve environmental quality, and enhance the overall well-being of the university community.

B. **Design Standard:** The A/E shall use the USGBC Leadership in Energy and Environmental Design Rating System as a goal for the basis of design with an additional goal of achieving a silver rating, using the most appropriate and current rating tools. The primary purpose of establishing this design standard is to accomplish the commitment stated above. The University will pursue the prestige of obtaining a plaque, or a certification, only if it determines doing so does not adversely affect overall design, budget, occupancy and use of the project. The A/E shall include a LEED
Accredited Professional as a member of the consultant team for the duration of the project. The A/E shall develop a High Performance Project Plan for approval by the University during the preliminary plan phase of the project. The A/E team shall provide the University all the professional assistance necessary to meet its goal and plan.

C. The A/E shall develop a High Performance Project Plan for approval by the University during the preliminary plan phase of the project. The A/E team shall provide the University all the professional assistance necessary to meet its goal and plan. The sustainable building design guidelines are outlined as follows:

1. Exceed existing energy code to the maximum extent feasible while meeting building program and budget requirements;
2. Achieve lowest possible lifetime costs for new building;
3. Encourage continual energy conservation improvements in new buildings;
4. Ensure good indoor air quality;
5. Create and maintain a healthy environment;
6. Specify ways to reduce materials costs;
7. Consider long-term operating costs including the use of renewable energy sources.

The base elements to be considered during the sustainability design process are as follows:

Sustainable Sites

| Prereq 1 | Erosion & Sedimentation |
| Credit 1 | Site Selection |
| Credit 2 | Urban Redevelopment |
| Credit 3 | Brownfield Redevelopment |
| Credit 4.1 | Alternative Transportation, Public Transportation Access |
| Credit 4.2 | Alternative Transportation, Bicycle Storage & Changing Rooms |
| Credit 4.3 | Alternative Transportation, Alternative Fuel Refueling Stations |
| Credit 4.4 | Alternative Transportation, Parking Capacity |
| Credit 5.1 | Reduced Site Disturbance, Protect or Restore Open Space |
| Credit 5.2 | Reduced Site Disturbance, Development Footprint |
Credit 6.1  Stormwater Management, Rate and Quantity
Credit 6.2  Stormwater Management, Treatment
Credit 7.1  Landscape & Exterior Design to Reduce Heat Islands, Non-Roof
Credit 7.2  Landscape & Exterior Design to Reduce Heat Islands, Roof
Credit 8    Light Pollution Reduction

Water Efficiency
Credit 1.1  Water Efficient Landscaping, Reduce by 50%
Credit 1.2  Water Efficient Landscaping, No Potable Use or No Irrigation
Credit 2    Innovative Wastewater Technologies
Credit 3.1  Water Use Reduction, 20% Reduction
Credit 3.2  Water Use Reduction, 30% Reduction

Energy & Atmosphere
Prereq 1    Fundamental Building Systems Commissioning
Prereq 2    Minimum Energy Performance
Prereq 3    CFC Reduction in HVAC&R Equipment
Credit 1.1  Optimize Energy Performance, 20% New / 10% Existing
Credit 1.2  Optimize Energy Performance, 30% New / 20% Existing
Credit 1.3  Optimize Energy Performance, 40% New / 30% Existing
Credit 1.4  Optimize Energy Performance, 50% New / 40% Existing
Credit 1.5  Optimize Energy Performance, 60% New / 50% Existing
Credit 2.1  Renewable Energy, 5%
Credit 2.2  Renewable Energy, 10%
Credit 2.3  Renewable Energy, 20%
Credit 3    Additional Commissioning
Credit 4    Ozone Depletion
Credit 5    Measurement & Verification
Credit 6    Green Power
Materials & Resources
Prereq 1  Storage & Collection of Recyclables
Credit 1.1  Building Reuse, Maintain 75% of Existing Shell
Credit 1.2  Building Reuse, Maintain 100% of Existing Shell
Credit 1.3  Building Reuse, Maintain 100% Shell & 50% Non-Shell
Credit 2.1  Construction Waste Management, Divert 50%
Credit 2.2  Construction Waste Management, Divert 75%
Credit 3.1  Resource Reuse, Specify 5%
Credit 3.2  Resource Reuse, Specify 10%
Credit 4.1  Recycled Content, Specify 5%
Credit 4.2  Recycled Content, Specify 10%
Credit 5.1  Local/Regional Materials, 20% Manufactured Locally
Credit 5.2  Local/Regional Materials, of 20% Above, 50% Harvested Locally
Credit 6  Rapidly Renewable Materials
Credit 7  Certified Wood

Indoor Environmental Quality
Prereq 1  Minimum IAQ Performance
Prereq 2  Environmental Tobacco Smoke (ETS) Control
Credit 1  Carbon Dioxide (CO2) Monitoring
Credit 2  Increase Ventilation Effectiveness
Credit 3.1  Construction IAQ Management Plan, During Construction
Credit 3.2  Construction IAQ Management Plan, Before Occupancy
Credit 4.1  Low-Emitting Materials, Adhesives & Sealants
Credit 4.2  Low-Emitting Materials, Paints
Credit 4.3  Low-Emitting Materials, Carpet
Credit 4.4  Low-Emitting Materials, Composite Wood
Credit 5  Indoor Chemical & Pollutant Source Control
Credit 6.1  Controllability of Systems, Perimeter
Credit 6.2  Controllability of Systems, Non-Perimeter
Credit 7.1  Thermal Comfort, Comply with ASHRAE 55-1992
Credit 7.2  Thermal Comfort, Permanent Monitoring System
<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1</td>
<td>Daylight &amp; Views, Daylight 75% of Spaces</td>
</tr>
<tr>
<td>8.2</td>
<td>Daylight &amp; Views, Views for 90% of Spaces</td>
</tr>
</tbody>
</table>

**Innovation & Design Process**

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Innovation in Design: Specific Title</td>
</tr>
<tr>
<td>1.2</td>
<td>Innovation in Design: Specific Title</td>
</tr>
<tr>
<td>1.3</td>
<td>Innovation in Design: Specific Title</td>
</tr>
<tr>
<td>1.4</td>
<td>Innovation in Design: Specific Title</td>
</tr>
<tr>
<td>2</td>
<td>LEED™ Accredited Professional</td>
</tr>
</tbody>
</table>
### III. DESIGN GUIDELINES

#### 3.03 Academic Building Interior Space Square Footage Standards

A. Plan academic spaces in new buildings and in the major renovation of existing buildings to conform to the following space standards:

B. Net Square Feet per Person

<table>
<thead>
<tr>
<th>Academic Space Type</th>
<th>Furniture</th>
<th>Persons</th>
<th>Net Sq. Ft. Per Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Classroom</td>
<td>Table armchairs</td>
<td>010-040</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Table armchairs</td>
<td>041-075</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Table armchairs</td>
<td>076-100</td>
<td>11</td>
</tr>
<tr>
<td>Conference-Seminar</td>
<td>Table &amp; chair</td>
<td>010-030</td>
<td>20</td>
</tr>
<tr>
<td>Case Study (tiered)</td>
<td>Swivel chairs, Continuous</td>
<td>050-125</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Counter Top</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture Rm. (tiered)</td>
<td>Fixed seating</td>
<td>050-100</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>101-300</td>
<td>10</td>
</tr>
<tr>
<td>Auditorium (tiered)</td>
<td>Traditional seating</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Auditorium (tiered)</td>
<td>Continental seating</td>
<td></td>
<td>9-1/2</td>
</tr>
<tr>
<td>Library</td>
<td>Reading Room</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Library</td>
<td>Stack (1 sq. ft./ 15 volumes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dining Hall</td>
<td>Chairs and tables</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Accounting and Bookkeeping Lab</td>
<td>Chairs and tables</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>Business Machines Lab</td>
<td>Chairs and tables</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>Home Economics Lab</td>
<td>Special furniture and equipment</td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>Art Sculpture and Ceramics Lab</td>
<td>Special furniture and equipment</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

Revised Jan-15

Design Guidelines-3.03-1
Art Painting Lab        Special furniture and equipment      50
Chemistry Lab            Lab furniture                        58
Science Lab              Lab furniture                        50
Photographic Lab         Special furniture and equipment       40
Academic Data Processing Room Special furniture and equipment 75

Other Space Requirements

<table>
<thead>
<tr>
<th>Room</th>
<th>Minimum Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telecom/Data Room</td>
<td>1 per floor @80 s.f. stack rooms in multiple floor building</td>
</tr>
<tr>
<td>Audio visual (A/V) Storage Room</td>
<td>1 per ea. Building @ 80 s.f. ea. (size based on A/V equip. required)</td>
</tr>
<tr>
<td>Master Custodial Closet</td>
<td>Minimum of 120 s.f. (no dimension &lt;12’ x 10’)</td>
</tr>
<tr>
<td>(1 per Building over 45,000 g. s.f. and for each 15,000 g.s.f. of floor space)</td>
<td></td>
</tr>
<tr>
<td>Custodial Closet (1 per floor of Building)</td>
<td>Minimum of 70 s.f. (no dimension &lt; 6’-0”)</td>
</tr>
<tr>
<td>Academic Classroom Building Corridors</td>
<td>Minimum Width is 8’-0”</td>
</tr>
<tr>
<td>Building Vending Areas</td>
<td>The A/E shall determine if Vending Spaces are required in the Building.</td>
</tr>
<tr>
<td>Family Restrooms</td>
<td>1 per Building</td>
</tr>
</tbody>
</table>

Revised Jan-15

Design Guidelines-3.03-2
C. Office Spaces. Plan office space in new buildings and in the major renovations of existing buildings to conform the following space standards:

<table>
<thead>
<tr>
<th>Office Type</th>
<th>Maximum Size-Assignable Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>President’s Office and Conference Area</td>
<td>600</td>
</tr>
<tr>
<td>Vice Presidents</td>
<td>350</td>
</tr>
<tr>
<td>Academic Deans</td>
<td>250</td>
</tr>
<tr>
<td>Nonacademic Deans and Other Administrators Appointed by the Board-Lg. Departments*</td>
<td>200</td>
</tr>
<tr>
<td>Administrators Appointed by Board-all others</td>
<td>175</td>
</tr>
<tr>
<td>Associate Academic</td>
<td>175</td>
</tr>
<tr>
<td>Deans and Chairmen*</td>
<td>175</td>
</tr>
<tr>
<td>Directors/Managers of Large Departments</td>
<td>175</td>
</tr>
<tr>
<td>All other Directors/ Managers</td>
<td>140</td>
</tr>
<tr>
<td>Faculty**</td>
<td>130</td>
</tr>
<tr>
<td>Professional Staff (Normally not Assigned a Private Office)</td>
<td>100</td>
</tr>
<tr>
<td>Two Person Staff Office</td>
<td>140</td>
</tr>
<tr>
<td>One Secretary, Filing Space, Reception Area</td>
<td>140</td>
</tr>
<tr>
<td>Two Secretaries, Filing Space Reception Area</td>
<td>250</td>
</tr>
</tbody>
</table>

* Responsible for 25 or more regular, full-time employees.
** In any department, faculty offices may vary in size with none smaller than 90 square feet, nor larger than 160 square feet with the average size 130 square feet.
III. DESIGN GUIDELINES

3.04 Minimum Technology Enhanced Classroom Design Standards

THIS SECTION DELETED, REFER TO:

DIVISION 27:

SECTION: 27 41 16.51
SECTION: 27 41 16.61
SECTION: 27 41 16.62
III. DESIGN GUIDELINES

3.05 Building Custodial Design Standards

A. Custodial Requirements

1. Custodial Closets (architects will make available “construction elevations” of the custodial closets for equipment and accessory clearances when doing the document review).
   
   a. General. Provide a custodial closet on each floor of a new or renewed building.
   
   b. Provide a minimum of one custodial closet per floor and for each 15,000 square feet of floor space.
   
   c. Place custodial closets in central locations, adjacent to restrooms whenever possible.
   
   d. Do not locate custodial closets on stair landings or under stairways.
   
   e. Make each custodial closet not less than 70 square feet with no linear dimension less than 6’-0”.
   
   f. Closet door shall be at least 36” wide, and shall be installed off-center in the wall, opening outward toward the hallway, thus permitting maximum use of interior wall space.
   
   g. Do not share functions or departments in or with custodial closets.
   
   h. Floor finish shall be concrete to be polished and sealed per Section 09 66 00-TERRAZZO FLOORING, 1.02 Design Guidelines.
   
   i. Do not install/place any of the following in custodial closets:
      1. Water heaters.
      2. Telephone or electrical equipment,
      3. Exposed plumbing pipes trap primers, risers, drain pipes,
      4. Water softeners
      5. Access doors, valves,
      6. HVAC equipment, vertical ductwork,
      7. Exhaust or drainage pipes,
8. Light switches **not related** to custodial operations.

j. Nothing is to be located directly over faucets of mop sink to allow for chemical dispenser installation (electrical shelving, pipes etc.).

k. On an open wall away from the sink, on wall adjacent to the closet door, but not behind shelves, provide a dedicated grounded duplex electrical outlet GFCI (120-volt) with 20amp capacity.

l. Walls shall have a hard, impervious, smooth surface (gloss enamel paint is suitable).

m. Provide an overhead light, controlled by a switch located inside the closet adjacent to door.

n. Allow floor space for storage of large electrical equipment, machines and custodial cleaning cart.

2. **Mop Sink.** (Refer to Custodial Closet Drawing, 3.05-4D)

a. Place mop sink in custodial closet to the rear **corner** of the closet adjacent to the door.

b. **Do not place sinks behind any closet doors.**

c. Provide mop sink with hot and cold water supplied through a mixing spout which includes bucket hook and threaded end for hose connection.

d. Position the spout at least 36” above sink to allow a three-gallon mop bucket with wheels to be filled and removed from the sink.

e. Mop basin shall be a terrazzo floor service sink at least 24” x 24” x 12” high, complete with cast brass 3” caulked drain with stainless steel strainer; Stern-Williams Serviceptor Model SB-900 or Fiat Products Model TSB-100 or TSB-200 Square or approved equal by the Director Custodial Operations.

f. Faucet set shall be Chicago Faucets 305 VBRRCF Service Sink Faucet complete with wall brace, hose end, vacuum breaker and chrome finish. (Refer to drawing, 3.05-4E)
g. Include a floor drain in each custodial closet at the center of the floor. Slope floor to floor drain.

h. Add FRP (Fiber Reinforced Panel-smooth) board as a sink “surround” extending 24” out from each edge of the sink both right and left with a minimum of 4’ in height to prevent water damage to the walls. FRP Board is to be installed prior to the installation of the sink. (Refer to Custodial Closet Drawing, 3.05-4D).

3. Interior Features. (Refer to Custodial Room Drawing, 3.05-4)

   a. All storage, hangers and shelving are to be designed, specified and ordered by Custodial Operations. Installation will be by custodial Operations. All will be reimbursed by FPDC to Custodial Operations.


   a. Provide an additional “Master Custodial Closet” for buildings exceeding 45,000 gross square feet.

   b. In addition to the above listed criteria, this closet shall be a minimum of 120 square feet with dimensions being no less than (12’ x 10’), and located in close proximity to a loading dock/ramp or service entrance door. Master Custodial Closet may be greater in size where applicable.

   c. The following shall be included:
      1. Each interior wall space shall be provided with a minimum of two (2) dedicated GFCI, 60-HZ, 120-volt duplex electrical outlets.
      2. Outlets to be located adjacent to door.
      3. Telephone jack adjacent to door
      4. Cable / computer connections
      5. Overhead light controlled by switch located inside the closet, adjacent to the door.

   d. Closet door shall be at least 36” wide and will open to the outside hallway to allow maximum floor space utilization of closet space.

   e. All storage, hangers and shelving are to be designed, specified and ordered by Custodial Operations. Installation will be by custodial Operations. All will be reimbursed by FPDC to Custodial Operations.
Example of custodial closet layout
f. Provide adequate force ventilation to prevent Hydrogen buildup from battery recharging on self-propelled equipment.

5. Custodial Supervisor Office.

a. Provide an additional “Supervisor Office” for buildings exceeding 100,000 gross square feet.

b. This office space shall be approximately 120 square feet (10’ x 12’) and shall be located on first floor in close proximity to a service entrance door.

c. Office door shall be at least 36” wide and shall be installed off-center in the wall, opening out, thus permitting maximum use of interior wall space.

d. Three interior wall spaces shall be provided with dedicated GFCI, 60-HZ, 120-Volt duplex electrical outlets and one interior wall will be provided a dedicated GFI, 60-HZ, 120-Volt fourplex electrical outlet next to data outlet for office electrical equipment.

e. An outlet for a telephone line and an outlet with a cable (CAT 5 E) for a computer terminal shall be provided.

f. All storage, hangers and shelving are to be designed, specified and ordered by Custodial Operations. Installation will be by custodial Operations. All will be reimbursed by FPDC to Custodial Operations.

g. An office desk & chair will be provided with appropriate filling cabinets in line with existing building furnished décor.

6. Interior Finishes

a. Technical information on finishes will be made available to Custodial Operations upon request, during the CD review process, in accordance with Section I. Introduction 1.03-5 23. MSDS

(1) Require the contractor to maintain material safety data sheet information at job and make data
available to the university for all sealers, paints, walls coverings, laminates, plastics, fabrics, upholstery, carpets, tiles and any finishes applied to any surfaces of all types.

(2) Information to include name, brand, and manufacture and recommended cleaning procedures.

b. Terrazzo.

(1) Terrazzo is a preferred floor material for heavy foot traffic areas such as in entryways, elevator lobbies, corridors, toilets, etc.

(2) Avoid use of white terrazzo and avoid the use of metal flakes within the terrazzo matrix.

(3) Terrazzo must be cut, ground, honed and finished in accordance with Construction Standards, Division 09-Finishes, Section 09 66 00 Terrazzo; 1.02 Design Guidelines.

(4) Contractor shall coordinate sealer with Texas State University Custodial Operations to verify compatibility between contractor and Texas State University maintenance finishes.

c. Concrete.

(1) Where exposed concrete floors are to be used, apply in accordance with section b. above for Terrazzo, unless the floor will be exposed to solvents, etc. then use a petroleum base sealer on the concrete.

(2) Consider installation of separate cement topping for floor areas where concrete is to be left exposed.

d. New Vinyl Composition Tile (VCT).

(1) Use vinyl composition tile (12” X 12” X 1/8”) is generally the best investment for most floors, with possible competitors being concrete, carpet, and terrazzo.
(2) Contractor will insure that vinyl tile floor covering is prepared as follows:

   a. Scrubbed or stripped with a green product supplied by Custodial Operations to ensure uniformity;
   b. Thoroughly rinsed of all dirt and debris;
   c. Apply three (3) layers of floor finish from Custodial Operations allowing adequate drying time between coats;
   d. Apply three (3) layers of green water based floor finish from Custodial Operations allowing adequate drying time between coats.
   e. Buff to a high shine.

(3) All floor chemicals will be furnished by Custodial Operations to ensure uniformity and chemical compatibility. They will include usage instructions and MSDS. All will be reimbursed by FPDC to Custodial Operations.

(4) Debris found imbedded within the floor finish or under the tile, as well as overly large gaps between tiles will be considered as an unacceptable finished product.

7. Existing Vinyl Composition Tile (VCT)

   a. Strip old finishes down to original VCT using green product supplied by Custodial Operations.

   b. Repeat D. 2. b.-e. above

   c. All floor chemicals will be furnished by Custodial Operations to ensure uniformity and chemical compatibility. They will include usage instructions and MSDS. All will be reimbursed by FPDC to Custodial Operations.

   d. Debris found imbedded within the floor finish will be considered as an unacceptable finished product.

8. Custodial Circuits

   a. Custodial circuits and receptacles shall be dedicated, rated at 20 amps, 120 volt and under no circumstances include
any other loads or circuits (such as classroom and/or offices).

b. Provide one, dedicated receptacle at no more than 40’ linear feet o.c. in hallways to allow use of 25’ floor machine electrical cords from any location in hallways.

c. For identification purposes, these receptacles and their covers shall be yellow in color.

d. Light switches not related to custodial closet operations shall not be installed inside the custodial closet.

9. Restroom Accessories Supplied by Custodial (except at Round Rock Campus):

a. Soap Dispensers: Will be provided and installed by Texas State University.

b. Toilet Tissue Dispenser: Will be provided and installed by Texas State University.

c. Paper Towel Dispenser: Will be provided and installed by Texas State University.

10. Restroom Items by General Contractor:

a. Locate recessed Hose Bibb, in lockable enclosure, for Custodial Staff in one ADA accessible toilet stall per restroom, 3’0” high, on toilet wall.

b. Sanitary Napkin Disposal: Refer to Section 10 28 13.13

c. Waste receptacle: Refer to Section 10 28 13.13

END OF SECTION 3.05
EXISTING REMODELING OF CAMPUS PROJECTS
CONSTRUCTION STANDARDS
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4.02 HVAC Components Cleaning Procedures when Working in Occupied Buildings
4.03 Hazard Communicator Program
4.04 “Hot Works” Permit Form
4.05 Trenching
4.06 Service Provider Parking Form
4.07 Contractor Building Key Form
IV. EXISTING REMODELING OF CAMPUS PROJECTS CONSTRUCTION STANDARDS

4.01 QUALITY STANDARDS

A. The object of these STANDARDS is to achieve the best possible work products and working conditions in regards to contracted services for projects being administered by Office of Facilities Planning Design and Construction (FPDC) staff.

B. Adherence to these STANDARDS for FPDC projects by contractors and those under their employ will result in quality products for Texas State University with intent to minimize, as much as possible, any inconveniences and negative impact on existing operations.

C. It is important that prime contractors advise their superintendents, project managers and subcontractors of the contents of these Standards at the onset of any FPDC remodeling project.

D. These included as part of CONTRACT DOCUMENTS in every FPDC administered remodeling project, unless specifically superceded in writing by individual project specifications.

E. Contractor’s adherence to applicable jobsite safety standards, statutes and regulations to include, but not be limited to, OSHA is required.

Division 01 - General Requirements

A. Dust Protection:

1. Adequately cover and protect all smoke alarms, communications, pull stations, and control panels in project area prior to commencing.

2. Provide temporary filters at return air inlets serving project area.

3. Seal off project area for dust protection. Accepted methods are four mil polyethylene plastic - clipped to ceiling grid and tape to the flooring

4. When removing carpet, spray down with water

5. Do whatever necessary to keep from tracking dust and debris outside project area. The use of disposable tack mats at project entry areas is encouraged.
6. Do not use any university trash containers, including waste baskets or dumpsters to dispose of materials.

7. Contractors may be held responsible for reimbursement of cost for lost labor due to false fire alarms when above enumerated protection is disregarded.

B. Existing flooring protection – take whatever action necessary to protect existing flooring – Contractor shall be responsible for damage to existing flooring.

1. If elevators are used they shall be protected against damage and debris. Discuss means and methods with Project Manager.

C. Utility Shutdown:

1. Unscheduled utility shutdowns are prohibited, except in Emergency situations. For locations of utility mains call 245-2148 and Project Representative.

2. Any project task requiring shutdown of any utility, fire alarm, roadway or portion of roadway, high traffic pedestrian walkway, or communications shall be scheduled at least twenty-four hours in advance with the Project Representative. Some projects may require longer advance notice of utility shutdowns. This will be addressed at pre-construction meetings.

D. Professional Worker Behavior and Appearance

1. All workers on the jobsite shall conduct themselves in a professional manner at all times. Only proper attire for work is acceptable, shirtless workers, sandals, ragged clothing, t-shirts deemed inappropriate by project representative, etc., is not acceptable. Loud music, catcalls, inappropriate gestures, smoking within buildings, use of a building’s sanitary facilities without prior approval by project representative is prohibited.

Division 02 - Site Work

A. Signs, barricades and erosion control measures may be needed. This will be addressed at pre-construction meetings.

1. Excavation must be cleared in advance to avoid damage to underground system and/or landscaping.

2. Contact Project Representative prior to any excavation.
3. Contractor will be responsible for damage to areas due to parking and/or staging. Obtain approval in advance from Project Representative.

4. Trenching, open pit, and fall protection in accordance with OSHA requirements is required.

**Division 03 - Concrete**

A. No water added to concrete without Project Representative approval.

B. Concrete truck and chute cleaning shall be done off University property unless arrangements by Project Representative.

C. Contractor’s responsibility to protect fresh concrete from vandalism. Graffiti laden or damaged concrete will not be accepted.

D. Contractor shall contact Project Representative with reasonable sufficient advance notice to inspect subgrade compaction, reinforcing steel and framework prior to placing concrete.

**Division 04 – Masonry**

A. Obtain approval for matching materials in advance via submittal process. Field samples may be required. This will be addressed at pre-construction meetings.

**Division 05 – Metals**

A. Hot Work Permit may be required.

**Division 06 - Wood and Plastics**

A. Rough Carpentry:

1. No yellow pine wall framing members shall be used unless otherwise specified.

2. Framing members shall be attached to bottom and top tracks by means of screws on each side of the track, shall have pre-punched utility holes in linear alignment.

3. Interior partition walls (including gypsum board sheathing) are to extend 6” minimum above ceiling assemblies unless otherwise specified.

4. Finish Carpentry:
a. Cabinets - no horizontal grains  
b. No tool marks, open joints, or other defects  
c. Use Plywood on countertops, no composites unless otherwise specified  

**Division 07- Thermal and Moisture Protection**  

**Division 08- Doors and Windows**  

A. No gap greater than 1/8 " permitted on newly installed doors  
B. Pre-drill screw holes on door hinges, latches, and jambs  
C. Hardware screws shall be tight but not stripped. Screw heads shall not be worn or distorted.  

**Division 09- Finishes**  

A. Gypsum Board: Installation of gypsum board in accordance with the American Gypsum Association  
B. Ceilings:  
   1. Ceiling tile cut around perimeter of ceiling shall not have more than 1/4" play side to side  
   2. Add #9 support wires at each corner of drop-in fixtures and a/c registers.  
C. Flooring:  
   1. If pre-formed outside corner cove base is not used, cove base shall extend 1’ minimum past corner.  

**Division 10- Specialties**  

**Division 11- Equipment**  

**Division 12- Furnishings**  

**Division 13- Special Constructions**  

**Division 13- Project Staging and Accessibility:**
A. If parking spaces are designated to the Contractor by the Project Representative for tool wagons vehicles (Ref. Supplemental Conditions 1.12) (not for personal vehicles) the Contractor will be responsible for providing and maintaining barricades, fencing, and appropriate signage for those designated places.

B. Area to be designated for access both inside and outside buildings and type of barricades allowed shall be addressed at the pre-construction meeting. Temporary controls and construction aids to include, but not be limited to, air hoses, water hoses, or any type of temporary wiring or cable shall be placed to avoid pedestrian or vehicular traffic. Any exceptions or deviations must be approved in advance with the Project Representative.

C. Work hours in occupied Residence Halls are limited to 10:00 a.m. – 6:00 p.m. This includes work under the buildings, on exterior of buildings and in close proximity to the buildings. Exceptions must be in writing from Project Representative.

Division 14 -49 – (Refer to Divisions and Construction Standards Sections)
IV. EXISTING REMODELING OF CAMPUS PROJECTS CONSTRUCTION STANDARDS

4.02 HVAC Components Cleaning Procedures when working in occupied buildings:

1. Before start of operations: Occupants should be notified of workmen in their area before arrival of contractor and should remove any items from tops of workstation dividers, etc.

2. Areas of duct cleaning must be vacated prior to start of work.

3. Upon arrival, contractor will cover workstations with plastic.

4. During the air duct cleaning process, some furniture may be moved in order to access ducts.

5. Ceiling tiles will be removed and some debris may fall out at this point, but all debris from air ducts is captured in Hepa vacuums (supplied by the contractor) and not released into the air space.

6. Approximately 30 minutes to one hour before the end of the shift, one contractor employee will be designated to start cleaning up with tools and equipment supplied by the contractor.

7. Clean up will include removal of plastic from workstations, check workstations and dust off if needed, vacuum carpet, place furniture back in place, gather all work trash in contractor furnished containers, and remove from the building.

8. A final walk through of the work area is done by the Project Representative to check all of these items.

9. The building should be secured as pre-discussed with the customer: 30 minutes before end of work shift, call Custodial Operations Supervisor to inspect cleanliness and to help with security. Names and phone numbers for these contacts are to be obtained from Project Representative.

10. Emergency numbers and/or phone numbers for campus police when working on campus:

   Campus police dispatch       (512) 245-2805
   Cogen Plant                  (512) 245-2108

Revised Jan-15

Existing Remodeling of Campus
Projects Construction Standards-4.02-1
11. Contractor’s Representative will leave a voice mail of his progress at main contracting office or for Project Representative when working after hours. During regular hours, contractor’s representative will call the contracting office and/or Project Representative directly.

12. All work performed is to be scheduled in advance between the Contractor’s Representative and FPDC Project Representative.

13. Tracking water/debris on floor will be cleaned by the contractor.
IV. EXISTING REMODELING OF CAMPUS PROJECTS CONSTRUCTION STANDARDS

4.03 Hazard Communication Program

1. The Architect/Engineer and contractor shall comply with Texas State University’s Hazard Communication Program.

2. This policy is available online at http://www.txstate.edu/effective/upps/upps-04-05-05.html or in the office of Facilities Planning, Design and Construction.

3. MSDS sheets must be submitted to the Project Representative for approval prior to the use of materials which pose a health hazard as defined by the Hazard Communication Program.

4. A Work Area Chemical List (WACL) shall be maintained by the Contractor.

5. The WACL shall contain copies of MSDS for each material listed.

6. Original container labels on incoming containers of hazardous chemicals may not be removed or defaced.

7. Chemicals transferred to other containers must have labels affixed on the container which contain the following information: chemical name, manufacturer name and address, health or physical hazard, target organ, effects and personal protective equipment required.

8. Chemicals shall not be stored in unlabeled containers.

9. As part of project close-out, the Contractor shall be required to forward all MSDS information to the Project Representative.
IV. EXISTING REMODELING OF CAMPUS PROJECTS CONSTRUCTION STANDARDS

4.04 Hot Works Permit

Date 

Building (Facility) 

Dept. Floor 

Work to be done 

Special Precautions 

Is fire watch required? Length of Time Date 

The location where the work is to be done has been examined, necessary precautions taken, and permission is granted for this work (See other side.)

Time Permit Expires Date 

Signed 

Permit Authorizing Individual 

Time Started Time Completed 

Final Check 

Work area and all adjacent areas to which sparks and heat might have spread [including floors above and below and on opposite side of wall(s)] were inspected: (Check one) 

30 minutes after the work was completed and found safe. 

Or 

minutes after the work was completed and it was determined that there is no potential for a smoldering fire.
ATTENTION

Before approving any hot work permit, the Shop Supervisor, or his/her designate, shall inspect the work area and confirm that precautions have been taken to prevent fire in accordance with this Facilities Policy and Procedural Statement.

PRECAUTIONS

- Sprinklers in service.
- Hot work equipment in good repair.

WITHIN 35 FT OF WORK

- Floors swept clean of combustibles.
- Combustible floors wet down, covered with damp sand, metal, or other shields.
- All wall and floor openings covered.
- Covers suspended beneath work to collect sparks.

WORK ON ALL WALLS OR CEILINGS

- Construction noncombustible and without combustible coverings.
- Combustibles moved away from the opposite side of the wall.

WORK ON ENCLOSED EQUIPMENT

(Tanks, containers, ducts, dust collectors, etc.)

- Equipment cleaned of all combustibles.
- Containers purged of flammable vapors.

FIRE WATCH

- Provided during and 30 minutes after operation.
- Supplied with a fully charged and operable fire extinguisher.
- Trained in use of equipment and in sounding fire alarm.

FINAL CHECK

- Made 30 minutes after completion of any operation unless fire watch is provided.

Signed___________________________

Shop Supervisor

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Existing Remodeling of Campus

Projects Construction Standards –4.04-2
IV. EXISTING REMODELING OF CAMPUS PROJECTS CONSTRUCTION STANDARDS

4.05 Trenching

Before any trenching on Campus or on City of San Marcos property, contractor is to call the Texas One Call System at 800-545-6005, at least 48 hours before you plan to do any excavating.
IV. EXISTING REMODELING OF CAMPUS PROJECTS CONSTRUCTION STANDARDS

4.06 Contractor Building Key Form

BORROWER’S NAME:

________________________________________________________________

BORROWER’S ADDRESS:

________________________________________________________________

BUILDING NAME:

________________________________________________________________

KEY #    ISSUE DATE    SIGNATURE    RETURN DATE    SIGNATURE

______    ___________    _____________    _______________    ____________

______    ___________    _____________    _______________    ____________

______    ___________    _____________    _______________    ____________

______    ___________    _____________    _______________    ____________

In consideration for the permission extended to me by Texas State University, through its agents and employees, to use the key listed above in its present condition and without modifications, I (for myself, my heirs, executors, and administrators) release, discharge, and agree to indemnify Texas State University and all of its agents and employees, acting officially or otherwise, from any claims on account of my death or on account of any injury to me or for damage to my property which may occur for any cause during the use of such equipment regardless of whether such death, injury or damage is caused in whole or in part by the negligence of Texas State University.

I intend to indemnify Texas State University and its agents and employees from the consequences of their own negligence, whether that negligence is the sole or concurring cause of the death, injury or damage.

I intend to indemnify Texas State University and its agents and employees from any damages resulting from my failure to return the key.
If I fail to return the key by the return date I agree to whichever of the following options Texas State elects:

a. I will pay for making a new key; or

b. I will pay for replacing the locks for this key or re-keying, and pay to replace the keys of all current key holders.

Dated the ________________ Day of ___________________ 20 ___.

_________________________________

Signature

PROJECT MANAGER ____________________________
PROJECT NAME ______________________________

ESTIMATED COMPLETION DATE _____________________
WORKING ON CITY OF SAN MARCOS PROPERTY
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5.01 Interfaces with the City of San Marcos

5.02 Texas State University-City Project Interface
V. WORKING ON CITY OF SAN MARCOS PROPERTY

5.01 Interface with the City of San Marcos

A. Texas State University is obligated to interface with the City of San Marcos for all work, which occurs off campus (Texas State University Property).

B. Texas State University is also obligated to pay Impact Fees for additional sewage discharge to the City system. A/E shall provide calculation, which establishes net increase/decrease of sewage to the City system, which will be used to determine Impact Fee Charges, which Texas State University will pay to the City.

C. Curb cuts onto City of San Marcos Streets and/or TXDOT roadways shall be submitted to the appropriate agency for approval before the project is bid. Bid documents shall include signed drawings establishing approval by City or TXDOT or any other agency having jurisdiction.

D. Generally Texas State University has its own water system and is not obligated to pay tap or meter fees. Where Texas State University water is not available, the A/E shall coordinate all connections and related equipment with City. Bid documents shall include City signature block signifying City approval of documents.

E. Generally Texas State University has its own electrical distribution system and is not obligated to interface with or pay fees to SMEU. Where Texas State University electrical service is not available, the A/E is to submit documents to the City/SMEU for approval prior to issue of documents for bid. Where SMEU lines need to be adjusted to accommodate new construction such modifications must be addressed with SMEU as part of the bid package. A/E to coordinate this effort with approval of Texas State University – FPDC.

F. Fire Lane Curb Painting on City of San Marcos-owned streets, Refer to EXHIBIT 1, 5.01-2
Exhibit 1:

ALL CURB TOUCHING THE FIRE LANE AS SHOWN ON THE STRIPING PLAN SHALL BE STRIPED AS SHOWN ON THIS DETAIL

ALL RED

FIRE LANE - NO PARKING

FIRE LANE STRIPING

TOP AND FACE OF CURB PAINTED RED. WITH 4” HIGH WHITE LETTERS ON FACE OF CURB "FIRE LANE- NO PARKING" EVERY 20'

6

STRIPING NOTES

SPP-15

SS4/SPEC ITEM 860

The City of San Marcos
DEPARTMENT OF ENVIRONMENT & ENGINEERING
STANDARD DETAIL
N.T.S.

APPROVED BY:
KATHRYN WOODLEE, P.E.
07-20-09
DRAWING: T/DETAILS/FIRE STRIPING.DGN

End of Section 5.01
V. WORKING ON CITY OF SAN MARCOS PROPERTY

5.02 Texas State University – CITY PROJECT INTERFACE

A. Texas State University provides contact for on-going correspondence and review status throughout project – Director of Facilities Planning Design and Construction (FPDC).

B. Initial design contact (Project Assessment) identifies impacts to existing City systems relating to water, sewer, traffic, and drainage. This requires a site plan, facility demands, and time frame. The result is a determination of applicable City ordinances and any off-site issues. A/E Team shall work with the City to achieve with coordination through FPDC.

C. If necessary, provide off-site engineering construction drawings & specifications and site plan showing tie-in’s to utilities, driveways and sidewalks for review by Engineering and Utilities for compliance with City ordinances relating to infrastructure construction, taps and industrial pretreatment. The review will produce driveway and right-of-way construction permits. A/E Team shall work with the City to comply with this requirement. Coordinate with FPDC.

D. Provide on-site architectural and civil drawings including total impervious cover for review by Public Works, SMEU, and Utilities for determination of drainage utility impact, grading issues, and utility impact fees. As related to waste water and storm water discharge, A/E Team shall work with the City to comply with city ordinances. A/E shall comply with City of San Marcos storm water detention ordinance. Interface with SMEU is only applicable if we are connecting to SMEU or removing/relocating SMEU lines. Work totally within Texas State University property will require City interface only to extent that waster and storm water are adjusted.

E. Completion of off-site extensions will generate a Certificate of Acceptance from the City. A/E shall include this requirement in bid documents and shall require Contractor to provide Texas State University the noted City of San Marcos Certificates of Acceptance.

F. Tie-ins to City services may be activated upon City approval and payment of fees. A/E shall determine if there will be tie-ins to City Services. If such are required by the construction contract, the A/E
shall require the contractor to acquire permits and pay all associated fees. A/E shall require Contractor to submit evidence of compliance with these requirements.
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Revised Jan-15
DIVISION 00: GENERAL CONDITIONS

Texas State University System General Conditions for Construction Contracts
Texas State University Owner’s Component’s Conditions

Revised Jan-15
PART 1:  GENERAL

1.01  Document:

A.  The current Texas State University System Uniform General Conditions is the State of Texas Uniform General Conditions for Construction Contracts, date August 17, 2005.

B.  The above General Conditions must be included in the A/E's Specification Manual.

1.02  Hierarchy of A/E Document Conflicting Information:

A.  If conflicts occur in the document information, the following order of hierarchy shall apply, 1) Texas State University System Uniform General Conditions for Construction Contracts, 2) A/E's Specification Manual, and 3) A/E drawings.

PART 2:  PRODUCTS


B.  Texas State University Owner’s Component’s Conditions

PART 3:  EXECUTION (NOT USED)

END OF DIVISION 00
SECTION 00 00 01  COMPONENT’S CONDITIONS

Laws Governing Construction:

2.2.2  Attachment "A" (of Exhibit B) Prevailing Rate Schedule indicates the prevailing wage rate determination by the Owner.

2.8  Antiquities: Contractor shall take precaution to avoid disturbing primitive records and antiquities of archaeological, paleontological or historical significance. No objects of this nature shall be disturbed without written permission of Owner and the Texas Historical Commission. When such objects are uncovered unexpectedly, the Contractor shall stop all work in close proximity and notify the Owner’s Designated Site Representative (ODSR) and the Texas Historical Commission of their presence and shall not disturb them until written permission and permit to do so is granted. All primitive rights and antiquities, as defined in Chapter 191, Texas Natural Resource Code, discovered on the Owner’s property shall remain property of State of Texas, the Texas Historical Commission. If determined by Owner, in consultation with the Texas Historical Commission that exploration or excavation of primitive records or antiquities on Project Site is necessary to avoid loss, Contractor shall cooperate in salvage work attendant to preservation. If the Work stoppage or salvage work causes an increase in the Contractor’s cost of, or time required for, performance of the Work, Contractor may file, with the ODSR, a Notice of Claim.

General Responsibilities of Owner & Contractor:

3.1.2.3  All written communications between the Owner, Contractor, and the Architect/Engineer concerned with the construction of the Project shall be furnished to the Owner (central office), the Owner’s Component Project Manager or Construction Manager and on-site Construction Inspector, the Architect/Engineer, and the Contractor by the party originating the communication. See also Division 1-013100, para. 2.

A series of flow diagrams, attached as Enclosure 2, indicate how various items (Applications for Payment, Requests for Information, Change Proposals/Change Orders, and Shop Drawings/Submittals) are processed.

3.3.1.1  Responsibility For Work Force:

Unacceptable behavior on the part of the workers anywhere on campus, including parking lots, the project site, and the accessing route(s) through the site through the campus, or failure to obtain parking permits, or traffic violations while on campus may lead to dismissal or cancellation of the Contractor's on-campus parking privileges. Further, identifiable offending worker(s) shall be removed from the project. See also Division 1-010000, para.15.

3.3.2.1  The Contractor shall provide all on-site project supervision at a responsibility level pre-approved by the Owner. Supervision shall include continued verification that all subcontractor work complies with the contract documents and industry standards.

3.3.2.2  Contractor’s Project Manager (PM) and Superintendent shall have full authority to act on behalf of the Contractor including, but not limited to, signature authority for progress payments and change orders. All communications given to the Contractor’s PM and Superintendent shall be binding on Contractor. All oral communications affecting Contract Time, Contract Sum and Contract Interpretation shall be confirmed in writing to Owner.
3.3.4.2 Protection: The Contractor shall handle all material as directed, so that it may be inspected by the A/E’s and the Owner’s representative(s).

3.3.4.3 Temporary Water for Work: The Contractor shall include all connections and means of conveying same to place where required, including the necessary metering devices capable of measuring water used by construction activity. In lieu of temporary connections, the Contractor may make permanent connections and this may serve for the construction period. In the event the Owner does not have water available at the site, the Contractor shall negotiate with the City for water and pay all fees and rates required by the City Water Department. The Contractor shall provide all drinking water required for construction activities at no cost to the Owner. See also Division 1-015000, para 3.

3.3.4.4 Temporary Electrical Energy: When utilizing local Utility Company power, invoices must be submitted prior to payment reimbursement. See also Division 1-015000, para 3.

3.3.4.5 Temporary Heating, Cooling and Lighting: Provide heating/cooling in such a manner that no Work will be damaged and ensure adequate ventilation exists. See also Division 1-015000, para 3.

3.3.4.6 Temporary Services Provided by Owner: The contractor is NOT to open or close any valves to utility systems. Once proper system operation, including operational thermal controls, has been demonstrated to the University Utility Department, the Contractor may use the system for heating and/or cooling. See also Division 1-015000, para 3.

Filters shall be changed at least every 2 weeks and more frequently if required by LEED or extremely dusty conditions exist. Any flushing or chemical treatment residue must be removed and disposed of properly and legally.

3.3.4.7 Equipment and Materials:

a. Expediting: The Contractor will be responsible for insuring the arrival of critical supplies and equipment on schedule.

b. Protection: The Contractor will insure that the following requirements are met to keep equipment and materials in good condition and that they are recorded on the appropriate daily reports:

1) Take steps as necessary to protect all equipment from physical damage and from the elements such as painting, greasing, rust preventive application, covering, or wrapping connections.

2) Rotate all rotating equipment four turns once each week during construction.

3) Protect all openings from the weather at all times.

4) Protect instruments and control panels from corrosion due to humidity, precipitation, temperature, and atmospheric conditions.
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3.3.5.1    Inspections:

The Contractor will be especially mindful of the following and will assist in facilitating the work of the Owner's Construction Manager or Construction Contract Administrator. All materials, equipment and work will be subject to inspection at all times by Owner, or his agents:

a. **Inspection at a project site**: It is the Contractor's responsibility to request Owner's Construction Manager or Construction Contract Administrator, and A/E’s Inspector to arrange for the inspection of materials, equipment and work. The Contractor will make prior inspection to insure that items are ready for inspection and approval by Owner or A/E. The Contractor is responsible for notifying testing agencies well in advance of time actual testing is required.

b. **Inspection away from a project site where required**: It is Contractor's responsibility to notify Owner and A/E in reasonable time as to where such materials, equipment or work are being produced or performed and when they will be ready for inspection. The Contractor is expected to make travel arrangements and pay for travel costs. Where such inspection away from a project site is required, Contractor will not make shipment until the inspection is made or waived.

c. Inspection by Owner, or his agents, will not relieve the Contractor from his responsibility for performing his own inspection to insure all contract requirements are being satisfied.

d. The Owner reserves the right to waive inspection at any time or point without prejudice to their right to pass on acceptability of materials, equipment, and work, at a later time or point.

e. The Contractor will remedy all defects of materials, equipment and workmanship in accordance with the applicable portions of the Contract. Materials or equipment rejected by Owner's representatives or by Contractor's inspectors will be returned to Contractor for replacement, or correction, or credit, at Owner's option, and if any handling or transportation expenses or costs are involved, all such expenses are by Contractor.

3.3.5.2    Condemnation and Removal of Defective Work

The Contractor shall, without charge or assessment against any contract contingency or allowance, replace any material or correct any workmanship found by the Owner or A/E not to conform to the contract requirements, unless in the public interest the Owner consents in writing to accept such material or workmanship with an appropriate adjustment in the contract price. The Contractor shall promptly correct all work rejected by the Owner or Architect/Engineer as defective or as failing to conform to the Contract Documents whether observed before or after the Date of Substantial Completion or final inspection and acceptance and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected Work. The costs of such corrective work shall also include reimbursement by the Contractor to the Owner of the amount of the fee to be paid by the Owner to the Architect/Engineer for the extra services of the Architect/Engineer in performing its responsibilities to the Owner relative to such corrective work. If the Contractor does not promptly complete the Work, replace rejected material or correct rejected workmanship, the Owner may, 1) by separate contract or otherwise, replace such material or correct such workmanship and charge the cost thereof to the Contractor, or 2) terminate the Contractor's employment in accordance with Article 14, Suspension and Termination.
If any portion of the Work is concealed by subsequent work without notification to the Owner as set forth herein contrary to the instructions of the Owner or Architect/Engineer or to the requirements specifically expressed in the Contract Documents, it must be uncovered for observation and recovered at the Contractor's expense.

If any other portion of the Work has been covered which the Owner or Architect/Engineer has not specifically requested or is not specifically indicated elsewhere in the Contract Documents to observe prior to being covered, either may request to see such Work and it shall be uncovered by the Contractor. If such Work is found to be in accordance with the Contract Documents, the cost of uncovering and recovering shall be charged to the Owner. If such Work is found not to be in accordance with the Contract Documents, the Contractor shall pay such costs including the amount of fee to be paid by the Owner to the Architect/Engineer for extra services related to such non-complying work.

Upon notice of condemnation, the Contractor may request to prove to Owner and the Architect/Engineer, at Contractor's sole cost, that the Work should be accepted because it meets performance, and other relevant standards. The Contractor shall have ten (10) working days from receipt of the notice to present documentation to prove compliance. Owner shall respond to Contractor's showing of proof in writing within fifteen (15) working days of receipt of Contractor's documentation.

3.3.8.1 Project Cleanliness: The contractor shall provide personnel for janitorial work in order to keep all offices, office toilet rooms, and portable toilets cleaned; attend to drinking water and supplies. Solid debris, such as brick bats, mortar and plaster droppings, may not be dumped on the grounds about the building. All scrap from lumber, crating, excelsior, paper and similar types of trash are to be removed from the building site. Trash, construction debris, and mud shall not be allowed to accumulate anywhere on the project, whether in the building, on the grounds, in the adjacent areas, or on the campus streets serving as delivery and haul-off routes for the work of this project. There must be thorough cleanup of the building and its surroundings daily or as directed by the Owner.

3.3.13 Documents and Samples at the Site: Contractor shall maintain one original record (red line) of the Drawings, Specifications, Addenda, Change Orders and other modifications, marked to record field changes and selections made during construction, and one record copy of approved Shop Drawings, Samples and similar required submittals, shall be available to the Architect/Engineer and shall be delivered to the Architect/Engineer for submittal to the Owner upon completion of the Work or Contractor's request for Substantial Completion Inspection.

Historically Underutilized Business (HUB) Subcontracting Plan:

4.1.2.1 For HUB Subcontracting Plan (HSP) Prime Contractor Progress Assessment Report-see Enclosure 8

Bonds & Insurance:

5.2.2.1.5.4 The builders risk policy shall have endorsements as follow:

If offsite storage is permitted, coverage shall include transit and storage in an amount sufficient to protect property being transported or stored.

When the project involves work in an existing structure, the scope of this Builder's Risk Insurance is to cover any portion of an existing building which is in the Contractor's care, custody or
control (which may be necessary to do Work in another portion of the building), over and above the normal limitations imposed in Article 5 of the Uniform General Conditions. Article 5 is not intended to increase the dollar amount of the Insurance, which is stipulated to be 100% of the value of the Work.

a. For renovation projects and/or new work, the Owner waives subrogation for damage by fire to existing building structure(s), if building structure(s) is in care, custody or control of Contractor, and Builder’s Risk Policy shall be endorsed to include coverage for existing building structure(s), except that (i) Contractor shall not be required to obtain such an endorsement unless specifically required by the Special Conditions or the Specifications, and (ii) the aforementioned waiver of subrogation shall not be effective unless such endorsement is obtained.

5.2.2.1.7 The above insurance requirements are not intended to be compounded with the Contractor’s standing insurance policies. If the Contractor already has in force insurance policies, which provide the required coverage, there is no need to purchase duplicate coverage for this project.

**Contract Documents:**

6.1.5.1 Request for Information (RFI), Enclosure 4 is an example form that the Contractor may use to request and receive written guidance and instruction from the A/E. Request for Information are to be sequentially numbered and the Contractor and A/E will maintain a RFI register. This register is to be updated and reviewed at progress meetings. The Owner and Consultants will respond to the Prime A/E and the Prime A/E will respond officially to the contractor. Distribute initial RFI to all reviewers.

Architect’s Supplemental Instructions (ASI), is a written clarification from the A/E, usually responding to a RFI from the contractor. ASIs will be sequentially numbered and the Contractor and A/E will maintain an ASI register. The register will be updated and reviewer at progress meetings. All ASIs will be distributed to the Owner, all consultants and the contractor.

6.1.6.7 Owner makes no representations, expressed or implied, about the adequacy or accuracy of the drawing, specifications or other Construction Documents provided or their suitability for their intended use. Owner expressly disclaims any implied warranty that the Construction Documents are adequate, accurate or suitable for their intended use.

6.1.6.8 The Contractor shall propose the most practical solution to resolve the conflict or omission requiring the minimum schedule and budget impact and furthering the best interest of the project. The Owner and Architect/Engineer shall evaluate the proposed solution and provide a response to Contractor.

6.2.3.1 The Contractor shall provide the Owner, two months prior to Substantial Completion, with a complete set of the “As-Constructed” Telecommunication Drawings and Telecommunication Port Log for the Owner’s use in coordinating selection and procurement of telephone/data equipment.

As a requirement for acceptance of Substantial Completion, the Contractor shall reproduce two (2) copies of the current “As-Constructed” Drawings and Specifications maintained at the job site and provide these copies to the Owner. These documents shall be labeled “Interim Record Drawings and Specifications”, and are required to assist the Owner in the operation of the facility until Final Completion is accomplished and the final Record Drawings and Specifications are provided to the Project Architect/Engineer to prepare the final “Record Drawings” and “Record Specifications”. Three (3) weeks before substantial completion acceptance of the
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project, the contractor shall have submitted a draft copy of the Owner’s operating and maintenance manuals. Two (2) copies of the final owners operating and maintenance manuals shall be delivered within 30 days of substantial completion and include copies of ALL approved shop drawings and submittal; list of ALL subcontractors and vendors including names, addresses, phone numbers; warranty and guarantee documents, and the final completed commissioning deficiencies list, etc.

Construction Safety:

7.1.2 The Contractor shall comply with recognized standards and code requirements for the erection of substantial barricades where needed to prevent accidents and any unsafe condition from developing during the construction period. Provide proper ventilation for interior welding and similar operations. Insure construction exhausts and fumes are kept away from nearby occupied areas.

7.1.4 The Contractor shall do all things necessary and provide all equipment and labor necessary to protect students, staff, faculty, and the general public from dangers associated with the work. Walkways, parking areas, and other areas surrounding the job site will be in use and given priority. The University shall not be held responsible for failure of the Contractor to perform the job in a safe manner.

7.5.5 The Contractor shall fully indemnify, save and hold harmless the Owner of and from any costs, losses, damages or liabilities resulting from its failure, of the failure of its subcontractors, to comply strictly with these provisions.

7.6.2 The Contractor shall indemnify and hold harmless the Owner and its employees and agents, including the Owner's Architect and Engineer, from any and all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgments, and claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this contract.

Quality Control:

8.3.1.5 The contractor will provide all submittals in electronic and “hard copy” formats. Electronic submittals shall be .pdf or CAD, as approved by the Owner.

8.2.2.2 Materials incorporated into the Project may be subject to routine tests as specified or as deemed necessary by the ODR or the Architect/Engineer to insure their compliance with the specifications. Materials to be tested may include, but are not limited to, the following:

- a. Concrete - Primary mix design, slump tests and cylinder compression tests
- b. Steel - Tensile tests
- c. Welds - Field inspection and X-ray equipment
- d. Soils - Subsoil investigation, physical analysis and compaction tests
- e. Pavement - Physical analysis and compaction tests
- f. Roofing - Samples cut from in-place roof; ongoing roof QA/QC
- g. Masonry/Cast Stone – Mock-up review; On-going QA/QC
- h. Window leakage
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Any other basic materials for which standard laboratory test procedures have been established may also be included if doubt as to their quality should arise. Any testing, as described, will be done at the discretion of the Owner who will bear all costs. The Contractor shall be held responsible for providing samples of sufficient size for test purposes and for cooperating with the Owner or his representative in obtaining and preparing samples for tests. All tests will be in accordance with standard test procedures and will be performed by a laboratory selected by the Owner. Results of all tests will be provided to the Owner, Architect/Engineer and the Contractor.

8.6 Condemnation and Removal of Defective Work:

The ODSR, Agents and the Architect/Engineer has the authority to reject and condemn Work, which does not meet the requirements of the Contract and to order such work removed and replaced in accordance with paragraph 8.6.2 hereof. The approval of a work item by the ODSR, or Agent, does not relieve the Contractor from compliance with the Contract Documents where such requirements are not judged at the time of observation of the Work due to work sequences by the contractor or the lack of time to judge the performance characteristics of the particular work item, or where the particular work item is part of a system that has not been fully completed and reviewed for overall operation.

The Owner’s Designated Site Representative (ODSR) and the Architect/Engineer shall interpret the Contract requirements and shall be the final judge of the acceptability of the Work under the Contract Documents. If any materials or Work furnished under this Contract are condemned or rejected by the ODR or the Architect/Engineer, the Contractor shall after notice from the Owner or the Architect/Engineer, proceed to remove materials, whether worked or unworked, and to take down all portions of the Work condemned. Contractor shall make good all Work damaged or destroyed by the removal and replacement process.

8.6.1 The Contractor shall, without charge or assessment against any contract contingency or allowance, replace any material or correct any workmanship found by the Owner or Architect/Engineer not to conform to the contract requirements, unless in the public interest the Owner consents in writing to accept such material or workmanship with an appropriate adjustment in the contract price. The Contractor shall promptly correct all Work rejected by the Owner or Architect/Engineer as defective or as failing to conform to the Contract Documents whether observed before or after the Date of Substantial Completion or final inspection and acceptance and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected Work. The costs of such corrective work shall also include reimbursement by the Contractor to the Owner of the amount of the fee to be paid by the Owner to the Architect/Engineer for the extra services of the Architect/Engineer in performing its responsibilities to the Owner relative to such corrective work.

8.6.2 If the Contractor does not promptly complete the Work, replace rejected material or correct rejected workmanship, the Owner may, 1) by separate contract or otherwise, replace such material or correct such workmanship and charge the cost thereof to the Contractor, or 2) terminate the Contractor's employment in accordance with Article 14, Suspension and Termination.

8.6.3 If any portion of the Work is concealed by subsequent work without notification to the Owner as set forth herein contrary to the instructions of the Owner or Architect/Engineer or to the requirements specifically expressed in the Contract Documents, it must be uncovered for observation and recovered at the Contractor's expense.
8.6.4 If any other portion of the Work has been covered which the Owner or Architect/Engineer has not specifically requested or is not specifically indicated elsewhere in the Contract Documents to observe prior to being covered, either may request to see such Work and it shall be uncovered by the Contractor. If such Work is found to be in accordance with the Contract Documents, the cost of uncovering and recovering shall by appropriate Change Order, be charged to the Owner. If such Work is found not to be in accordance with the Contract Documents, the Contractor shall pay such costs including the amount of fee to be paid by the Owner to the Architect/Engineer for extra services related to such non-complying work.

8.6.5 Upon notice of condemnation, the Contractor may request to prove to Owner and the Architect/Engineer, at Contractor's sole cost, that the Work should be accepted because it meets performance, and other relevant standards. The Contractor shall have ten (10) working days from receipt of the notice to present documentation to prove compliance. Owner shall respond to Contractor's showing of proof in writing within fifteen (15) working days of receipt of Contractor’s documentation.

Construction Schedules:

9.2.1.3 The initial schedule submission shall coincide with the initial submittal of the Contract Price Breakdown and the two documents will be reviewed together. The Contractor shall revise the schedule as necessary to obtain acceptance by the Owner and A/E to establish a Baseline Schedule for the project. The format and content of monthly update reporting shall be as determined at the project-planning workshop unless specified otherwise in the contract documents. The Contractor shall include a separate line item in its Contract Price Breakdown for planning and scheduling, to include development of the accepted Baseline Schedule and all updates and reporting.

9.3.4.4 In the event, an Outage (Utilities, Street Closure, Systems, etc.) is necessary, the Contractor shall submit Shut Down Notification form-see Enclosure 9.

9.9.3.4 Such other information that the Contractor and/or Owner and/or Architect/Engineer considers necessary to justify the claim for an extension of time. No time extensions shall be granted for delays that do not affect the Project Schedule Critical Path

Payments:

10.2.1.5 For Certificates and Applications for Payment-see Enclosures 5, 6, 7.

10.3.2.3 Substantial Completion shall be issued before the Owner will consider the release of any retainage.

Changes:

11.1.5 The Contractor is responsible for having visited the Site and having ascertained pertinent local conditions such as location, accessibility, and general character of the Site or building, the character and extent of existing Work within and adjacent to the Site, and any other Work being performed thereon at the time of the submission of its proposal. Any failure to do so will not relieve the Contractor from responsibility for successfully performing the Work without additional expense to the Owner.
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11.1.6 The Owner makes no representations as to the accuracy or completeness of the site information furnished to the Contractor by Owner and does not expressly or implicitly warrant same and is not responsible for any interpretations or conclusions reached by the Contractor with respect thereto. It is Contractor’s sole responsibility to verify to its own satisfaction all site information, including but not restricted to topographical data, borings, subsurface information, utilities and easements and to account for all reasonably anticipated costs in their proposal for construction.

11.3.4 No claim shall be allowed for an adjustment under this or any other provision of the Contract if asserted after the Owner makes tender final payment under this contract.

11.7.6 Owner-initiated Changes: When the Owner wishes to order changes in the Work, the ODSR or the Architect/Engineer shall submit to the Contractor a Change Order Request (COR), consisting of a description of the request, including such Drawings and Specifications as are reasonably necessary to inform the Contractor of the nature of the change. Within 30 days of receipt of the Owner’s COR, the Contractor shall submit a Change Order Proposal Evaluation (CPE) to the ODSR and the Architect/Engineer, stating that the proposed change is a no-cost change, or proposing an adjustment in the Contract Sum, as provided herein. Following resolution of impact of cost and/or time for the change, the ODR or the Architect/Engineer shall issue and the Contractor shall execute a Change Order documenting the change in scope of the Work. The Owner may process formal Change Orders that accumulate several separate change actions.

11.7.7 Contractor-initiated Changes: When the Contractor considers that any written instruction or interpretation of the Contract Documents issued by the Owner or the Architect/Engineer constitutes a change in the Work affecting the Contract Sum, the Contractor shall so notify the Owner and Architect/Engineer in writing as soon as possible, but not later than 15 days after receipt of the instruction or interpretation, and shall submit a Change Order Proposal Evaluation (CPE) to the ODSR and Architect/Engineer as soon as possible thereafter, but not later than 30 days after issuance of the notice. The Contractor’s failure to meet either of these time requirements shall constitute waiver of any and all claims related to such instruction, interpretation, or notice. This CPE shall contain a proposal for an adjustment in the Contract Sum, as provided herein. The CPE shall be accompanied by a copy of the written document containing the instruction or interpretation, evidence of the date Contractor received the written document and an explanation of how the written document creates the need for a change under the terms of the contract.

11.7.8 Submission of Contractor Claim: Claims for adjustment of the Contract Sum shall be made in the form of a CPE submitted to the ODSR and Architect/Engineer no later than twenty-one (21) calendar days after the cessation of the circumstances giving rise to the claim. The CPE shall set forth the Contractor’s proposed cost adjustment and schedule impact, together with the Contractor’s documentation of costs incurred. Within twenty one (21) days after completion of the work in question, the Contractor shall submit in writing to the Owner and the Architect/engineer the additional following elements of the claim: (4) supporting cost or pricing data; (5) legal analysis, if appropriate; (6) an expert’s opinion, if appropriate; (7) certification; and (8) a formal request for decision. No such claim shall be valid unless these additional elements are so submitted, and the Contractor hereby waives all such invalid claims.

11.7.9 Response to CPE: As soon as practical allowing for consultant review after receipt of any CPE submitted by the Contractor, the ODSR or the Architect/Engineer shall respond either directly to the Contractor in writing or verbally at a project meeting the outcome of which is committed to the written record as to the Owner’s response being either (1) accepting the contractor’s
proposal, (2) rejecting the same, (3) initiating negotiations with the contractor concerning the proposed cost or schedule adjustment, or (4) requesting additional information.

11.7.10 Change Authorization: When agreement has been reached concerning the adjustment of cost and/or schedule, the ODR or ODSR shall accept the Contractor’s CPE, or any subsequently revised CPE issued pursuant to negotiation, by endorsing the CPE “Accepted” with the date, and returning it to the Contractor. A CPE that has been accepted is a Change Authorization (CA). A CA is effective upon receipt and constitutes the Contractor’s notice to proceed with the changed work, entitles the Contractor to prepare to submit the adjusted cost of the Work to be incorporated into the approved Schedule of Values on succeeding Pay Applications, as it is completed.

The Owner may, in writing, issue a notice to proceed for any portion of the Work in a Change Order for which final adjustment in Contract Sum and/or Contract Time has not been finalized. The Notice to Proceed letter may have a not-to-exceed cost amount for any or all portions of the Change Order. This amount is not to be exceeded without prior written approval by the Owner.

11.7.10.1 Construction Manager at Risk (CM@R) Contracts: The Contractor shall follow the same processes required in Article 11 for a Change Order and CPE when submitting for usage of the Construction Manager’s contingency, buy-out contingency allowance or construction savings contingency. No charges to any of the above funds, including the CM contingency, will be allowed without pricing justification, back-up information, review, and approval by the A/E and Owner.

11.7.11 Execution and Processing of Change Order: The Owner will undertake to issue Owner-Contractor agreed Change Order for signatures within thirty- (30) calendar days of agreement, unless otherwise agreed to, provided the Contingency Allowance is not exceeded. In those cases where Change Order work causes the Contingency Allowance to be exceeded, approval of higher authority may be necessary and, if such approvals are necessary, the Owner will have up to ninety- (90) additional calendar days to issue such agreed Change Order.

11.7.11.1 The ODSR will authorize the Architect/Engineer to prepare a Change Order to include specific change items for which time and cost impacts have been agreed.

11.7.11.2 The Architect/Engineer shall affix seal and signatures and distribute directly to the Contractor. The Contractor shall execute the Change Order within ten (10) calendar days of receipt and return it directly to the ODSR.

11.7.11.3 The ODSR will obtain signature of component institution and Owner.

11.7.12 The Owner may issue a Unilateral Change Order (ULCO) without the agreement of the Contractor.

The issuance of a ULCO does not prejudice any of the Contractor’s rights to relief otherwise available under the Contract Documents. The Contractor may preserve such rights by submitting a written objection to the ULCO within 30 days of receipt of the ULCO.

A Unilateral Change Order (ULCO), establishing such adjustment of cost, if any, as the Owner deems fair and reasonable, may be issued under the following circumstances:

11.7.12.1 If the Contractor fails to submit a change proposal within the time required,
or fails, or refuses to execute an Agreed Change Order within the time required;

11.7.12.2 If negotiations fail to achieve an agreed price; and

11.7.12.3 If, in the Owner’s judgment based on the Progress Schedule, a failure to authorize the Contractor to proceed with a change in Work may adversely affect the timely completion of the Work. In addition to the above, the ODR shall issue a ULCO on any change proposal that remains unresolved 90 days after Substantial Completion of the Project.

11.7.12.4 A ULCO is effective on receipt by the Contractor. The ULCO obligates the Contractor to perform the Work according to its terms. The contractor, and its subcontractors, shall keep all time and material charges applicable to the ULCO. The contractor shall provide, to the Owner, a detailed schedule identifying work days and dates of delivery of materials for the ULCO. The contractor may submit for payment, on succeeding Construction Vouchers, those costs, accepted and approved by the ODSR, that meet the above-described criteria.

11.7.13 Interim Change Authorization: When the Owner determines that an Owner-initiated change in the Work, or a written instruction or interpretation of the Contract Documents for which the Contractor has given notice of its intent to initiate a claim or any other change implementation, must be made promptly in order to prevent damage to the Work in place, to prevent significant delay in the Project Schedule or to maintain safety or for any other reason as determined by the ODSR, the ODSR may issue an Interim Change Authorization (ICA) directing the Contractor to proceed with changed work before submitting or during the review of a CPE. The ICA shall authorize the Contractor to proceed with the work on the basis of either (1) time and materials or (2) cost not to exceed a specified amount. Upon receipt of an ICA, the Contractor shall proceed immediately to document all increased costs actually incurred as a result of the Work required under the ICA. At any time prior to the completion of the changed Work, the Contractor may submit a CPE containing a lump sum proposal for the cost of the changed Work, which, if accepted, shall be administered as a change; provided, however, that if the Work is completed prior to acceptance by the ODSR of the Contractor’s CPE, the Contractor’s adjustment of the cost shall be limited to the actual cost of the Work. If the ODSR or the Architect/Engineer determines that a Contractor-initiated change is without merit, the ODSR or the Architect/Engineer shall notify the Contractor to proceed according to the subject written interpretation or instruction. Such a notice to proceed shall have the same effect as a Unilateral Change Order, and the Contractor’s rights shall be as set forth herein.

11.8.4 Change Order Pricing: The total cost of all labor and materials, including supervision up to the level of Project Superintendent, itemized to show man-hours by trade and classification, unburdened hourly rates, and total labor cost. Man-hour totals, labor rates, and materials shall be based on reasonable and prevailing area labor rates and materials costs, but in no case shall exceed rates identified via task-applicable line item unit cost(s) in the latest version of “Means Facilities Construction Cost Data” as published by R. S. Means Company, and as adjusted for the nearest City Cost Index for Project site. The Contractor shall provide the Owner (via the ODSR) one copy of the most current edition of “Means Facilities Construction Cost Data” (updated regularly) at no cost. The Owner’s copy shall be either a hard copy of the publication or an electronic CD version, at Owner’s option. The Owner reserves the right to hire third-party estimating services to verify quantities of labor and/or materials as needed to analyze contractor and/or subcontractor-submitted change proposals. The selection of the estimating services provider will be at the discretion of the owner, unless there is reasonable objection to the chosen estimator by the Contractor.
Lump Sum Cost Proposals: All proposals for an adjustment in Contract Sum shall be made on a lump sum basis as required herein and by Owner’s Change Order pricing procedures and forms, setting forth the Contractor’s estimated or actual costs attributable to the changed Work only. The proposed lump sum cost adjustment shall consist of a Base Cost, reflecting the Contractor’s actual or estimated cost of performing the changed Work, in the case of a change, or the increased cost of performance in the case of a claim. The Base Cost of changes may be marked up to cover the Contractor’s profit, general conditions costs, scheduling costs, bonding and insurance costs, and all other costs directly attributable to performance of the change Work. The markup also covers all impact costs on unchanged Work. These lump sum cost provisions also apply to Work performed by or claims submitted by Subcontractors as part of the Contractor’s CPE.

11.8.5.1 Base Cost Computation for Changes: The Base Cost computation includes the following elements only, as relevant:

a. The total cost of materials and supplies, reflecting all available discounts, itemized by cost and quantity;

b. The total cost of all labor, including supervision up to the level of Project Superintendent, itemized to show man-hours by trade and classification, unburdened hourly rates, and total labor cost.

c. The reasonable equipment cost calculated for each type of equipment used in performing the changed Work, based on hours of use, and multiplied by the most recent version of the Rental Rate Blue Book for Construction Equipment (published by PRIMEDIA Information, Inc.) to yield total cost. Mobilization costs will not be allowed except when the Contractor demonstrates that the need to mobilize a piece of equipment arose solely because of the changed Work. The Contractor shall provide the Owner (via the Construction Coordinator) one copy of the current edition of the “Rental Rate Blue Book for Construction Mobilization Costs” at no cost. The Owner’s copy shall be either a hard copy of the publication or an electronic CD version, at Owner’s option.

d. All transportation costs for delivery and handling of materials, equipment and supplies, and the removal of waste or debris related solely and directly to the change work; and

e. All storage costs in excess of 30 days for materials and supplies, if necessitated solely by the changed Work

11.8.5.2 Labor Burden: To the base cost computation plus the mark-up amount may be added the actual amount for labor burden for the following, if applicable, Social Security, Old Age Pension and/or other taxes of like nature imposed upon the Subcontractor, or Contractor (when it performs the work) by the State or Federal Government, or both, which are incident solely to such Change Order work and which the Contractor would be required to pay if or as it performs the work.

11.8.5.3 Unit Prices: Unit prices bid by the Contractor, or subsequently agreed upon, shall include only those cost elements as those set out in 11.8.5.1, and shall be subject to markup pursuant to 11.8.5.2.

Each unit price bid by the Contractor shall include all costs applicable to the work, including but not limited to mobilization, demobilization, labor, materials, equipment, supervision, delays, overhead at any level, and profit.
Either party may request an equitable adjustment. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above one hundred and fifteen percent (115%) or below eighty-five percent (85%) of the originally specified amount. If the quantity variation causes an increase in the time necessary for completion, the Owner, upon receipt of a written request for an extension of time within thirty- (30) days from the recognition of the variation or within such further period of time as may be granted by written agreement signed by the Owner, will ascertain the facts and make such adjustment for changing the completion date as in its judgment the findings justify.

11.8.5.4 Cost Computation for Contractor Claims:

a. Costs and Documentation: For a Contractor claim change, the CPE shall include all information required by Article 11 including but not limited to a reasonably detailed narrative setting forth (1) the nature of the cost impact and its cause, (2) the contractual basis of the Contractor’s claim of entitlement to a cost adjustment, (3) description and documentation of steps taken by the Contractor to mitigate the claimed cost impact, and (4) such other information that is necessary to justify its claim. The Contractor hereby waives any such claim for which they cannot document steps taken to mitigate the claimed cost impact. The cost adjustment proposal for a Contractor claim shall be based on itemized documented costs actually incurred. If and only if the actual cost claimed cannot be demonstrated with reasonable certainty, the Contractor may utilize mathematical formulas or models to compute the proposed cost adjustment, but no CPE will be valid unless accompanied by documentation showing that the increased costs claimed in fact resulted from the alleged cause and that the increased costs are compensable under terms of the contract.

b. No Markup Authorized: No markup is authorized on the Base Cost of a Contractor’s claim for costs alleged by either the Contractor or its Subcontractors.

c. Certification: On CPEs for Contractor claim changes, the Contractor shall certify in writing that all information contained in the CPE is true and correct, and that the costs claimed were incurred as a result of the alleged cause, and were reasonably necessary for the performance of the Work. In the case of Subcontractor pass-through claims, the Contractor shall further certify that the claim stated by the Subcontractor constitutes a legitimate claim against the Contractor, that it is not barred by the terms of the subcontract, and whether and to what extent the claim has been paid. The Contractor may not subsequently modify a claim that has been so certified except for the correction of errors. No CPE shall be considered valid that is not certified and submitted within the time limits set forth in Article 11.

d. Cost Computations Under Interim Change Authorizations: Where the Owner issues an ICA authorizing the Contractor to proceed on a time and materials, or a cost not to exceed basis, the Contractor may submit the cost of the Work for payment, as authorized by the ICA, in succeeding Pay Applications once the Contractor has executed the Change Order that includes the particular change action. At any time after receipt of an ICA, the Contractor may submit a CPE proposing a lump sum cost for the changed work, which shall be processed as a change under Article 11. The method of incorporating approved changes into the parameters of the accepted Schedule of Values must be coordinated and administered in a manner acceptable to the ODR.
e. **Time Extension Requests:** If the Contractor believes that the completion of the Work has been delayed by a circumstance designated as excusable, other than inclement weather, he shall give the Owner written notice, stating the nature of the delay and the activities potentially affected, within thirty (30) calendar days after the onset of the event or circumstance giving rise to the excusable delay. Such claims should be accompanied by sufficient written evidence to document the delay. In the case of a continuing cause of delay, only one claim is necessary. Claims for extensions of time shall be stated in numbers of whole or half calendar days. All requests for extensions of time not submitted in connection with proposed costs for changed or added Work must be made in writing within 30 calendar days after the cessation of the delay. The Contractor and Owner recognize and agree that it is beneficial to each to identify delays and make necessary schedule adjustments promptly, and that a Progress Schedule prepared and updated by the Contractor provides an effective tool for measuring and tracking the impact of delays. Therefore, it is agreed that no extension of time will be granted unless the required notice is submitted timely, the required Work Progress Schedule has been regularly updated and submitted as specified, and the notice includes sufficient documentation to include the changes to the critical path.

All Changes to the Contract Time made as a result of such claims shall be by Change Order.

**Warranty and Guarantee:**

13.2.1 Substantial Completion establishes the beginning of the period of Owner occupancy and/or use of the Work. In the case, Substantial Completion is granted without the Owner able to occupy and/or use the Work, this warranty begins upon final completion and acceptance of the Work. After the warranty begins, upon receipt of written notice from the Owner of the discovery of any defects, the Contractor shall promptly and at its own cost remedy the defects and replace any property damaged. Owner notices of defects will normally come from the facility user, represented by the Physical Plant of the institution. The Contractor shall promptly provide written notice to both the Owner and the campus Physical Plant indicating action taken to resolve the defect. In case of emergency where delay would cause serious risk of loss or damage to the Owner, or if the Contractor, after notice, fails to proceed promptly and remedy within 30 days, the Owner may have the defects corrected and the Contractor and his surety shall be liable for all expenses incurred. The Contractor and Owner may agree in writing on different period of time, which complies with the terms of the warranty and guarantee.

13.8 Additional warranty requirements and guarantees are described more fully in various sections of the technical specifications.

**Suspension and Termination:**

14.8 All settlements on termination shall be administered as Change Orders as provided.

**Dispute Resolution:**

15.3 Neither the occurrence of an event nor the pendency of a claim constitutes grounds for the suspension of performance by the Contractor, in whole or in part.

15.4 Nothing herein shall hinder, prevent or be construed as a waiver of Owner’s right to seek redress on any disputed matter in a court of competent jurisdiction.

Revised Jan-15
16. Article 16 – Miscellaneous: Add the following terms and conditions in the appropriate section and sequence as indicated by the paragraph number.

16.4 Computation of Time: In computing any time-period set forth in this Contract, the first day of the period shall not be included, but the last day shall be.

16.5 Survival of Obligations: All representations, indemnifications, warranties and guarantees made in accordance with the Contract Documents will survive final payment, completion and acceptance of the Work, as well as termination for any reason. All duties imposed upon the Contractor by reason of termination, including without limitation the duty to assign subcontracts and contracts with vendors and suppliers, shall likewise survive the termination of the Contract.

16.6 No Waiver of Performance: The failure of either party in any instance to insist on the performance of any of the terms, covenants or conditions of the Contract Documents, or to exercise any of the rights granted thereunder, shall not be construed as waiver of any such term, covenant, condition or right with respect to further performance.

16.7 Independent Contractor Status: The Contract Documents create an independent contractor relationship between the Owner and Contractor and neither party’s employees or contractors shall be considered employees, contractors, partners or agents of the other party.

16.8 No third party beneficiaries: The parties do not intend, nor shall any clause be interpreted to create in any third party, any obligations to, or right of benefit by, such third party under these Contract Documents from either the Owner or Contractor.

16.9 Entire Agreement: These Contract Documents supersede in full all prior discussions and agreements (oral and written) between the parties relating to the subject matter hereof and constitute the entire agreement.

16.10 Assignment: This Contract may not be assigned by either party without the prior written consent of the other, except either party may, upon notice to the other party but without the other party’s consent, assign this Contract to a present or future Affiliate or successor, provided that any such assignment by Contractor shall be contingent on Owner’s determination that the assignee is qualified to perform the work, is in good standing with the State of Texas and otherwise eligible to do business with the State of Texas.

16.11 Severability: If any provision, sentence, clause or article of this Contract is found to be invalid or unenforceable for any reason, the remaining provisions shall continue in effect as if the invalid or unenforceable provision were not in the Contract. All provisions, sentences, clauses and articles of this Contract are severable for this purpose.

16.12 Parties Bound: Execution of this Contract by each party binds the entity represented as well as its employees, agents, successors and assigns to its faithful performance.

16.13 No waiver of Sovereign Immunity: Nothing herein shall be construed as a waiver of the state’s sovereign immunity.

16.14 Meeting Minutes: Minutes will be recorded by the A/E, in the format of meeting agenda-Enclosure 3, typed and distributed to all principal parties within four day or less of a meeting. Minutes will reflect date reviewed, and specifically record decisions, instructions, clarifications, questions, etc. The minutes will indicate the party responsible for action, the target date for response, and indicate if an action remains open or is closed. Successive minutes will reflect...
SECTION 00 00 01  COMPONENT’S CONDITIONS

outstanding items and carry forward until the issue is closed. Project work progress meetings are usually held weekly or bi-weekly, as determined by the progress of the project, with representatives of the Owner, A/E, Contractor, and others, as appropriate, in attendance. The basis of discussion will be the official minutes of the previous work progress meeting. The submittal log, RFI, ASI, and Change Proposal registers, and As-Built Drawings will also be reviewed. The contractor will provide a four (4) week Look Ahead Schedule which will be compared to the official project progress schedule. If the Contractor has fallen behind schedule, he will provide an itemized plan indicating the actions necessary to regain the approved schedule. Unless a correction is requested within fifteen (15) calendar days, the minutes will become the official record of the meeting.

ARCHITECT/ENGINEER
The A/E will bring a minimum of six copies of each of the documents listed below to each work progress meeting.

a. Prior month minutes
b. Submittal Log-log will reflect dates of receipt of submittal and party currently reviewing. A/E processing will not exceed 30 days. Contractor is to allow maximum review time in establishing the submittal schedule.
c. Distribution of documents as follows: Director of OFPDC, Project Manager, Construction Manager, Construction Inspector, Stakeholder, and Contractor.
d. The A/E shall maintain a Change Proposal/Change Order Log listing subject, date forwarded to Contractor, date of response from Contractor, date of OFPDC authorization, date of Change Order and Change Order number, if applicable, and any time requested and granted.
e. RFI Log-log will reflect subject, date of receipt of RFI, date of response.
f. ASI Log-log will reflect subject, date of issuance, and cross-reference ASI and/or Change Proposal, as applicable.
g. Drawing log-log will reflect all drawings and specifications indicating all subsequent revisions and latest issuance dates.
h. Field Log-log will reflect date of report and date of Contractor response.

CONTRACTOR
The contractor will bring a minimum of six copies of each of the documents listed below to each work progress meeting.

a. Submittal Log-log will reflect date submitted to A/E and date returned from A/E. The log will reflect the original planned date for submission, date of actual submission, and type of approval or rejection.
b. Change Proposal Log-log will reflect date Change Proposal received, date Proposal pricing was forwarded to A/E and Owner, costs and time values.
c. ASI Log-log will indicate pending actions.
d. RFI Log-log will reflect date forward to A/E and Owner, date of response, and open/closed status.
e. Updated progress schedule and four (4) week Look Ahead schedule.
f. Distribution of documents as follows: Director of OFPDC, Project Manager, Construction Manager, Construction Inspector, Stakeholder, and A/E.

16.15 Firearms: University policy prohibits firearms of any kind on campus, including security Watchman employed by the contractor.

17.1. LAYING OUT BUILDING: The General Contractor shall employ an experienced and competent Professional Civil Engineer or a Registered Professional Land Surveyor (RPLS) and cause him to establish at least two (2) separate permanent benchmarks, such benchmarks shall be established using two (2) of the permanent University benchmarks as identified by the University to which easy access may be had during the progress of the Work, and from time to time to determine and verify
the lines and grades. As the Work progresses, establish easily accessible benchmarks at each level referenced to finish floor line.

a. The layout work shall be supervised by the Civil Engineer or RPLS and approved by the Architect/Engineer. At completion of the layout work, the Civil Engineer or RPLS shall submit a signed report to the Architect/Engineer stating that he is satisfied with the work and its accuracy.

b. The General Contractor shall erect and maintain substantial protection of all established layout controls for structures, set their location to provide proper working clearance and verify that they are level and at the proper grade.

c. As the Work progresses, the General Contractor shall lay out columnar grids and partitions on rough floors in exact locations as a guide to all contractors and trades.

17.2. CUTTING, PATCHING AND INSTALLATION OF SLEEVES: The General Contractor shall coordinate and oversee all cutting and patching activities in the execution of the work and shall leave all chases, holes or openings straight, true and of proper size as may be necessary for the proper installation of his own or other contractor's or subcontractor's work, consulting with the superintendent and contractors or subcontractors concerned regarding proper location and size.

a. No excessive cutting will be permitted nor shall any piers or other structural members be cut without the written approval of the Architect/Engineer. After such work has been installed, the Contractor shall carefully fit around, close up, repair, patch, and point up as directed to the entire satisfaction of the Architect/Engineer and Owner.

b. All this work shall be done carefully with proper tools by personnel of the particular trade to which such work belongs, and shall be done without extra charge to the Owner. Each Contractor or Subcontractor will be required to build into his own work, as directed, any and all items furnished by others. Cutting and repairing of new work, in place, made necessary by negligence of another Contractor or Subcontractor or anyone employed by him, shall be paid for by the party, which is at fault.

c. The work of each section of the Specifications, unless otherwise specified, includes all cutting, patching and digging for work in that trade section required for proper accommodations of work of other trades. Execute such work with competent personnel skilled in trade required for restoration. The Contractor and/or each Subcontractor shall arrange and pay for cutting and patching required for installation of its own work, as applicable.

c. The Contractor shall ensure sleeves are provided for all service lines, including piping and conduit, covered in the Contract documents, which may pass through walls, roof or floors. Sleeves through floors shall extend 2" above finish Floor and cast into floor or sealed with heavy-duty sealant or fire stop material.

17.3 Access to Site and Protections: See also Division 1015000

a. The construction fence shall be at least six feet high and completely surrounding the site. Posts shall be placed not more than eight (8) feet apart and set securely; wire mesh shall be tightly stretched over the supports. The construction fence shall in no way obstruct any other part of the campus or utilize any campus facilities for any purpose.

b. Enclosure fences shall be provided with fire gates and gates for trucking in locations shown on Construction Documents, hung with heavy strap hinges, and provided with hasps for locking. Where directed by TSUS representatives, contractor shall include
c. The Contractor is responsible for all expenses incurred as the result of the loss of a security access card or key. If a security access card or key is lost or misplaced, the contractor will be responsible for all personal liability associated with the loss, as well as all costs associated with re-keying all building(s).

17.4 Project Signs: No signs or advertisements will be allowed without the approval of the Owner. See also Division 1-015010

17.5 SALVAGE: The contractor is to remove, unless indicated otherwise, all fixtures and appurtenances within the construction site. The Owner has the first right of salvage. Prepare and submit, to the Owner, a list of all existing fixtures (gates, signs, light standards, etc). Those items to be salvaged for the owner will be delivered within a 10 mile radius of the project site. Those items not required to be salvaged for the owner will be removed from campus and properly disposed.

17.6 The contractor is to schedule deliveries and haul-off to minimize disruption to campus operations; provide flagman to protect pedestrians. Pedestrians have the right of way.

17.7 Any flushing, cleaning, or chemical treatment residue must be moved and disposed of legally and requires acceptance, in writing, of the Texas State University Environmental Health, Safety and Risk Management Department, as well as the City of San Marcos. Nothing may be discharged onto or into the ground or into the sanitary or storm sewers.

17.8 SITE AND AREA MAINTENANCE: The Contractor is to prevent air borne particles generated by demolition, excavation, and construction activities. The Contractor shall erect erosion control at the perimeter of the site and otherwise control migration of construction debris and dirt to campus and public areas adjacent the project site. The Contractor shall keep all roadways, in the vicinity, of the project clear of mud, dirt, debris, and construction materials and shall comply with City of San Marcos and Texas State University traffic control requirements; provide barricades, warning signs, controls, etc., as required. The Contractor will be required to clean campus streets utilized as truck routes for the project if mud or debris is allowed to remain in the roadways. If such roadways, parking lots or site improvements are damaged by the work of this project, the Contractor will be required to repair them in kind to a quality acceptable to the Owner.

17.9 GENERAL PERMITS: The Owner is exempt from paying for permits and fees to local government entities related to work on the Owner's property. There will be no building permit required, no platting fees and no local government inspection fees for permanent work on the Owner's property. The Owner is not exempt from permit and fee requirements for work in public rights of way or outside the boundaries of the Owner's property. The Contractor shall secure, pay and maintain all required permits.

17.10 SEDIMENTATION AND EROSION CONTROLS/NPDES GENERAL PERMIT: The National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges from Construction Sites (General Permit) issued by the United States Environmental Protection Agency (EPA) requires compliance for construction activities. Compliance with the NPDES General Permit is required.

a. Indemnification. GENERAL CONTRACTOR HEREBY INDEMNIFIES AND HOLDS HARMLESS THE OWNER FROM ANY AND ALL LIABILITY, LOSS, DAMAGE, COST, AND EXPENSE ARISING OUT OF A VIOLATION OF THE APPLICABLE

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CONSTRUCTION STANDARDS                             DIVISION 00 – GENERAL CONDITIONS

SECTION 00 00 01 COMPONENT’S CONDITIONS

EPA NPDES REGULATIONS, THIS SPECIAL CONDITIONS SECTION, AND/OR THE TERMS AND CONDITIONS OF THE UNIFORM GENERAL CONDITIONS APPLY TO THE EXTENT ATTRIBUTABLE TO AN ACT OR OMISSION OF GENERAL CONTRACTOR, ITS SUBCONTRACTORS AT ANY TIER, OR CONSULTANTS.

17.11 ENVIRONMENTAL PROTECTION PROCEDURES: Any vegetation damaged during construction shall be replaced in kind; replacement shall consist of replacing trees, vegetation, and grasses in kind, with watering and maintenance as required for establishment unless otherwise noted on the Drawings.

Furthermore, Contractor is responsible for ensuring that all discharges from the site are in compliance with all applicable laws and regulations. Contractor is responsible for pollutant contaminated run-off and proper disposal of all waste materials generated as a result of work activities. See also Division 1-010000, para. 15.5.

17.12 FIELD MANAGEMENT AND TEMPORARY STRUCTURES: See also Division1-015000

a. The Contractor shall coordinate and direct the work of this project from the site or Owner-designated area at adjacent site for the duration of the Work. One or more of the following options applies to this Project only if designated by a checked box:

☐ The Owner will designate and provide an adequately sized enclosed area for field office operations to the General Contractor adjacent the Project site. This location is to be properly maintained and released back to the owner in its original condition.

☐ The Contractor shall provide and maintain its own temporary field office(s) that is weather-tight, well-lighted, air conditioned and safely heated, and to include provisions for telephone, data, and facsimile services, conference area(s), including tables and chairs, toilet facilities, and maintenance of all project files including submittals, project correspondence, and payment and payroll records, etc. The University will assist in providing hook-ups for telephone, data, and facsimile services when project is within campus grid. A lockable, 12’ x 12’ minimum private office shall be provided for the use of the Owner and A/E, equipped with an operational telephone, a 4in1 (copier, scanner, color printer, and fax machine) and internet connectivity and separate lines for each.

☐ The Contractor shall provide and maintain a conference area, which shall include at least one primary area suitable for up to fifteen (15) persons to participate in progress and coordination meetings. The walls of this conference area are to serve as display surfaces for maintaining current prints of project schedules and work placement plans; space will include internet connectivity. This space can be incorporated with the Contractor's office trailers, and will be for shared and joint use by both throughout the project duration.

☐ The Contractor shall provide and maintain at the site for the duration of the Project, for the use of the Owner and its consultants, including the Architect/Engineer, a separate field office structure which is adequately weather-tight, well-lighted, air conditioned and safely heated, adequately supported and anchored, with toilet facilities, and two long distance phone lines and a 4in1 (copier, scanner, color printer and fax machine) and internet connectivity and separate lines for each. Local calls made from these lines shall be paid by the General Contractor. Long distance calls shall be paid for by the person or party placing the calls. The telephone numbers shall be reported to the Owner and the Architect/Engineer.

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as soon as the telephones are installed.

☐ Such field office shall be a minimum of twelve (12) feet wide by about thirty-(40) feet long and shall be partitioned to provide for two separate work areas including two entry doors with keyed locks, and shall include toilet facilities. Each of the three "office" areas within this structure shall be provided with layout tables, plan storage, file cabinets, desk and chairs, one telephone, a 4in1 (copier, scanner, color printer and fax machine) with separate lines for each, and adequate convenience outlets to accommodate business machines.

☐ Telephone service to this field office shall include one phone line capable of local and long distance service with voice mail and one fax and internet connectivity, for a total of three separate lines, each with individual phone numbers and each line to be connected to multiple outlets for convenient arrangement. All costs for providing this telephone service, including a phone unit in each separate area, shall be paid by the Contractor.

b. The General Contractor shall arrange for each Subcontractor to have field office accommodations as necessary to perform their work adequately.

c. The General Contractor shall provide adequate and safe entries to all field offices, including steps with railings and landings or stoops as required, and shall provide hard surface walkways to connect the field office structures to one another and to site entry or exit.

d. Upon authorization to mobilize, the General Contractor shall submit a plan layout showing location of field offices, size and arrangement of spaces and outlets, fencing, site control points, and utility tie-in locations for Owner review and acceptance.

e. All costs for temporary field offices shall be included in the Contractor's Contract Price Breakdown. Reimbursement of such costs shall be included in the regular Progress Payment on a monthly basis, pro-rated over the anticipated duration of the project.

17.13 See other enclosures for additional information, examples, and samples of forms the Contractor is to use.

END OF SECTION 00 00 01
## SECTION 00 00 01 COMPONENT’S CONDITIONS

### Project 90 Day Submittal Timeline

<table>
<thead>
<tr>
<th>Description</th>
<th>Duration</th>
<th>Date</th>
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<tbody>
<tr>
<td>NTP - Notice to Proceed</td>
<td>based on contract</td>
<td></td>
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<tr>
<td>Pre-Construction Photos &amp; Videotapes</td>
<td>NTP+1</td>
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<tr>
<td>Mobilization</td>
<td>NTP+1</td>
<td></td>
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<tr>
<td>Construction Fence</td>
<td>NTP+1</td>
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<tr>
<td>SWPPP, BMP’s, Silt Fence, etc</td>
<td>NTP+1</td>
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<tr>
<td>Completed Project Safety Program submitted to Owner’s Designated Representative (ODSR) &amp; Project Safety Coordinator (PSC)</td>
<td>NTP+1</td>
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<tr>
<td>Completed Project Safety Program submitted to ODSR &amp; PSC/Assistant</td>
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<tr>
<td>Revisions to Project Safety Program submitted to ODSR &amp; PSC/A</td>
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<tr>
<td>PSC &amp; PCA Qualifications (with certificates)</td>
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<tr>
<td>Coordination of Project Safety Meeting w/ ODSR &amp; PSC/A</td>
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<tr>
<td>Project Hazard Analysis &amp; Emergency Action Plans with safety manual</td>
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<td>Initial Project Safety Meeting (minutes)</td>
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<tr>
<td>Site Trench Safety Plan (sealed by Engineer)</td>
<td>NTP+15</td>
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<tr>
<td>Project Safety Meetings</td>
<td>weekly</td>
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<td>Monthly Safety Reports issued to Owner’s Safety Coordinator</td>
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<tr>
<td>Safety Inspections</td>
<td>daily &amp; monthly</td>
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<td>Formal Project Safety Inspection</td>
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<td>Annual Safety Inspections</td>
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<td>Submittal Schedule</td>
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<td>Submittal Schedule update w/ ea. Pay App</td>
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<td>Schedule of Values</td>
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<td>Project Schedule Submittal</td>
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<td>Planning &amp; Scheduling Workshop</td>
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<tr>
<td>(Preliminary) Equipment List/Matrix</td>
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<td>Equipment List/Matrix</td>
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<tr>
<td>Contractor to furnish Owner one copy of the &quot;Means Facility Cost Data&quot;</td>
<td>NTP+30</td>
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<tr>
<td>Contractor verifies/validates current copy of the &quot;Rental Rate Blue Book for Construction Mobilization Costs&quot;</td>
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<tr>
<td>Owner Review of Submittal Schedule</td>
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<td>Video Display and Wall System</td>
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<td>TSU Key Cores</td>
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<td>Baseline Schedule Submittal</td>
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<td>Pre Commissioning Meeting</td>
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<td>Re-submittal of Submittal Schedule</td>
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<td>Contractor &amp; Sub-Contractor Daily Reports issued to ODSR</td>
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<td>8x10 Construction Photographs</td>
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<td>Maintain As-Built Blueline Set</td>
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<td>Substitution Submittal</td>
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<td>Building Shut Down Requests</td>
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<td>Burn Permits Requested and Posted</td>
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**UNIFORM GENERAL CONDITIONS:**

The Uniform General Conditions have been issued in the Project Manual and are included in the Contract.

**DIVISION 1 SPECIFICATIONS:**

Division 1 Specifications have been issued in the Project Manual and are included in the Contract.
**CONTRACT CHANGE**

Project: 
Location: 
Contractor:
Classification Types: U=Unforeseen, SC=Scope Change, O=Omission, E=Error

The following changes in this contract are authorized:

<table>
<thead>
<tr>
<th>Proposal #</th>
<th>Classification Type</th>
<th>Description</th>
<th>Amount</th>
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Total Amount This Change: $13.50

Completion Date Before This Change:
Number of Contract Days Extended by this Change:
New Completion Date:

**ORIGINAL CONTRACT AMOUNT**
Amount of Previous Change Orders
Total Revised Contract Amount before this Change

This Change: Previous Contingency Balance
Amount this Change
Remaining Contingency Balance

**JUSTIFICATION FOR CHANGE:** A/E to Provide Justification for Change for Each Proposal (If Necessary, Provide Additional Sheets):

Total Amount of this Change

**TOTAL REVISED CONTRACT AMOUNT** including this Change

It is mutually agreed that the above stated amount and time extension constitutes full compensation to the contractor for all costs, expenses, damages, or other claims, whether direct, consequential or otherwise, in any way incident to, or arising out of, or resulting directly or indirectly from the work performed or modified by the contractor under this Change Order.

**RECOMMENDED BY:**
Architect/Engineer  Date
Representative  Date

**ACCEPTED BY:**
Contractor  Date
Representative  Date

**APPROVED BY:**
Component Project Manager  Date
ODEP: Date
Director, Facilities Planning, Design & Construction

Chancellor or Vice Chancellor for Contract Administration  Date

**THOMAS J. RUSK BUILDING**
208 E. 10th Street, Suite 600  
Austin, TX 78701-2407  
(512) 463-1858  
tous.edu

Revised Jan-15

Component’s Conditions-00 00 01-23
# THE TEXAS STATE UNIVERSITY
## SYSTEM DAILY TIME & MATERIAL WORK STATEMENT

<table>
<thead>
<tr>
<th>Project:</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Location:</td>
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<td>Contractor:</td>
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**Description of Change In Work:**

### LABOR:

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Subtotal Labor $__________

### MATERIALS:

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Subtotal Materials $__________

### EQUIPMENT:

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Subtotal Equipment $__________

**TOTAL THIS STATEMENT** $__________

Daily Statement No: ________________

Approval:

Owner's Representative ____________________________  Contractor's Representative ____________________________

Revised Jan-15  Component’s Conditions-00 00 01-25
THE TEXAS STATE UNIVERSITY SYSTEM CONTRACT TIME STATEMENT

Project: _______________________________ Report No:__________________ Location:__________________

Contractor:_______________________ Date Work Began:_____, 20__ Date Time Computed From: _____, 20__

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<th>Reason for Extended Days</th>
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TOTALS

# Consecutive Calendar Days in Contract _____  # Extended Days _____
Total Consecutive Calendar Days _____  # Consecutive Calendar Days Used _____
NEW COMPLETION DATE: ___________20_____

Recommended and Approved:
____________________________________  ___________________________________
Owner’s Representative    Architect

Revised Jan-15            Component’s Conditions-00 00 01-26
MINIMUM PER HOUR CONSTRUCTION WAGE RATE DETERMINATION BY CONTRACT

Pursuant to the requirements of law and in compliance with V.T.C.A., Government Code §2258.001 et seq., the following wage determination is issued as required by law applicable to the work described. This determination shall be made a part of the contract for the work for which it is issued. The wage rates contained in the determination, including modification, if any, shall be the minimum to be paid by contractors and subcontractors to each worker employed by it in the execution of the work.

Texas State University-San Marcos has adopted the Recommended Minimum Prevailing Wage Rates as approved by the Hays County Commissioners’ Court December 22, 2009.

The contractor shall comply with all the requirements of V.T.C.A., Government Code §2258.001 et seq.

When the contractor or subcontractor proposes to utilize a particular class of laborers or workers not listed in the wage determination, such worker or laborer shall be classified or reclassified conformable to the wage determination and a report made in writing of such action to the Owner. When the interested parties are unable to agree on the classification or reclassification of workers, the question with recommendations of the parties shall be submitted to the Owner for determination. The decision of the authorized representative of the Owner shall be furnished to the parties and shall be binding and final.

The contractor and each subcontractor shall keep, or cause to be kept, an accurate record showing the names and occupations of all laborers, workers and mechanics employed by him, in connection with the said public work, and showing also the actual per hour wages to each of such workers, which record shall be open at all reasonable hours to the inspection of the Owner, its officers and agents.

LOCATION OF PROJECT: San Marcos, Hays County, Texas

BUILDING CONSTRUCTION includes construction of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment or supplies, the installations of utilities, machinery and equipment, both above and below grade level, as well as incidental grading and paving.
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<td>Air Conditioning Helper</td>
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<td>Air Conditioning &amp; Heating Mechanic</td>
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<td>Broom or Sweeper</td>
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<td>21</td>
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Submittal Data-Flow Diagram
(Including Commissioning Agent and TAB)

Manufacturer
Supplier
Fabrication

Subcontractor

Contractor

University Shops
1C 1C

Owner
2C

Consultant(s)
2C

Commissioning Testing & Balancing Agent
2C

Lead A/E
2C

Submit
Return

If HVAC/Controls
+ 1 Reproducible or amount Contractor wants

Coordinated final comments to Contractor with copy of Transmittal to Owner and Consultants

Contractor saves and files one (1) copy for return to Owner at closeout

Owner
2C

Consultant(s)
1C

Commissioning Testing & Balancing Agent
1C

If HVAC/Controls

1C + 1 Reproducible or amount Contractor wants

Revised Jan-15
Component’s Conditions-00 00 01-35
Data-Flow Diagram
Change Proposals/Change Orders

PARTY WHO IDENTIFIES NEED FOR CHANGE

User → Construction Manager → Contractor

Owner’s Testing Consultant

FPDC Senior Construction Inspector

C.P. Doc. est. over ($5,000)

COPF → FPDC

FPDC

A/E & Associates

Auth. to issue C.P.

C.P. document issued

COPF

Contractor

A/E

R

TSUS

A

Auth. to issue C.O.

*C.O. issued 4C w/approved COPF & backup

All change order proposals (time, cost) are to be prepared on FPDC form reflecting detailed labor & material breakdown for credits & extras. Shall also reflect time extension request if warranted.

COPF – Change Order Proposal Form (with cost/time & backup)

CP - Change Proposal (proposal request)

Contractor for Signature

4 copies of change order

FPDC

4 copies of executed change order

- Contractor
- A/E
- FPDC
- TSUS 1 ea

*All 4 copies of C.O. must bear original signature.
Pay Application-Flow Diagram

Contractor

A/E & Associates

OFPDC

TSUS

Accounting

A/E

Construction Manager

DRAFT

Final

R

R

*All 4 copies (1 for A/E) of the pay estimate must bear original signature.

1 original Construction Voucher
1 original HSP Progress Assessment Report
4 original AIA G702
4 continuation sheet (schedule of values)
2 Updated Project Schedule
2 copies of appropriate backup

NOTE:
*Contractor must have received concurrence with his initial Submittal Log, Construction Schedule and Pay Estimate breakdown before first pay estimate will be processed.
Closeout Documents – Project Record Documents:
As Constructed Drawings, Shop Drawings, Guarantees,
Parts Lists, Operating Instructions, Service Manuals, etc.

**NOTE:**
Project Record Documents shall be submitted (completed) to A/E 30 days prior to substantial completion inspection.

Failure to submit documents will delay substantial completion inspection.

Project Record Documents shall include As-Constructed drawings, shop drawings, guaranteed, parts lists, operating instructions, service manuals, spare parts, etc.
MONTHLY MEETING AGENDA  
(generic outline)

DATE __________________________

PROJECT _______________________

A/E ____________________________

CONTRACTOR ___________________

A. Attendance roster.
B. Review of last month meeting minutes for pending items. (old business)
*C. Review of Submittal Status.
*D. Review of Request for Information. (RFI)
*E. Review of Architect Supplemental Instructions. (ASI)
*F. Review of Change Proposals and Change Orders. (CP’s and CO’s)
G. Review of Progress Schedule forecast of operations for next month. Hard copy by Contractor for distribution and discussion.
H. New Business - Contractor, A/E, Owner questions.
I. Round table opportunity for everyone to voice problems. Complaints, etc.
J. Review of Pay Application questions (monthly).
K. Discussion of anticipated outage(s).
L. Review of As-Built Drawings.

*In order that items C thru F may be effectively reviewed, each party, FPDC, Contractor and A/E should have their logs of each available for crosscheck and comparison.
REQUEST FOR INFORMATION

TEXAS STATE UNIVERSITY
A Member of the Texas State University System

Originator:  ___ Contractor    ___A/E    ___Owner

Contractor RFI#: _____________________  A/E RFI#: _____________________

TO: ________________________________  FROM: ________________________________

Subject: ______________________________________________________________________

Reference Drawings: _________________________ Spec Section: ____________________

Date Initiated: ____________ Date Requested: _________ Date Answered: ___________

QUESTION:

PROPOSED RESOLUTION:

ANSWER:

______________________________________  ________________________________

Signature      Date

Revised Jan-15              Component’s Conditions-00 00 01-43
APPLICATION AND CERTIFICATION FOR PAYMENT

TO OWNER: Texas State University - San Marcos
601 University Drive
San Marcos, TX 78666

FROM CONTRACTOR: VIA PROJECT MANAGER:

CONTRACT:

CONTRACTOR'S APPLICATION FOR PAYMENT
Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM
   $__________________

2. Change Orders
   $__________________

3. CONTRACT SUM TO DATE (Line 1 + 2)
   $__________________

4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)
   $__________________

5. RETAINAGE:
   a. % of Completed Work
      $__________________
      (Column D + E on G703)
   b. % of Stored Material
      $__________________
      (Column F on G703)
   c. Total Retainage (Lines 5a + 5b or
      Total in Column I of G703)
   $__________________

6. TOTAL EARNED LESS RETAINAGE
   (Line 4 Less Line 5 Total)
   $__________________

7. LESS PREVIOUS CERTIFICATES FOR PAYMENT
   $__________________

8. CURRENT PAYMENT DUE
   $__________________

9. BALANCE TO FINISH, INCLUDING RETAINAGE
   (Line 3 Less Line 6)
   $__________________

CHANGE ORDER SUMMARY

<table>
<thead>
<tr>
<th>CHANGES</th>
<th>ADDITIONS</th>
<th>DEDUCTIONS</th>
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<tr>
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<td>in previous months by Owner</td>
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<td>NET CHANGES by Change Order</td>
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</table>

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for the Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: ________________________________ Date: ________________________________

State of: Texas County of Travis
Subscribed and sworn to before me this day:
Notary Public: Valerie Odell
My Commission expires: 4/7/2008

ARCHITECT'S CERTIFICATE FOR PAYMENT
In accordance with the Contract Documents, based on on-site observations and the data comprising the application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED: $__________________

(Attach explanation if amount certified differ from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are change to confirm with the amount certified.)

ARCHITECT:

By: ________________________________ Date: ________________________________

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner of Contractor under this Contract.
## The Texas State University Schedule of Values Division 1-16 of 1/21 "Sheet ONU"  
### O F C Request Name:
### Contractor’s Name:
### Application for Payment Number:

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<th>Item No.</th>
<th>Work Item</th>
<th>Itemized Description of Work</th>
<th>Unit of Measure</th>
<th>Sub</th>
<th>Original Line Item/Amount</th>
<th>Change Order Amount</th>
<th>Total Line Item/Amount</th>
<th>Amount Previously Requested</th>
<th>Total Amount This Period</th>
<th>Materials/Equipment/Not In Fare</th>
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<td>Task 22 - Labor</td>
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</table>
**Shut Down Notification**

**A 7 Day Notification is Required**

**Project/Building:**

**Origination Date:**

**Reason for Shut-Down:**

**Requestor:**

Name: ______________________ Phone: ______________________ e-mail: ______________________

**Specific systems, equipment, utilities to be shutdown:**

**Location of Shut-Down:**

RMSO Notified: [ ] Yes [ ] No

**Hot Work Permit:**

Yes [ ] No [ ]

**ROAD CLOSURE REQUIRED:**

If yes, notify UPD and City of San Marcos

**Desired Shut-Down date:**

start: __________ end: __________

**Desired Shut-Down time:**

start: __________ end: __________

This Shut-Down could affect the following:

- Fire Alarm Systems
- Fire Suppression Systems
- Security
- Compressed Air
- Other

<table>
<thead>
<tr>
<th>System</th>
<th>Start</th>
<th>End</th>
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<tbody>
<tr>
<td>Steam</td>
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<td>Emergency Power</td>
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<td>Domestic Water</td>
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<td>HVAC system</td>
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<td>Traffic</td>
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<td>Chilled Water</td>
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<tr>
<td>Other</td>
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</tbody>
</table>

**Outside Contractor**

**GC** contact name: ______________________ phone/email: ______________________

**Sub** contact name: ______________________ phone/email: ______________________

**Other** contact name: ______________________ phone/email: ______________________

**Other Contacts:**

<table>
<thead>
<tr>
<th>Contact Name</th>
<th>Phone/Email</th>
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**Date of Pre-Shut-Down walkthrough:**

**Notes:**

---

FSS/PPS No. 05.04.32

---

Revised Jan-15 Component’s Conditions-00 00 01-47
HUB Subcontracting Plan (HSP)
Prime Contractor Progress Assessment Report

This form must be completed and submitted to the contracting agency each month to document compliance with your HSP.

<table>
<thead>
<tr>
<th>Contract/Requisition Number:</th>
<th>Date of Award:</th>
<th>Object Code:</th>
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<thead>
<tr>
<th>Contracting Agency/University Name:</th>
<th>State of Texas VID #:</th>
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<table>
<thead>
<tr>
<th>Contractor (Company) Name:</th>
<th>Point of Contact:</th>
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<tbody>
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<thead>
<tr>
<th>Reporting (Month) Period:</th>
<th>Total Amount Paid this Reporting Period to Contractor:</th>
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</table>

Report HUB and Non-HUB subcontractor information

<table>
<thead>
<tr>
<th>Subcontractor's Name</th>
<th>Subcontractor's VID or HUB Certificate Number</th>
<th>*Texas Certified HUB? (Yes or No)</th>
<th>Total Contract $ Amount from HSP with Subcontractor</th>
<th>Total $ Amount Paid This Reporting Period to Subcontractor</th>
<th>Total Contract $ Amount Paid to Date to Subcontractor</th>
<th>Object Code</th>
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**TOTALS:**

| $                      | $                                           |                                |                                                     |                                                          |                                                          |             |

Signature: ____________________________  Title: ____________________________  Date: ____________________________

*Note: HUB certification status can be verified on-line at: [http://www2.cpa.state.tx.us/cmbt/hubonly.html](http://www2.cpa.state.tx.us/cmbt/hubonly.html)  Rev. 1007

Revised Jan-15  Component’s Conditions-00 00 01-48
DUCT LEAK TEST REPORT

Test No:______________

Structure or Building: Project: ______________

Test Location: ______________________

Duct Static Pressure:_________ Inches W.G.

Description of system or part of system tested:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Total Design:_______________ CFM

Allowable System Leakage:_______ CFM

Actual System Leakage:________ CFM

Name and Title of Person in charge of performing test for Contractor:

Name: _______

Title: _______

Signature: ____

I HEREBY CERTIFY THAT THE ABOVE DESCRIBED SYSTEM HAS BEEN TESTED AS INDICATED ABOVE AND FOUND TO BE ENTIRELY SATISFACTORY AS REQUIRED IN THE CONTRACT SPECIFICATIONS.

Signature of Contractor’s Inspector:

____________________________________________

DATE: ______________________________

REMARKS:

Owner’s Construction Manager or Construction Contract Administrator:

____________________________________________

Signature Date
FIELD ORDER

FIELD ORDER NUMBER: ________________________________

DATE: ________________________________________________

PROJECT NAME: __________________________________________________________________________

CONTRACTOR: __________________________________________________________________________

DESCRIPTION OF WORK:

AUTHORIZED COST: __________________________________________________________

AUTHORIZED TIME EXTENTION: ________________________________________________

CAMPUS CONSTRUCTION REPRESENTATION: _____________________________________________

Signature ____________________________________________

CONTRACTOR REPRESENTATIVE: ______________________________________________________

Signature ____________________________________________

*Unless stated otherwise, time extension will be zero.

Distribution:
Contractor
Architect
User
File

Revised Jan-15
Component’s Conditions-00 00 01-50
Texas State University San Marcos, Texas
Facilities Department Planning, Design and Construction
Date: January 8, 2007
Harvey M. Juarez
Senior Bldg. Construction Inspector
Ph: 512-245-9968  Cell 512-753-9566

Project: Harris Dining Hall Renovation
Selective Demolition and Plumbing Package

FIELD INSPECTION REPORT/OBSERVATIONS
Weather: Blue skies. Temperature @ 60 degrees
Arrived on site @ 3:25PM
Contractor: Superintendent – off site
Trades: Plumbers

ACTIVITIES:
Back fill of trenches with road base is on going. *Ref: RFI response from Engineer to use sand.* Base is being processed (water introduced) and spread in @ 8” lifts compacted by gas powered “jumping jack”, whacker type compactors. Compaction witnessed appears sound.

Called B-C Superintendent, on cell, to discuss use of base.
Says he hadn’t seen response to RFI. He did not check e-mails Friday.
He says that Engineer’s rep did visit site on Friday. (OFPDC was not called as per S. Vandekieft)
He says that base back fill began this AM when suitable excavated back fill material ran out.
OFPDC to consult with Carter-Burgess on the subject.

Sections of the pipe within the mechanical room have neither been bedded nor backfilled.
Remove all rocks from the proximity of the pipe before and bedding same. Typical.

Portion of trench behind existing chiller no. 1 appears to have place dry as it sloughs off into the open trench. Remove this material, process backfill, spread in lifts NTE 8” and compact.

Left site @ 4:00 PM.
Harvey M. Juarez, SBCI

Cc: File: G. Krezinski; F.Price; Carter-Burgess

Revised Jan-15  Component’s Conditions-00 00 01-51
Submittal Review Comments

Project:  

Submittal No. :

Contractor:  

Received From GC:  

Architect:  

Returned To Architect:  

Action Codes:

A  Approved
B  Approved As Noted
C  Make Corrections & Resubmit
D  Rejected
E  Not Made - Submit

Submittal No. :0135-7410-0 Standing Seam Metal Roof 0132-05585-0 Metal Pan Soffits 0134-06100-0 Rough Carpentry - roof 0136-07620-0 Sheet Metal Flashing and Trim 0137-10200-0 Roof Louvers Metal Building System Copper Roof Insulation

Note: The above submittals were provided as a combined package for review. The comments below address collectively all the above submittals.

Comments:
- See attached roofing shop drawings for additional red marked comments.
- Theses comments are in addition to the Owner’s comments from Pat Sullivan, sent to the Architect on November 11, 2004.
- There is no data showing testing of the roof system that meets specified UL uplift and Class 1A-90 requirements.
- Warranty is not per specifications and is not acceptable. See Par. 1.10
- Who is to be considered the Manufacturer?
- Confirm that 180 degree, double lock, 2” high seams will be used.
- Confirm H01 or H02 temper on copper material.
- GS&C: Is there a particular copper alloy requirement?
- Clarify whether the #14 HD S.S. drill point fasteners used for both clips and for soffit panels.
- If both copper rivets and S.S. rivets are available, why not use copper?
- Verify soffit panel approved by the Chancellor will be installed in the job site mock-up for review.
- Confirm soffit panel color selection on job site mock-up.
- Specs call for soffit material to be .050 inch aluminum. Confirm.
- Submittal calls for pancake head fasteners on soffit panels, as well as the #14 HD drill point screws. Which is correct? Mock up should have correct fasteners installed.
- Note: Specification requirements for roofing conferences.
<table>
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<tr>
<th><strong>PROJECT:</strong></th>
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<tr>
<td><strong>DIVISION #:</strong></td>
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<tr>
<td><strong>SUBMITTAL SECTION/NUMBER:</strong></td>
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<tr>
<td><strong>DESCRIPTION:</strong></td>
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<td><strong>DATE FPDC RECEIVED:</strong></td>
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<td><strong>DATE SENT TO SHOPS/STAFF:</strong></td>
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<td><strong>DATE RETURNED FROM SHOPS/STAFF:</strong></td>
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<tr>
<td><strong>DATE RETURNED TO ARCHITECT:</strong></td>
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<td><strong>DATE RETURNED TO G.C.:</strong></td>
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<tr>
<td><strong>DATE RECEIVED APPROVED SUBMITTAL:</strong></td>
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<td><strong>ACTION:</strong></td>
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<td><strong>REMARKS:</strong></td>
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</table>
Team Roster – [Project Name]

**FPDC TEAM - TEXAS STATE UNIVERSITY**
601 University Drive – US Mail
151-2 E. Sessom Drive, Suite 104 – Physical Address
San Marcos, Texas 78666-4615

**DESIGN TEAM**

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<td>Civil Engineer</td>
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<td>Structural Engineer</td>
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<td>MEP Engineer</td>
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<td>Other</td>
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**CONSTRUCTION TEAM**

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<td>A. Texas State University System, DIV 1 Specifications</td>
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<td>Substitution Form</td>
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<td>01 56 39</td>
<td>Tree Protection</td>
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<td></td>
<td>A. Refer to 31 23 16 TREE PROTECTION: Earth Moving and Fill Excavation</td>
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<td>01 78 36</td>
<td>Warranty Forms</td>
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Revised Jan-15
SECTION 01 10 00 – GENERAL REQUIREMENTS

PART 1: GENERAL

A. Texas State University System DIV 1 Specifications

B. General Requirements, in addition to the Sections in this Division, will be developed by the Facilities Planning Design and Construction, and issued to the A/E for inclusion to the A/E’s specification manual, specific to individual Projects.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 01 10 00
DIVISION 01 25 00 – SUBSTITUTION FORM

PART 1: GENERAL

1.01 SUBSTITUTION FORM

A. The following form shall be used for product substitutions:

TO: ARCHITECT OF RECORD
OR
TEXAS STATE UNIVERSITY PROJECT REPRESENTATIVE

PROJECT:

SPECIFIED ITEM:

Section ______ Paragraph ______ Description__________________________________

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION____________________________________________________

Upon submitting this Request for Substitution, the undersigned certifies that the following paragraphs are correct, unless otherwise modified on attachments:

1. Contractor has investigated the proposed substitution and believes that it is equal to or superior in all respects to specified item, and will conform to design requirements and artistic effect
2. Cost saving to Owner for accepting substitution: None__ $____________________
3. Contractor will pay the Architect and/or Engineers for additional studies, investigations, submittal reviews, redesign and/or analysis caused by the requested substitution and at no additional cost to Owner.
4. Substitution requires dimensional changes or redesign of structure or M & E Work No __ Yes __ (If yes, attach complete data).
5. Contractor will waive future claims for added cost to Contract caused by substitution.
6. Changes in contract time caused by substitution: No __ Yes __ Add/Deduct __ days.
7. Adverse affect on other Trades caused by substitution: No __ Yes __ (If yes, explain on attachment).
8. Contractor will modify other parts of the Work as may be required to make all parts of Work complete and functioning. Yes __ (Explain on attached page if necessary)
9. Same type of warranty for specified product will be furnished for proposed substitution: Yes __ No __
10. Maintenance Service Available: Yes __ No __ Where?___________________________
11. Contractor has complied with requirements of the Texas State University Design Guidelines and Construction Standards and Contract Documents as part of request for substitution, and has completely filled-in this form.
DIVISION 01 25 00 – SUBSTITUTION FORM

REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEM:
See attached ___ Not required ___

Submitted by:  ____  Approved
Signature ________________________  ____  Approved as noted
Firm ____________________________  ____  Rejected
Address __________________________  ____________________________
____  Rejected only for conformance with
Date _____________________________  Signature ________________________
Telephone _________________________  Date ____________________________

REQUIRED ATTACHMENTS:

A.  Product Data for Specified Item: Clearly marked to indicate full compliance with
specification section and Contract Documents: Attached
B.  Product Data for Substitution: Clearly marked for adequate evaluation and comparison
with data submitted for specified item: Attached ___
C.  Samples: Attached ___ Not Required ___
D.  Cost Data and Implications of Substitution: Attached ___ Not required ___
E.  Contractor's Comments: Attached ___ Not required ___
F.  Manufacturers certifications on asbestos arid PCB: Required/must be attached
G.  Other:  ________________________________________________

PART 2:  PRODUCTS (NOT USED)

PART 3:  EXECUTION (NOT USED)

END OF SECTION 01 25 00
01 56 39   Tree Protection

A. Refer to 31 23 16 TREE PROTECTION: Earth Moving and Fill Excavation
3.01 CONTRACTOR’S SAMPLE WARRANTY

Project Warranty for________________________________________________________
Whereas, ________________________________________________________________
Address______________________________________________________________
Telephone (___) ___-__________ext. _____has performed __________________
(Work) on the following Project _________________________________________
Address______________________________________________________________
WHEREAS, The Contractor has agreed to warrant said Work __________________
NOW, THEREFORE, the Contractor hereby warrants said Work in accordance
with the terms hereof, complying with the terms of the Contract with the Owner
dated_________ that___________________________________________________
WARRANTYPERIOD ______ STARTING______ TERMINATING _________
IN WITNESS THEREOF, this instrument has been duly executed this ______
day of ______ 20___ for Contractor (typed name) as its (position).
Name of Firm __________________________________________________________
Address______________________________________________________________
And has been countersigned in accordance with terms and conditions, for the
Manufacturer (typed name)____________________________________________
as its ______________________________________ (position).
Name of Firm __________________________________________________________
Address______________________________________________________________
3.02 MANUFACTURER’S SAMPLE WARRANTY

Project Warranty for_________________________________________________
Whereas, _____________________________________________ (Manufacturer),
Address ___________________________________________________________
Telephone (___) ___-______ ext. _____ has furnished/provided_______________
(product) on the following Project : _____________________________________
__________________________________________________________________
Address____________________________________________________________
Constructed by ___________________________________________ (Contractor).
Address____________________________________________________________
For ________________________________________________________ (Owner).
Address____________________________________________________________
WHEREAS, the Manufacturer, through the Contractor, has agreed to warrant
said product ________________________________________________________
__________________________________________________________________
NOW, THEREFORE, the Manufacturer hereby warrants said product accordance
with the terms hereof, complying with the terms of the Contract between the
Contractor and the Owner dated ___________ that _________________________
__________________________________________________________________
WARRANTY PERIOD, STARTING_______, TERMINATING _____________
IN WITNESS THEREOF, this instrument has been duty executed this _____ day
of _______ 20___ for Manufacturer (typed name) as its _____________________
__________________________________________________________(position).
And has been countersigned in accordance with terms and conditions for the Contractor
(typed name)_________________________________________
as its _____________________________________________________ (position).
DIVISION 02: EXISTING CONDITIONS

02 32 00 Geotechnical Investigations
SECTION 02 32 00 – GEOTECHNICAL INVESTIGATIONS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for the preparation of a geotechnical report and guidelines for the resulting foundation design.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 General Requirements

A. Review copies of any available geotechnical reports at or near the location(s) of proposed construction. The scope of work for the geotechnical engineer retained to provide the investigation and report shall be based on the available information and preliminary design information for the proposed structure(s), including layout, column or continuous loadings, loading types and conditions, subgrade depth, and/or any other information that would make the recommendations included in the final report more specific to the design.

B. Coordinate with Texas State University-San Marcos Utilities plans to determine all current or future obstructions that may affect the foundation design. This coordination effort shall be initiated as soon as possible before beginning design work to assure that obstructions are accounted for in the design.

C. Maximum foundation loads shall include all proposed or current loading, as well as any anticipated loading due to renovations or additions to the structure(s). Coordinate with Texas State University-San Marcos.

D. Coordinate all work on campus. This shall include Parking & Traffic, Texas State University-San Marcos Police Department, any other entities who might be affected by work.

PART 2: PRODUCTS

2.01 Geotechnical Report

A. The geotechnical report shall be prepared and sealed by a registered geotechnical engineer with five (5) years of continuous related work in the San Marcos area.
SECION 02 32 00 – GEOTECHNICAL INVESTIGATIONS

B. All geotechnical work and recommendations shall be supervised by a professional engineer registered in the state of Texas.

C. As a minimum, the geotechnical report shall test, study, discuss, indicate on drawings, and/or present in charts, tables, or graphs the following:

1. Background information.
   a. The general topography of the site as it affects the foundation design and construction, including surface conditions, site irregularities, or other elements that could affect the foundation design.
   b. The general geology of the site with particular emphasis on the main geological formations underlying the proposed structure(s).
   c. The location of utilities or other known obstructions.
   d. The previous known construction history at or near the site and, where applicable, any known problems or failures attributable to the site conditions and subgrade.
   e. Any special conditions, such as faults, seasonal fluctuations, erosion, etc.
   f. Test methods.

2. Boring location plan.

3. Generalized subsurface profiles, indicating stratigraphic and structural relationships.

4. General foundation construction requirements including loading capabilities and construction limitations.

5. Evaluation of groundwater conditions, including the anticipated effects on construction, the performance of the completed structure(s), and the recommended method(s) for handling groundwater during construction and in the completed structure(s).

6. 25, 100, and 500 year flood plains.

SECTION 02 32 00 – GEOTECHNICAL INVESTIGATIONS

8. The acceptability of on-site materials for construction.


10. Any other items that could effect construction or the long-term performance of the foundation.

D. As applicable to specific project requirements, the geotechnical report shall test for, study, discuss, indicate on drawings, and/or present in charts, tables, or graphs the following:

1. Lateral earth pressures, both active and passive.

2. Temporary construction procedures and support systems.

3. Dewatering procedures and equipment.

4. Subgrade drainage.

5. Trench safety.


7. Piling, drilled shafts, and sheet piling.
   A. Provide Pressure Meter Reading on Pier Shafts.

E. The number, depths, and locations of borings shall be determined based on the proposed structure and in coordination with the geotechnical engineer retained.

2.02 Miscellaneous Materials

A. Polyethylene sheeting shall be used below all slabs-on-grade. The sheeting shall be a minimum of 6 mils and overlapped a minimum five (5) feet at joints.

B. For structures that will be subject to high plasticity soils, use a foundation isolation system.

C. Provide a subgrade drainage system at the perimeter of all foundation elements that will have occupied spaces on one side and exposed earth on the other side. The system may be required to drain into water-recovery system. Subgrade drainage shall be as recommended by the geotechnical report and shall include the following:

1. Drainage pipe, draining to a well-point system or free drainage.
SECTION 02 32 00 – GEOTECHNICAL INVESTIGATIONS

2. Course filter material in a drainage trench surrounding the drainage pipe.

3. Drainage fabric surrounding the drainage pipe and course filter material.

4. Drainage backfill over the drainage trench, to a depth as recommended by the geotechnical report.

5. Other methods and products as recommended by the geotechnical engineer and as approved by Texas State University-San Marcos.

PART 3: EXECUTION

3.01 Excavation

A. Photo document site prior to commencement of work.

B. Protect adjacent structures.

C. Blasting is not permitted. (Unless authorized by systems office).

D. Provide protection at open excavation work and trenches.

3.02 Foundation Design - The foundation drawings shall include the following as a minimum:

A. Limits of the required work.

B. Existing and final contours coordinated with established benchmarks.

C. Locations, inverts, gradients, and dimensions of new utilities and trenches where related to the foundation elements.

D. Locations of exiting utilities or obstructions to remain or be demolished as a part of the foundation work.

E. Plan and details of all foundation elements.

F. Subgrade drainage.

G. Any specialized construction detailing.

END OF SECTION 02 32 00
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03 30 00</td>
<td>Cast-In-Place Concrete</td>
</tr>
<tr>
<td>03 30 01</td>
<td>Concrete Foundation Slab for Electric Transformers and Switches</td>
</tr>
<tr>
<td>03 33 00</td>
<td>Architectural Concrete Sidewalk Paving</td>
</tr>
</tbody>
</table>
SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for cast-in-place concrete.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. All sidewalks will be designed and constructed following Texas State University Campus Master Plan.

1.03 Reference Standards

A. The current editions of the applicable American Concrete Institute (ACI) publications, to the extent applicable in each reference.

B. The current editions of the applicable American Society for Testing and Materials (ASTM) specifications, to the extent applicable in each reference.


1.04 Environmental Controls

A. Rinsing out of the transit mix trucks, washing or wetting of concrete, site cleanup, or other activity related to water at the site shall be in strict conformance with all EPA requirements for the prevention of water runoff to storm water sewers or creeks.

PART 2: PRODUCTS

2.01 Materials

A. All concrete shall be normal weight concrete weighing not more than 145 pcf, unless otherwise required.

B. Cement
SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

1. Cement shall conform to one of the following:

<table>
<thead>
<tr>
<th>Type/ASTM No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA/C150</td>
<td>Standard Portland cement.</td>
</tr>
<tr>
<td>IIA/C150</td>
<td>Provides moderate sulfate resistance or moderate heat of hydration.</td>
</tr>
<tr>
<td>IIIA/C150</td>
<td>Produces high early strength.</td>
</tr>
<tr>
<td>IPA/C595</td>
<td>Type I cement blended with a pozzolan (20% by weight maximum of the cement/pozzolan blend).</td>
</tr>
<tr>
<td>E-ika/C845</td>
<td>Contains anhydrous calcium aluminosulfate, calcium sulfate, and uncombined calcium oxide.</td>
</tr>
</tbody>
</table>

2. Only one type and brand of each type of cement will be permitted in any one structure.

C. Flash

1. Conform to ASTM C618, Class F. Class F flyash is generally the best class of flyash to use. However, flyash varies from area to area and from year to year so the source and quality should always be checked carefully.

2. Flyash shall be produced from a single known and consistent source.

3. The amount of flyash used shall be no greater than 20 percent by volume of the specified cement volume (cement is specified by weight, which can be converted to an equivalent volume).

4. Flyash shall not be used in architecturally exposed concrete.

D. Aggregates

1. Aggregates shall conform to ASTM C33.

2. Use coarse aggregate from only one source and fine aggregate from only one source for exposed concrete in a single structure.

E. Mixing Water shall be potable.

F. Admixtures

1. The use of a super plasticizer is recommended, especially where waterproofing is required since it helps to produce a denser, more water-resistant concrete.
SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

G. Chlorides are not permitted in any form.

H. Reinforcing Steel
   1. Conform to ASTM A615, Grade 60 (#3 bars shall be Grade 40).
   2. Welded wire fabric is not allowed as reinforcing.

I. Water stops
   1. A major problem with flexible water stops is that they are often displaced during concrete placement. Thus water tightness is impaired. The drawings and/or specifications should carefully address proper placement of flexible water stops. Some water stops are manufactured with wire embedded in them that allow the water stops to be tied off more securely during concrete placement. Since water stops are critical to water tightness in a structure, these reinforced water stops should be considered.
   2. Splices should be fused or “welded” in accordance with the material chosen and the manufacturer’s recommendations.
   3. Where “adhesive” or “rope” water stops are specified, the products shall have a proven life consistent with expected life of the structure being designed.

2.02 Proportioning of Concrete

A. Select proportions of ingredients to produce a concrete having proper workability, durability, strength, and appearance. Proportion ingredients to produce a mixture that will work readily into corners and angles of forms and around reinforcement by methods of placing and consolidation employed on the project.

B. The maximum recommended allowable water/cement or water/cement-pozzolan ratio shall not exceed 0.47. Include free water in the aggregate in all water/cement or water/cement-pozzolan ratio computations.

C. Air entrainment shall be included in all concrete mixes, unless required otherwise.

PART 3: EXECUTION

3.01 Rinsing Trucks

A. Rinsing of transit mix trucks or other concrete mixing devices shall either be off of the Owner’s site or onsite in a contained area, which does not allow run-off. If
rinsed in a contained area onsite, run-off must be prevented until concrete dries, at which time it must be removed as solid debris.

### 3.02 Reinforcing

A. Reinforcing bars field cut on the job shall be cut by shearing or sawing.

B. Field cutting with a torch is not acceptable.

C. Welding of reinforcing bars is prohibited. Mechanical methods for splicing bars are preferred.

### 3.03 Construction Joints

A. Construction joints should be shown on the drawings to assure that the Contractor does not place joints where water tightness or strength of the structure will be impaired. A note should be placed on the drawings that all construction joints not shown on the drawings should be submitted to the Engineer for approval.

B. Constructability is very important to assure good concrete placement. Therefore, the Engineer should be careful in reviewing proposed joints so that those necessary for constructability are not rejected.

C. 100% of reinforcing shall be continuous across construction joints.

### 3.04 Control Joints

A. Control joints are herein described as joints that are designed to allow for movement either from contraction or expansion.

B. Contraction joints allow for contraction of the concrete and also function as construction joints.

1. Fifty percent of reinforcing shall be continuous across contraction joints.

2. If saw-cutting of contraction joints is allowed, the following shall be adhered to:

   a. During hot and dry periods, saw-cutting should occur within 4 to 12 hours of concrete placement.

   b. During cool and moist periods, saw-cutting should occur within 24 hours of concrete placement.
SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

3. Where applicable, use water stops to assure water tightness.

C. Expansion joints allow for expansion of the concrete and also function as construction and contraction joints.

1. Reinforcing shall not be continuous across expansion joints, except for shear transfer as noted below.

2. For shear transfer, use smooth dowels with expansion caps on one side.

3. Expansion joints should be considered at approximately 120 foot spacing as a general rule.

4. Where applicable, use water stops to assure water tightness.

3.05 Concrete Finishing

A. Carefully specify the types of concrete finishing required for all areas of the structure to assure proper finishing and to avoid costly change orders due to lack of definition on the drawings or in the specifications.

1. Rough form finish shall be in accordance with ACI 301, Section 10.2.1. This is the roughest finish and is recommended for surfaces that will not be visible in the completed structure.

2. Smooth form finish shall be in accordance with ACI 301, Section 10.2.2. A smooth form finish is recommended for surfaces to be coated or where appearance is not important.

3. Smooth rubbed finish shall be in accordance with ACI 301, Section 10.3.1. A smooth rubbed finish requires an initial smooth form finish as required above. A smooth rubbed finish is recommended for surfaces that will not be coated and do not require a highly finished appearance. A smooth rubbed finish should also be used if recommended by the manufacturer of the specified protective coating(s).

4. Grout cleaned finish shall be in accordance with ACI 301, Section 10.3.2. A grout cleaned finish requires an initial smooth form finish as required above. A grout cleaned finish is recommended for surfaces that will not be coated but do require a highly finished appearance. A grout cleaned finish is labor intensive and requires some skill to produce the desired results. Therefore, the Contractor’s procedure must be monitored carefully to assure that a proper finish is obtained. Depending on the project, a protective coating can be more cost effective.
SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

5. Tops of walls and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed. Float unformed surfaces to a texture consistent with that of the formed surfaces. Final treatment on formed surfaces shall continue uniformly across the unformed surfaces.

B. Carefully specify the finishing slabs and similar flat surfaces for all areas of the structure to assure proper finishing and to avoid costly change orders due to lack of definition on the drawings or in the specifications.

1. Floated finish. Usually most slabs and flat surfaces receive a floated finish, except as noted below.

2. Troweled finish. Usually a troweled finish is specified where a nicer finished appearance is desired or where floor coverings will be applied.

3. To obtain a broom, belt, or rake finish, immediately upon completing a floated finish, draw a broom or rake across the surface to give a coarse transverse scored texture. Usually a broom, belt, or rake finish is specified for sidewalks and ramps.

3.06 Testing and Control

A. Texas State University shall employ, a commercial testing laboratory, to prepare and test the initial mix design for each class of concrete specified.

B. In addition to the initial mix design(s), Texas State University shall employ, a commercial testing laboratory, to prepare and test the mix design for each class of concrete for which the material source has been changed.

C. Field Test Cylinders During Construction.

1. Mold four cylinders for each set of tests specified.

2. Test one specimen at 7 days and two at 28 days according to ASTM C39. If one, or both, of the 28-day tests indicate a compressive strength below the strength required, the fourth specimen shall be tested at 56 days. If all tests indicate a compressive strength below the strength required, Texas State University-San Marcos may, at their discretion, direct the Contractor to perform additional testing at no additional cost to Texas State University.

3.07 Testing of Deficient In-place Concrete
SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

A. The strength of the concrete will be considered potentially deficient if the averages of two consecutive sets of strength test results fail to equal or exceed the specified strength or if any individual strength test result falls below the specified strength. Testing may be required as directed by the Engineer.

B. Concrete work not having the required strength, as determined by the Engineer, shall be replaced at the Contractor’s expense.

C. The Contractor shall bear all costs incurred in providing the additional testing and/or analyses required as a result of deficient in-place concrete. All costs as a result of delays due to additional testing and/or analyses will be at the Contractor’s expense, with no extension of contract length, regardless of the outcome of the testing.

3.08 Acceptance of Concrete Work

A. Formed surfaces resulting in a configuration of members smaller than permitted under the tolerances specified shall be considered deficient and repaired or replaced as directed by the Engineer.

B. Concrete members cast in the wrong location shall be rejected if the strength, appearance, or function of the structure is, in the Engineer’s opinion, adversely affected or if misplaced members interfere with other construction. If rejected, remove members cast in the wrong location and repair or replace at the Contractor’s expense as directed by the Engineer.

C. All work required under this section shall be at the Contractor’s expense, with no extension of contract length.

END OF SECTION 03 30 00
SECTION 03 30 01 – Slab for Electric Transformers & Switches

Exhibit 1:

Transformer Pad

Switch Pad

Elevation

Note: When level of concrete slab is 12" or greater above finished grade, guardrails shall be installed.

END OF SECTION 03 30 01
SECTION 03 33 00 – ARCHITECTURAL CONCRETE SIDEWALK PAVING

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for pavement for sidewalks.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Interior Campus Sidewalk Paving:

1. Sidewalk widths are defined in Section 03 33 00; the proportions of the exterior concrete band dimension and the interior paver field dimension will need to be adjusted.

   a. The sidewalk will have 6” wide concrete curbs at the perimeter edges.

   b. The interior field between the concrete curbs will be Pavestone 12” x 12” City Stone and “Holland Stone”, antique terra cotta color Pavers, laid in an 8” module “parquet” pattern.

   c. Refer to design drawings, in Exhibit Section 03 33 00.

2. ADA Sidewalk Curb Ramps: Curb ramp design are to comply with latest Texas Accessibility Standards (TAS), with a maximum slope of 1:12.

   a. Curb ramps will be a minimum of 4’-0” wide, with a field inset of Pavestone “Detectable Warning”, charcoal paver, laid in an 8” module “parquet” pattern.

      (1) Refer to design drawing, in Exhibit Section 03 33 00.

   b. Flared Sides Curb Ramp will meet the required code slope of 1:10.
SECTION 03 33 00 – ARCHITECTURAL CONCRETE SIDEWALK PAVING

(1) The sloped portion will have an insert field of Pavestone “Detectable Warning”, antique terra cotta paver, laid in an 8” module “parquet” pattern.

(2) Refer to design drawing, in Exhibit 2A.

3. Perimeter of Campus Street Sidewalks.

   a. Sidewalk design and specifications will be the same as 1.02, A., 1 above.

   (1) The sidewalk will be located a minimum of approximately 6'-0” from the inside face of the street curb.

   (2) Refer to design drawing, in Exhibit 1A.B.C; Exhibit 2, and Exhibit 2A.

4. General

   a. Walking surfaces shall be designed to be nominally level. Abrupt changes in elevation of walking surfaces shall not exceed ¼ inch. The slope in the direction of travel shall not exceed 1 in 20. The slope perpendicular to the direction of travel shall not exceed 1 in 48.

   b. Any wood utilized for expansion and/or control joints must be coated with an appropriate sealer so to prevent deterioration of the wood. The type of wood preferred for use in this application is redwood.

PART 2: PRODUCTS

2.01 Sidewalk Paver

   A. Field Paver

   1. Pavestone Company, “Holland Stone”, (2 3/8” thick, 4” w. x 8” long nominal), antique terra cotta color.

   2. Pattern: “Parquet”

   B. Borders and Periodic Bands

SECTION 03 33 00 – ARCHITECTURAL CONCRETE SIDEWALK PAVING

2.02 ADA Sidewalk Curb Ramp Paver.
   A. Ramps and Flares
      2. Pattern: “Parquet”

2.03 General Concrete:
   A. Concrete shall be a minimum of 560 lb. Of ASTM C150, Type II Portland Cement per cubic yard of concrete, and a water-cement ratio no greater than 0.53 by weight. Minimum compressive strength shall be 4,000 psi at 28 days.
   B. Finish.
      1. Provide a trowel finish.
      2. All concrete sidewalk edges shall receive a 1/8” radius curved tooled finish.
      3. After sidewalk has cured and no sooner than 2 weeks after the concrete has been placed, concrete shall be washed with a 5% to 10% solution of muriatic acid.

2.04 Campus Perimeter “Logo Paver”:
   A. The sidewalks on the perimeter boundaries of the campus are to have the “TXST Logo Paver”. The “Logo Paver” is to be located at street intersections and at 30’-0” intervals on the sidewalk. Refer to EXHIBITS 3 AND 3A.

PART 3: EXECUTION

3.01 General
   A. Any concrete flatwork shall be no less than 5” thick with #4 reinforcement 12” o.c. each way. Flatwork must be doweled with 24” long #4 reinforcement dowels, placed 18” on center, to a penetration of 12”, into any abutting concrete flatwork. Building entry flatwork must also be doweled into the building foundation.
   B. Rinsing of transit mix trucks or other concrete mixing devices shall either be off of Texas State University’ site or onsite in a contained area that does not allow
run-off. If rinsed in a contained area onsite, run-off must be prevented until concrete dries, at which time it must be removed as solid debris.

C. Wash water from exposed aggregate sidewalks or other paved areas may not enter the storm sewer system. Water must either be collected and discharged on an area of pervious cover acceptable to Texas State University, discharged offsite, or allowed to pool until only sediment is left and can be disposed of as solid refuse.
SECTION 03 33 00 – ARCHITECTURAL CONCRETE SIDEWALK PAVING

EXHIBIT 1:

PLAN B:

Sidewalk light fixture pad 24" x 24" Fig by civil engineer

6" Conc. Curb

Pavestone - City Stone, Tan
Pavestone - Holland Stone, Antique Terra Cotta

60" O.C. ±

PLAN A:

Sidewalk light fixture pad 24" x 24" Fig by civil engineer

6" Conc. Curb

Pavestone - City Stone, Tan
Pavestone - Holland Stone, Antique Terra Cotta

60" O.C. ±
SECTION 03 33 00 – ARCHITECTURAL CONCRETE SIDEWALK PAVING

Exhibit 1A:

Fill paver joints w/ masonry sand

6" 1'-0"

#3 Rebar, continuous

Crushed stone road base, compacted to 95%

"Varies, refer to plan"

2" 3/8"

Sod

Conc. Curb
Exhibit 2:

- Pavestone Holland Stone, Antique Terra Cotta, sidewalk pavers in 8"x8" basketweave pattern.
- Pavestone, 12"x12" City Stone paver, "Tan".
- 8"x8" basketweave pattern, raised dot paver.
- Landscape Area.
- Conc. ramp perimeter.
- 7 - 8" Modules.
- ADA raised dot pavers: Pavestone: "Charcoal".
- Match Antique Terra Cotta paver width, except, min. width 36".

Cross-walk pavement marking:
TXDOT DMS-8220 thermoplastic type material; heat applied.

Match Sidewalk Width
See Plans

File name: ADA_Ramp_Standard_a

Title: ADA Ramp Standard & Crosswalk

Sheet No.: 1 of 1

File updated: 5/28/2013
Plot Date: 5/28/2013

Revised Sept-15
Arch. Concrete Sidewalk Paving-03 33 00-8
SECTION 03 33 00 – ARCHITECTURAL CONCRETE SIDEWALK PAVING

Exhibit 3:

Title: Campus Perimeter "Logo Paver"

Plot Date: 6/11/2013  
File name: TxState_Paver

Sheet No.: 1 of 1

Revised Sept-15  
Arch. Concrete Sidewalk Paving-03 33 00-10
Hatched area of Letters, Line and Star to be recessed 1/8".

Hatched areas to be finished with a clear waterproof sealer.

Specifications:
1. Pavestone Company, 24" square patio stone, 2" thick, color: "Caststone".
2. 8,000psi compressive strength
3. Letters, star and line to be recessed 3/8".

Title: Logo Paver
Plot Date: 6/11/2013
File name: TXStatePaver_Detail
Sheet No.: 1 of 1
Scale: NTS
## DIVISION 04: MASONRY

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<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>04 01 20.52</td>
<td>Unit Masonry &amp; Cleaning</td>
</tr>
<tr>
<td>04 01 20.91</td>
<td>Unit Masonry &amp; Restoration</td>
</tr>
<tr>
<td>04 20 00</td>
<td>Unit Masonry</td>
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<td>04 43 00</td>
<td>Stone Masonry</td>
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<tr>
<td>04 72 00</td>
<td>Caststone Masonry</td>
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</table>
PART 1:  GENERAL

1.01  Scope of Standard

A.  This standard provides general guidance concerning the specific preferences of the Texas State University for materials, equipment, and services for the cleaning and restoration of masonry.

B.  Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02  Reference Standards

A.  Finishes: Section 09 90 00, Painting and Coating

B.  The Secretary of the U.S. Department of the Interior’s Standards for Rehabilitation.


D.  Clear Water Repellent Treatments for Concrete Masonry, Masonry Institute of America.

E.  Practical Building Conservation, 4 vols., John Asbury.

1.03  General Requirements

A.  Masonry cleaning:

1.  Cleaning shall be limited to the gentlest means possible.

2.  Test areas in inconspicuous locations.

3.  Tests must be approved by Texas State University Project Representative.

4.  Low pressure washes no greater than 400 psi unless authorized by Texas State University-San Marcos Project Representative.
SECTION 04 01 20.52 – UNIT MASONRY CLEANING
SECTION 04 01 20.91 – UNIT MASONRY RESTORATION

5. In no instance shall sandblasting be acceptable.

6. Compliance with the Office of Environmental Health and Safety is required. See 3.01A below.

B. Masonry restoration: Historic buildings’ grout re-pointing shall comply with the Texas State University campus historic restoration recommendations. Extreme care shall be taken during the repointing process. Use of hand tools is required.

PART 2: PRODUCTS

2.01 Sealants

A. General

1. Sealer: After cleaning or restoration, provide the following sealer. “ENVIROSEAL DOUBLE 7” clear penetrating water based sealer, formulated not to yellow and not be affected by UV, manufactured by Hydrozo, Inc. /Lincoln, Nebraska.

   a. The sealer is withstand a hydrostatic pressure of 40 psi.

PART 3: EXECUTION

3.01 Discharges

A. Discharges from pressure washing shall not be allowed to enter a storm sewer or waterway. Vacuum the water for disposal off-site or berm the process water and allow it to evaporate. If the rinseate only contains water and dirt or sediment, it may be spread on the ground only with written prior permission from the Texas State University Office of Environmental Health and Safety.

END OF SECTION 04 01 20.52 & 04 01 20.91
CONSTRUCTION STANDARD DIVISION 04 – MASONARY

SECTION 04 20 00 – UNIT MASONRY

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for manufactured units of masonry, both load bearing and non-load bearing.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Unity Through Design Expression: San Marcos Campus

1. As the major design tool in the creation of unity among Texas State University campus buildings, employ brick masonry as the predominant exterior building material, with stone or precast concrete door and window lintels/sills, and with stone or precast concrete floor articulated courses. Refer to the 2006-2017 Master Plan for design guidelines.

2. The strength and appeal of this basic material are universal. Repeat the use of face brick of tan color and of velour texture to match brick masonry of recently constructed Texas State University buildings.

B. Unity Through Design Expression: Round Rock Campus

1. As the major design tool in the creation of unity among Texas State University-Round Rock campus buildings, employ brick masonry and chopped limestone as the predominant exterior building material.

2. Repeat the use of face brick of tan color and chopped limestone, with punched windows, to match the character of the Avery Building.

C. Brick Masonry Approval

1. Early in the construction phase, before the material is installed, secure University approval of samples and sample panels of actual brick, or other material, proposed for installation on the new building’s exterior walls.
SECTION 04 20 00 – UNIT MASONRY

2. Contractor shall be required to construct a sample panel (8’ L. X 6’ H. minimum) showing brick and mortar color and any other materials (stone, plaster, cap flashing, window, etc.)

3. The contractor shall allow a minimum 6 weeks review rework and approval of the sample panel before ordering brick.

4. Locate in full sun & as directed by Texas State University representative.

5. Mock up will be constructed no later than 3 months prior to needing masonry delivered to the construction site.

6. Deviation from Brick. If, in the design of a new building, the architect proposes a deviation from the brick masonry envelope described above, Texas State University must approve such deviation in writing.

1.03 Reference Standards

A. Reinforced Grouted Brick Masonry, Masonry Institute of America

B. Masonry Veneer (Second Edition), Masonry Institute of America

C. Reinforced Masonry Engineering Handbook (Fifth Edition Updated), Masonry Institute of America.

D. 1997 Masonry Codes and Specifications, Masonry Institute of America

E. Reinforcing Steel in Masonry, Masonry Institute of America

F. Technical Notes on Brick Construction, Brick Industry Association

SECTION 04 20 00 – UNIT MASONRY
PART 2: PRODUCTS

2.01 Brick Veneer:

A. San Marcos Campus:

1. Brick: To match Acme Brick Company “Doeskin Elgin 186” blend-modular, velour texture (Project Code 151860121)

   a. To be used only as accent brick course(s) on perimeter brick monument signs and fence columns.

B. Round Rock Campus: (Avery Building)

1. Brick: To match “Painted Desert #230”, Velour face, as manufactured by Acme Brick (Project Code 152300121)-modular.


C. Consultant shall arrange to bring brick supplier into the design process early to verify any new developments in brick production that may impact brick unit appearance or delivery.

D. New masonry used in renovation work is to match the masonry of the existing building.

E. Grout: Coordinate color of mortar with the Texas State University project representative. Use only a pre-mixed mortar, with no calcium chloride admixtures.


F. Repointing should occur in advance of cleaning, unless authorized by Texas State University project representative.

2.02 Sign Letters
SECTION 04 20 00 – UNIT MASONRY

1. The “Texas State University” letters are 8” high, all upper case, Times Bold, font, 1” return, dark bronze anodized aluminum, water jet cut.

2. The “Established 1899” letters are 4” high, all upper case, Times Bold, font, 1” return, dark bronze anodized aluminum, water jet cut.

2.03 Perimeter Campus Brick Columns (San Marcos): Refer to Exhibits 1 & 2

2.04 Perimeter Campus Brick Monument Signs (San Marcos): Refer to Exhibits 1-10.

2.05 Sealer: Same as sealer under Unit Masonry Cleaning & Restoration

PART 3: EXECUTION: (NOT USED)

END OF SECTION 04 20 00
Exhibit 1:

Sheet No. 2
Exhibit 1A

(Varies)

Cast stone, Continental cast stone,
#1101-T, "Greystone".
Center line of Fence Knuckle must
align with center line accent brick

Acme Brick, Accent Brick
Acme Brick, blend 186.

Cast Stone, Continental
Cast Stone, #1101-T "Greystone".

Brick Mortar:
1. Spectrum, Eldridge "Buff".
2. Spectrum Mortar:
   1. Spectrum, Eldridge "Khaki".

Brick Column Elevation
No Scale

Notes:
1. All Brick Joints 3/8" high.
Exhibit 1A:

Column Cap Detail

1/2" = 1'-0"
SECTION 04 20 00 – UNIT MASONRY

EXHIBIT 2:

Notes:
1. Plant Finish: Steel fence to be painted semi-gloss finish.
2. All brick joints 3/8" high.

Texas State

Title: Campus Perimeter Brick Fence and Ornamental Rail
File name: Fence_Standard_a

Revised Jan-15  Unit Masonry-04 20 00-7
Exhibit 3:

Plan View
Scale: 1/4" = 1'-0"

3 Lights KIM lighting, #4348/132-T8/3L/FH48/SM188L

Line of cast stone in brick

Fit angle to site conditions

Cast stone cap
Landscape bed

14'-2" Rad.
17'-7.5"

5.5" minimum

1'-2.5"
14'-2" Rad.
Exhibit 4:

Plan View
Scale: 1/4" = 1'-0"

Title: Campus Standard Large Monument Sign
File updated: 6/6/2013
Plot Date: 6/6/2013
File name: StandardMonumentSign1.dwg

Sheet No.: 2 of 12
Exhibit 8:

Precast Wall Cap
Precast concrete panel sign letters to be pin mounted by others.
6" Dowel
8" C.M.U.
Face Brick
Horiz. Masonry Reinf. @ every 16" O.C.
Dampproofing
Weep holes at every head joint w/ cement wash
Proposed grade

Wall Section A

Scale: 3/4" = 1'-0"

Brick Legend:

1 Acme Brick, Blend 186, "Doeskin", code 151860121.

2 Acme Brick, Blend 138, Royal Birkdale, Denton, TX, code 29-138-01-27.
Exhibit 9:

Wall Section B

Scale: 3/4" = 1'-0"
Exhibit 10:

A Precast Column Cap

3'-8"

8" C.M.U.
Face Brick

Horiz. Masonry Reinf. @ every 16" O.C.

ACME Accent Brick

2" 6"

3"

17 Courses

3." 6" 2"

Dampproofing

Weep holes at every head joint w/ cement wash

Reinforcing bars, refer to structural design.

Column Section

Scale: 3/4" = 1'-0"

Title: Campus Standard Monument Sign
File updated: 6/6/2013
Plot Date: 6/6/2013
File name: StandardMonumentSign1.dwg

Sheet No.: 8 of 12

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Unit Masonry-04 20 00-15
Exhibit 11:

Cast stone, Continental cast stone, #1101-T, "Greystone".

Precast Column Cap

Scale: 1" = 1'-0"
Exhibit 12:

Cast stone, Continental cast stone, #1101-T, "Greystone".

Elevation

Field verify radius of wall for cap dimension

Plan

Precast Wall Cap A

Scale: 1" = 1'-0"

Sheet No.: 10 of 12
Exhibit 13:

Cast stone, Continental cast stone, #1101-T, "Greystone".

Elevation

Field verify radius of wall for cap dimension

Plan

Precast Wall Cap B

Scale: 1" = 1'-0"
SECTION 04 43 00 – STONE MASONRY

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for natural and cut stone.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Reference Standards

A. Refer to the Texas State University-San Marcos Campus Master Plan for guidelines pertaining to use of stone.

B. Successful maintenance guidelines shall be developed and approved prior to the specification or installation of any porous stone. Use caution when specifying use of shell stone limestone at locations where it is exposed to rainfall.

C. Marble and Stone Slab Veneer, (Second Edition), Masonry Institute of America.

D. Dimension Stone Design Manual, Marble Institute of America.


1.03 Quality Control

A. Details for installation and cleaning shall be approved by the Texas State University-San Marcos project representative prior to specification or installation of any porous stone.

PART 2: PRODUCTS

2.01 Stone

A. San Marcos Campus: Refer to 04-72-00 Caststone Masonry.

B. Round Rock Campus:

1. Limestone: Austin Cream, chopped-face limestone, Gamboa Quarry, Liberty Hill, Texas.
C. Anchors: Use only stainless steel.

PART 3: EXECUTION

3.01 General

A. Provide drips where stone projects more than one inch.

B. Avoid using cream limestone where it extends below finished grade at lawn or planting beds.

C. Provide masonry mock up for approval at least three months prior to needing stone on site.

END OF SECTION 04 43 00
SECTION 04 72 00 – CASTSTONE MASONRY

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University caststone masonry

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Reference Standards

A. Refer to the Texas State University Campus Master Plan for guidelines pertaining to use of stone.

B. Successful maintenance guidelines shall be developed and approved prior to the specification or installation of caststone.

1.03 Quality Control

A. Details for installation and cleaning shall be approved by the Texas State University project representative prior to specification or installation of any caststone.

PART 2: PRODUCTS

2.01 Caststone

A. San Marcos Campus:

1. Continental Caststone, #1101.T, “Greystone”, or equal color from other manufacturers. Other caststone manufacturers must match exactly Continental Caststone #1101-T. A custom color may be required. No color substitutions.

B. Anchors: Use only stainless steel.

C. Mortar: Spectrum, Eldridge, “Khaki”.
PART 3:  EXECUTION

3.01  General

A. Provide drips where caststone projects more than one inch.

B. Provide caststone mock up for approval at least three months prior to needing caststone on site.

END OF SECTION 04 72 00
DIVISION 05: METALS

05 51 00  Metal Stairs
05 52 00  Exterior Metal Railings
05 52 01  Metal Dumpster Screens
05 52 02  Metal Fences over 5 Feet Tall
SECTION 05 51 00 – METAL STAIRS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for metal stairs.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Make stair tread surfaces of such materials as precast terrazzo, stone, concrete, and provide non-slip nosings.

B. Do not use ceramic or quarry tile, bluestone, slate, or marble for interior stair tread or landing surfaces.

C. Carpeted landings function effectively as soil traps as well as noise absorbers.

D. Do not locate lighting fixtures over runs of stairs; make lamps replaceable from landing. Provide an electrical outlet on each stair landing.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 05 51 00
SECTION 05 52 00 – Exterior Metal Railing

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for exterior metal railings.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Exterior metal railing at exterior stairs and guardrails on the site or on the Building shall have a Spanish Colonial influence, and follow the design for stairs, in Exhibit 1 and Exhibit 1a, and for guardrails, in Exhibit 2, for ramps, in Exhibit 3, Perimeter Campus Fence, in Exhibit 4 and Interior Campus Fence, in Exhibit 5 at the end of this Section.

1.03 Submittals

A. Shop drawings submittals are required for approval by the Project Representative.

PART 2: PRODUCTS

2.01 Metals

A. Metals shall conform to standards of ASTM A36 (ASTM A 36M).

B. Metal Railing product referenced components shall be as manufactured by King Architectural Metals, Dallas, Texas, 214-388-9834, or an approved equal.

C. Cutting, Assembly, welding, and painting shall be completed by the subcontractor.

2.02 Fabrication

A. Fabricate metal railings for connecting members, complying with ANSI A14.3, welded steel construction. All welds shall be ground smooth.
SECTION 05 52 00 – Exterior Metal Railing

2.03  Grouting in Concrete

A. Use non-shrink, non-metallic grout: factory packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107.

2.04  Finishes

A. Metal Railings shall be shop primed with a rust inhibitive primer for shop or field painting.

B. For exterior metal railing detached from a building, paint shall be Sherwin Williams, SW6258 "Tricorn Black", with a semi-gloss finish.

C. For exterior metal railing attached to a building, paint shall be Sherwin Williams, BRZ-3, Chestnut Bronze, semi-gloss finish.

PART 3:  EXECUTION

3.01  Installation

A. Set Metal Railings accurately in location, alignment, and elevation: with surfaces level, plumb, true, and free of rack.

B. Anchor steel support bars and posts in concrete by forming or core-drilling holes; then fill with non-shrink grout as specified above.
Exhibit 1:

Exterior stair with Spanish Colonial Vertical bars 4" apart, at non-fall protection requirement

1" x 2" steel post #61x1x2x14-24
1/4"W. MOLDED STEEL HANDRAIL #45 - 905.
Sg. Tubing 1" x 1"
#61-1x16-24

PLAIN SQ. BAR ½" x ½",
#13-45026-000
COLLAR #14-04-58

Lamb's Tongue 13-00302-403

NOTES
1. ALL RAIL COMPONENTS ARE BY KING ARCHITECTURAL METALS, DALLAS, TX: 214-286-9834
2. ALL RAIL COMPONENTS ARE PRIMED WITH RUST INHIBITIVE PRIMER AND PAINTED SHERWIN WILLIAMS, ENAMEL, SW 6258 "Tricorn Black", SEMI-GLOSS FINISH

Elevation
No Scale

Title: Standard Stair Handrail Elevation
File name: HandRail_Standard_2a

Sheet No.: 1 of 1

Revised Jan-15
Exterior Metal Railings - 05 52 00 –3
SECTION 05 52 00 – Exterior Metal Railing

Exhibit 1aa:

Stair railing without pickets, at non-fall protection requirement

Lamb's Tongue 13-00302-403

1" x 2" steel post #81x1x2x14-24

1¼"W. MOLDED STEEL HANDRAIL #45 - 905.

Sq. Tubing 1" x 1"
#61-1x16-24

NOTES

1. ALL RAIL COMPONENTS ARE BY KING ARCHITECTURAL METALS,
   DALLAS, TX: 214-386-8834

2. ALL RAIL COMPONENTS ARE PRIMED WITH RUST INHIBITIVE PRIMER AND
   PAINTED SHERWIN WILLIAMS, ENAMEL, SW 6258 "Tricorn Black", SEMI-GLOSS FINISH

Elevation

No Scale
Exhibit 1a: Exterior Stair Requiring Fall Protection

NOTES
1. ALL RAIL COMPONENTS ARE BY KING ARCHITECTURAL METALS, DALLAS, TX: 214-388-9834
2. ALL RAIL COMPONENTS ARE PRIMED WITH RUST INHIBITIVE PRIMER AND PAINTED SWERWIN WILLIAMS, ENAMEL, SW 6258 "Tricorn Black", SEMI-GLOSS FINISH

Elevation
No Scale

Title: Standard Stair Handrail with Guardrail Elevation

File updated: 7/30/2007  Plot Date: 6/3/2013
File name: HandRail_Standard_3
Exhibit 2: Exterior Guard Rail Requiring Fall Protection

Elevation
No Scale

NOTES
1. ALL RAIL COMPONENTS ARE
   BY KING ARCHITECTURAL METALS,
   DALLAS, TX: 214-388-9834
2. ALL RAIL COMPONENTS ARE PRIMED
   WITH RUST INHIBITIVE PRIMER AND
   PAINTED SHERWIN WILLIAMS, ENAMEL,
   SW 6258 "Tricorn Black", SEMI-GLOSS FINISH

Title: Standard Guardrail Elevation
File name: HandRail_Standard_1a
Scale: 1/2" = 1'-0"
CONSTRUCTION STANDARDS  DIVISION 05 - METAL

SECTION 05 52 00 – Exterior Metal Railing

Exhibit 2A: Exterior Railing, at Non-Fall Protection Requirement

Elevation
No Scale

NOTES
1. ALL RAIL COMPONENTS ARE
   BY KING ARCHITECTURAL METALS,
   DALLAS, TX: 214-388-9834
2. ALL RAIL COMPONENTS ARE PRIMED
   WITH RUST INHIBITIVE PRIMER AND
   PAINTED SHERWIN WILLIAMS, ENAMEL,
   SW 6258 "Tricorn Black", SEMI-GLOSS FINISH

Title: Standard Guardrail Elevation
File updated: 7/30/2007  Plot Date: 6/3/2013
File name: HandRail_Standard_1b

Scale: 1/2" = 1'-0"
SECTION 05 52 00 – Exterior Metal Railing

Exhibit 3:
ADA accessible ramp with pickets, at non-fall projection requirements

Elevation

Notes:

1. ALL RAIL COMPONENTS ARE PRIMED, PAINTED 6288 "_CNTS Block", SEMI-GLOSS FINISH.
2. LAMINATE TONGUE: FILE THE EDGES OF 1 3/4" LAMINATE TO MATCH THE WIDTH OF TOP RAIL.

Title: Accessible Ramp Typical Handrail

File name: Accessible_Ramp_HandRail_Standard

Sheet No.: 1 of 1

Revised Jan-15

Exterior Metal Railings - 05 52 00 –8
SECTION 05 52 00 – Exterior Metal Railing

Exhibit 5: Campus Interior Fence @ Brick Columns

Fence Elevation

NOTES
1. ALL RAIL COMPONENTS ARE BY KING ARCHITECTURAL METALS, DALLAS, TX: 214-388-9834
2. ALL RAIL COMPONENTS ARE PRIMED WITH RUST INHIBITIVE PRIMER AND PAINTED SHERWIN WILLIAMS, ENAMEL SW 6258 "Tricorn Black", SEMI-GLOSS FINISH

Mounting Bracket

NOTES
All welded construction - all bolts completely welded

END OF SECTION 05 52 00

Revised Jan-15

Exterior Metal Railings - 05 52 00 –11
SECTION 05 52 01 – Metal Dumpster Screens

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for metal dumpster screens.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Submittals

A. Shop drawing submittals are required for approval.

PART 2: PRODUCTS

2.01 The dumpster screen enclosure is comprised of steel tubes and flat stripes. These parts are cut, assembled, welded, and painted.

2.02 The design is shown in the following exhibits. The design is based on a 6 cubic yard standard dumpster. The A/E must contact the Texas State University Grounds Department, during the Schematic Design phase, to determine the planned cubic yard size and quantity of dumpsters required for said building or location.

PART 3: EXECUTION (NOT USED)
SECTION 05 52 01 – Metal Dumpster Screens

Note: The dumpster fence screen is based on a single 6 cubic yard dumpster. Each enclosure screen size must be verified with Texas State's Grounds Department, for size and quantity of dumpsters(s) required for each site.

6 cu.yd. dumpster

6" steel bollard, painted black (typ.)

4" x 4" steel tube, painted black

1 1/2" x 1/2" th. flat bar steel, painted black

1 1/2" x 1 1/2" steel tubes, painted black (typ.)

3/4 space between steel bars, (typ.)

Notes:
1. Black color: SW 6258 "Tricorn black", semi-gloss
2. All steel fence components are to be galvanized and primed for painting.
SECTION 05 52 01 – Metal Dumpster Screens

END OF SECTION 05 52 01
SECTION 05 52 02 – Metal Fences Over 5’-0” Tall

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for exterior metal railings.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Submittals

A. Shop drawings submittals are required for approval by the Project Representative.

PART 2: PRODUCTS

2.01 Metal Fences

A. All fences higher than 5’-0” tall shall be aluminum construction. Refer to EXHIBIT 1 for the design. No design changes are to be accepted.

2.02 Finishes

A. Exterior aluminum fences shall be factory painted to match Sherwin Williams, SW6258 "Tricorn Black", with a semi-gloss finish.

PART 3: EXECUTION (NOT USED)
SECTION 05 52 02 – Metal Fences Over 5’-0” Tall

EXHIBIT 1:

Title: Campus Metal Fence w/ Brick Columns Over 5’-0” Tall

File updated: 6/6/2013 Plot Date: 7/10/2013
File name: Fence_Standard_Overs/
DIVISION 06: WOOD, PLASTIC, & COMPOSITES

06 10 00  Rough Carpentry
06 40 00  Interior Architectural Woodwork
SECTION 06 10 00 – ROUGH CARPENTRY

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for wood foundations; framing, sheathing, and decking using timber, lumber, and engineered wood products. Blocking and supports to join members and anchor framework to other construction.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Quality Control

A. All older campus building should be thoroughly checked for termites and other insect infestations, and specifications should address treatment measures required if termites are found during renovation.

PART 2: PRODUCTS

2.01 General

A. Contractor shall provide UL label for fire retardant material.

B. Contractor shall provide certification for preservative treated material.

C. Lumber shall be kiln dried, bearing stamp of Southern Pine Inspection Bureau or equivalent agency.

D. Fire retardant treated lumber shall bear UL label.

E. All treated lumber and plywood shall be Kiln Dried After Treatment (KDAT) 19%.

F. Contractor shall install 2x10 wood blocking in walls for door wall stops.

G. Contractor shall install treated lumber at exterior locations, where in contact with concrete, masonry, roofing or where subject to moisture.

H. Contractor to use stainless steel fasteners for attachment of treated lumber or plywood.
SECTION 06 10 00 – ROUGH CARPENTRY

PART 3: EXECUTION (NOT USED)

END OF SECTION 06 10 00
CONSTRUCTION STANDARDS        DIVISION 06 – WOOD, PLASTIC AND COMPOSITE

SECTION 06 40 00 – INTERIOR ARCHITECTURAL WOODWORK

PART 1:  GENERAL

1.01  Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for fine shop fabricated woodwork, requiring expert craftsmanship and joinery.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02  Design Guidelines

A. Wood is to be used as a wall finish only with specific approval of Texas State University-San Marcos.

B. Where wood veneer base and upper cabinets are designed as a selected finish, consider use of impregnated or plastic protected wood.

C. Types of wood in specific areas: In remodeling work, match existing. For new construction where there is no existing to match, use AWI “Premium” grade as the guideline.

D. Cabinet carcass material selection, typical storage shelving, fixed, adjustable: In no instance shall particleboard be used. Refer to AWI “custom” grade for preferred guidelines.

E. Grain matching: Book matched for any wall paneling and also where stained wood is used on door faces.

F. Visible connections: Refer to AWI “Premium” grade guidelines.

G. Color of paint/stain: The preferred finish is light in lieu of dark.

H. Plastic laminate preference: Refer to AWI “custom” grade. Plastic laminate utilized for facings on cabinet doors and drawers must be applied with contact cement. The use of spray on latex adhesive is prohibited.

Installation where any off gassing will occur is not allowable in certain controlled environment. Contact the Texas State University project representative for confirmation of these areas. Also, any requirement for chemical...
resistant laminate shall be clarified with the Texas State University project representative.

I. Plywood shelving: Refer to AWI “Premium” grade. In areas other than janitorial, finish shall be a clear coating rather than solid color paint or plastic laminate. Coating shall be polyurethane type. Painted coatings may be utilized on shelving in janitorial areas.

J. Cabinet hardware –Hidden: Review proposals with Texas State University Project Representative.

K. Pre-finished woodwork/In-field finish: Provide pre-finished woodwork where possible. Where in-field finish must be performed, coordinate environmental concerns, ventilation requirements, shutdowns, etc. with Texas State University Office of Environmental Health and Safety.

L. Delivery of woodwork to project: Any area where woodwork is to be installed shall have been satisfactorily conditioned for temperature and humidity control prior to introducing woodwork into the space.

1.03 Reference Standards

A. Refer to AWI “Premium” grade.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 06 40 00
DIVISION 07: THERMAL & MOISTURE PROTECTION

07 22 00  Cover Board Over Isocyanurate Roof Insulation
07 32 00  Clay Roof Tile
07 52 16  SBS Mod Bit Membrane Roof
07 60 00  Sheet Metal Flashings
07 61 13  Standing Seam Sheet Metal Roofing
--------- WJE Roofing Specs Drafts-4 Types
PART 1 - GENERAL

1.1 SUMMARY

A. This standard provides general guidance concerning the specific preferences of Texas State University, the Round Rock Campus only for roof insulation on low slope roof areas only.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

C. Extent of Insulation work is shown on Drawings and indicated by provisions of this Section.

D. Applications of insulation specified in this Section include the following materials:
   1. Isocyanurate board type roof insulation
   2. Preformed perlite tapered cricket insulation
   3. Preformed tapered insulation systems
   4. Impact resistant cover board

E. Extent of roof insulation work is shown on Drawings and indicated by provisions of this Section.

1.2 QUALITY ASSURANCE

A. Insulation values calculated to conform to these Specifications shall be based on the 6-month conditioned thermal values as determined by the RIC/TIMA Thermal Conditioning Procedure. The guidelines shall comply with those published by RIC/TIMA Technical Bulletin No. 281-1 and as endorsed by the National Roofing Contractors Association (NRCA) and Federal Specification HH-I-1972.

B. The materials shall comply with requirements for Underwriters Laboratory Class A Fire Rating, Factory Mutual Class I requirements, or local codes, whichever is the most stringent.

1.3 SUBMITTALS

A. The Contractor shall provide submittals in advance of the preroofing conference. Any materials ordered prior to receiving written approval of submittals shall be at the Contractor's risk.

B. The Contractor shall provide submittals in advance of delivery to the jobsite of all insulation materials. Any materials ordered prior to receiving written approval of submittals shall be at the Contractor's risk.

C. Submittals shall be provided in accordance with the General Conditions of the Contract. Provide a submittal cover sheet identifying the project by name and number and listing the following columns for review by the design professional with a separate sheet for each roof section.

   1. Specification section
   2. Description of brand and product
   3. “Accepted”
SECTION 07 22 00 COVER BOARD OVER ISOCYANURATE ROOF INSULATION

4. “Rejected”
5. “Resubmit”
6. “Comments”

D. Provide a place for the design professional’s signature.

E. Tapered insulation layouts shall be prepared in advance and submitted as a part of the submittal package.

F. Shop Drawings: Show roofing system with flashings and accessories in plan, sections, and details. Include metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations; thermal expansion provisions and special supports. Indicate relationships with adjacent and interfacing work. Indicate fastener types and spacing, and provide fastener pullout values.

G. Manufacturer’s Letter of Certification: Provide a letter from the roofing material manufacturer using the exact language on the attached letter and listing all materials comprising any part of the roof assembly and stipulating that such materials are acceptable to the manufacturer and will be covered under the manufacturer’s Twenty (20) Year No Dollar Limit Total Roof System Guarantee.

1.4 PRODUCT HANDLING

A. All materials covered under this Section are to be stored and protected as specified elsewhere in these documents.

B. Materials damaged or rendered unusable for any cause resulting from the Contractor's acts or omissions shall be removed from the jobsite at the Contractor's expense.

C. Insulation and Cover Board shall not be stocked or stored on the roof overnight for any reason. All insulation is to be stored in a covered storage trailer. No material may be stocked on the ground or on the roof. Covering insulation with tarpaulins or plastic is not acceptable.

D. An allotment of insulation and cover board for daily production shall be loaded to the roof and used the same day, or removed from the roof and stored as stipulated elsewhere.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyisocyanurate Insulation Board - Rigid, closed cell, isocyanurate insulation board having a "R" value as calculated in accordance with the 1987 MRCA/NRCA Joint Bulletin which specifies an "in-service" R-value = 5.6 per inch thickness excluding the facer sheet. The factory applied facer sheet shall be fully adhered to both sides of the insulation board and shall be asphalt compatible; fiberglass reinforced and shall meet ASTM C1289-06, Type II Class 21, Class 21, Grade 3 (25 psi). The following additional criteria shall apply:

1. Board density shall be 2.0 lbs. per cubic foot when measured in accordance with ASTM D-1622.
SECTION 07 22 00  COVER BOARD OVER ISOCYANURATE ROOF INSULATION

2. Compressive strength shall be 20 psi minimum when measured in accordance with ASTM C-209 or ASTM D-1621.

3. Board insulation shall comply with water absorption requirements when measured in accordance with ASTM C-272.

4. Acceptable manufacturers shall be the following:
   b. Firestone Building Products Company, 310 East 96th Street, Indianapolis, IN 46240
   c. Johns Manville Corporation, P.O. Box 5108, Denver, CO 80217-5108
   d. Hunter Panel, 15 Franklin Street, Portland, ME 04101
   e. GAF Building Materials Corporation, 1361 Alps Road, Wayne, New Jersey 07470
   f. R-Max Corporation, 13524 Welch Road, Dallas, TX 75244

5. Isocyanurate insulation board stock larger than 4'x 4' is not acceptable under any circumstances.

6. No isocyanurate insulation board stock thicker than 2” shall be laid in a single layer. Where the “R” value or other details requires an iso thickness greater than 2”, such thickness shall be achieved by multiple layers of isocyanurate insulation.

7. Where a specific “R” value equivalent to 22.0 is required that value shall be achieved as follows:
   a. Two layers of 2.0” isocyanurate insulation board not exceeding 48”x48”
   b. One additional layer cover board as specified in sheets not to exceed 48” x 96”.

8. Tapered insulation boards shall be provided in sizes of 24" x 48" or 48" x 48" sections. Board shall be factory cut in tapers equivalent to those shown on the Drawings or stipulated in a layout prepared by the manufacturer and approved in advance. Minimum and maximum board thickness shall be as shown in the Drawings.

B. Cover Board ~ Rigid, hard, impact and moisture resistant cover board shall be asphalt compatible and suitable for torch applications with an open flame torch.
   1. Acceptable products and manufacturers listed below are intended to be equivalent in performance:
      a. 3/4” thick DuraBoard manufactured by Johns Manville Corporation, P.O. Box 5108, Denver, CO 80217-5108
      b. 1/2” thick Securock, manufactured by U.S. Gypsum Company, 125 South Franklin Street, Chicago, IL 60680-4124.

2.2 CRICKETS AND DRAIN SUMPS

A. Tapered isocyanurate as specified above also shall be used for formation of crickets, saddles, kick-backs, and sumps around drains and where otherwise shown on details.

2.3 THERMAL VALUES

A. Contractor shall select isocyanurate insulation suitable for a two-layer system. The combined "R" value shall be equal to or greater than 22.00 as calculated by the in-service method established by the MRCA/NRCA Joint Bulletin of 1987.
SECTION 07 22 00       COVER BOARD OVER ISOCYANURATE ROOF INSULATION

2.4 INSULATION ADHESIVE MATERIALS

A. Foam Adhesives - The following foam adhesive products are approved for such applications provided they meet wind uplift requirements for FM 1-90:
   1. Insta-Stik Professional Roofing Adhesive as manufactured by Flexible Products Company, 1500 Clearwood Drive, Joliet, IL 60435-3187.
   2. OlyBond Adhesive Fastener as manufactured by Olympic Manufacturing Group, 153 Bowles Road, Agawam, MA 01001-0508.
   3. Adhesive recommended by roof system manufacturer for their rated assembly.

2.5 FASTENERS

A. Steel Deck Fasteners - Fasteners equal to Olympic Factory Mutual approved #12 with a CR-10 fluorocarbon coating with a .172 diameter shank and .220 diameter thread to be used with Olympic round pressure plates. Fastener must penetrate the deck a minimum of 1/2”. Pressure plates may be of galvanized steel or polypropylene. Fasteners long enough to penetrate to the bottom of deck flutes are NOT acceptable.
   1. Roofgrip #12 as manufactured by Buildex, A Division of ITW
   2. #12 Standard Roofing Fasteners as manufactured by Olympic Mfg. Group, Inc.

B. Corner and Perimeter Fastening - All perimeter and corner fastening of insulation or base plies shall be in accordance with Factory Mutual requirements. The Contractor shall submit the fastening pattern with other submittals. When an approved fastening pattern has not been submitted or approved in advance, the default fastening pattern for perimeters shall be 150% of the field pattern and quantity, and the corners shall be 200% of the field pattern. The perimeter is defined as 10’ in from edge, and the corner is defined as a 10’ x 10’ area, or as otherwise defined by Factory Mutual if different.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION OF DECK

A. Tear off roofing and prepare deck as specified elsewhere.

B. Inspect the deck to see that all requirements for deck preparation specified elsewhere have been met and that the deck meets the following requirements for application of the roof materials:
   1. The deck must be smooth, free of voids and holes, and all damaged areas replaced or repaired.
   2. Ensure that metal decks have side laps fastened at 36 inches O.C.

3.2 INSTALLATION OF INSULATION - GENERAL

A. Insulation, having been protected as stipulated elsewhere in these documents, shall be installed in the following manner in accordance with the manufacturer's printed instructions.

B. Edges - At edge details, or where edge nailers are present at the perimeter, butt the outside edge of the tapered insulation terminating piece against the roof side edge of the nailer. Do not extend the tapered insulation out onto the nailer.
C. Where wind uplift requirements or standards require wood nailers shall be installed at the perimeter. Such nailers shall be attached by using suitable fasteners with pre-drilled holes. Attachment with nail guns is not permitted. Joints shall be staggered and subsequent layers attached with screws, not nails. The combined thickness or height of nailers shall be equivalent to the combined layers of all insulation and cover boards.

D. All perimeter and corner fastening of insulation or base plies shall be in accordance with Factory Mutual requirements. The Contractor shall submit the fastening pattern with other submittals. When an approved fastening pattern has not been submitted or approved in advance, the default fastening pattern for perimeters shall be 150% of the field pattern and quantity, and the corners shall be 200% of the field pattern. The perimeter is defined as 10’ in from edge, and the corner is defined as a 10’ x 10’ area, or as otherwise defined by Factory Mutual, if different.

E. Where field observation determines fasteners to be installed at a greater spacing than specified, one additional fastener shall be installed between each existing fastener as a remedial measure. Failure to install fasteners at the required spacing interval will be considered a serious act of defective workmanship and may cause replacement of the entire roof assembly.

F. Wood Blocking Insulation Stops - Where the slope of the deck exceeds 1” per foot, wood insulation stops shall be installed. The wood blocking shall be installed in multiple layers with the joints staggered. The thickness shall equal the thickness of the roof insulation, and shall be secured attached to the deck at 12” O.C. Insulation stops shall be installed at a maximum spacing of 8’0” I.D. unless otherwise approve differently in advance. Additional insulation stops shall installed at the ridge and eave of the roof.

G. Joints of all layers of insulation shall be tight, square, and not exceeding 1/4". Joints shall be staggered 1/2 the length of the board in one direction. If alignment gets out of square, do not continue. Stop the installation, lay a chalk line, cut the insulation smoothly using a power cutter or other device, and square up the installation. After obtaining a straight and square installation resume laying the installation in a pattern to accommodate the revised and squared up alignment. All corner pieces should be carefully mitered to produce a snug fit without excessive voids at penetrations, projections, curbs, or terminations.

H. Isocyanurate insulation shall be used in multiple layers with no layer exceeding 2” thickness. The second and subsequent layers of insulation and cover board shall be imbedded in a full application of low-rise foam adhesive with the joints in the second and subsequent layers of insulation and cover board staggered at least 12” in each direction from the underlying layer. At no location shall a joint of the top layer fall over a joint in the bottom layer except when crossing at 90 degrees. The joints on the top layer must be staggered at least 12” in both directions from the joints in the bottom layer.

I. Ensure that all low rise foam beads are at the proper interval, and that insulation is adhered before the adhesive skins over. Walk in all pieces to ensure full adhesion. Fill all voids greater than 1/4” with insulation pieces to avoid thermal energy loss. Lack of adhesion of insulation shall be considered defective workmanship and will be rejected.

J. Cover All Insulation - Under no circumstances shall applied insulation be left overnight without a roof covering in place. Any roof insulation installed, but not covered by roofing material before quitting time shall be torn off and replaced the following day.
3.3 INSTALLATION OF INSULATION - METAL DECK

A. The first layer shall be screwed down to the steel deck in accordance with requirements for Factory Mutual 1-90 requirements. Screws shall be applied at the rate and in the pattern approved for the roof assembly by Factory Mutual Engineering.

B. Fasteners shall penetrate the deck a minimum of 3/4". Fasteners shall not be long enough to reach the bottom of the flute, and accordingly fasteners shall not penetrate the deck more than 1 inch. Using a power screwdriver, drive the fastener until a slight depression is visible in the insulation around the plate or a dimple is visible in the surface of the plate. Take care not to overdrive the fasteners and fracture the facer sheet of the insulation. Fasteners must be tight enough that the plate does not turn.

C. In areas where mechanical attachment is utilized, if screws coincidentally align with a concealed underlying deck flute or hole, the Contractor shall remove the offending screw completely. The Contractor may either adjust the screw location by up to 2" in any direction to contact a flush face of the deck. Use of longer fasteners to reach the bottom of the flute is not permitted. The Contractor shall use extra fasteners as required to smooth out irregularities. All fastening patterns are to be in accordance with Factory Mutual Engineering published standards for the assembly being utilized on this project.

3.4 INSTALLATION OF TAPERED INSULATION

A. Slope - All tapered insulation systems shall provide a minimum 1/4” in 12” slope unless stipulated otherwise on the Drawings. The slope shall be maintained on all crickets, tapered edges, and the main roof area.

B. Minimum Thickness - A minimum of 3/4” fill board and tapered board is to be used throughout the project, and at no point, unless shown otherwise on the Drawings, shall the minimum thickness be less than 3/4”. The tapered insulation board shall be in addition to the minimum thickness of the fill board.

3.5 CRICKETS

A. Tapered crickets shall be installed between all roof drains (saddles), at all walls sloping back or in the reverse toward drains (kick-backs), and on the high side of all raised curbs, equipment, skylights, or access hatches of any type (crickets) whether shown on the Drawings or not. All such crickets shall have a counter-slope of twice the underlying slope or a slope sufficient to result in a 1/4” per foot counter-slope, unless otherwise approved.

B. Crickets, saddles, and kick-backs are to be installed in sequence with the insulation, not after the cover board or roof membrane is installed. No cover board or roofing plies are to be installed between the cricket materials and the top layer of insulation.

END OF SECTION 07 22 00
SECTION 07 32 00 – CLAY ROOF TILE

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Clay Roof Tile.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

C. Roof systems shall be designed by, and with plans and specifications, sealed by a licensed architect or engineer, in accordance with ASCE 7-98, the IBC, and the International Plumbing Code.

1.02 Design Guidelines

A. Pitched Roofs:

1. Clay Tile Systems shall match the random blended terra cotta color and style on existing buildings on the Campus, such as Brogdon Hall, Brazos Hall, and Speck Street Parking Garage.

2. When a flat or low slope roof building is approved by the Project Representative, the perimeter of building roof shall have a pitch mansard type clay tile roof system.

3. Avoid the use of skylights, unless approved by Project Representative.

4. Include fall protection and roof anchors for safe roof access after construction.

1.03 Related Documents

A. Drawings and general provisions of the Construction Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.04 Reference Standards

A. All roofing systems shall be in accordance with Factory Mutual I-90 requirements.
SECTION 07 32 00 – CLAY ROOF TILE

B. American Society for Testing and Materials (ASTM)

1. ASTM B134 – Brass Wire
2. ASTM B159 – Phosphor Bronze Wire
4. ASTM C270 – Mortar for Unit Masonry.
5. ASTM D226 – Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
7. ASTM D4586 – Asphalt Roof Cement, Asbestos Free.

C. NRCA, National Roofing Contractors Association

D. UL, Underwriters Laboratories

1.05 Quality Assurance

A. The work of this section shall be performed by a company which specializes in the type of clay tile roofing work required for this project, with a minimum of 5 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

B. Manufacturer shall specialize in manufacturing the type of clay tile roofing system specified in this section, with a minimum of 5 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility and warranty.

1. Provide secondary products only as recommended by manufacturer of products for use with tiles specified.

1.06 Submittals

A. Submit the following according to Conditions of the Construction Contract and Division 1 Specification Sections.
SECTION 07 32 00 – CLAY ROOF TILE

B. Product Data: Shall be clearly marked to indicate all technical information which specifies full compliance with requirements of this Section and Contract Documents, including manufacturers published installation recommendations.

C. Samples, but not limited to the following:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Quantity</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>5</td>
<td>Typical tile</td>
<td>Each tile and accessory tiles</td>
</tr>
<tr>
<td>S2</td>
<td>5</td>
<td>6” long</td>
<td>Each mortar color</td>
</tr>
</tbody>
</table>

D. Complete shop drawings showing roof plans and 3” scale details of all project specific detail conditions, including, but not limited to: rake, ridge, valley, eave, gutter, parapet, and all penetrations, including lightning terminal penetrations.

E. Roof Mock-Up: Provide a 96” x 96” on-site mock-up, showing clay tile installed with eave and rake.

F. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB)

1.07 Delivery, Handling, and Storage

A. Comply with General Conditions and including the following:

1. Protect all work of this Section against breakage, chipping, staining, and other damage.

2. Should such damage occur prior to Texas State University acceptance of the Work, it shall be replaced with new material under this section and the entire work left in first class condition.

3. All such replacement costs and expenses shall be borne by the contractor at no additional expense to Owner.

1.08 Warranty

A. Comply with General Conditions and Section 01 78 36, agreeing to repair or replace specified materials or Work that has failed within the warranty period. Failures include but are not limited to the following:

1. Failure to perform as protective roofing.
2. Roof leaks which are detected during the Warranty Period.
SECTION 07 32 00 – CLAY ROOF TILE

3. Broken or discolored roof tiles attributable to product manufacturing defects.

B. Contractor to provide the Warranty Forms included in this section, to Owner’s Project Representative upon substantial completion of the Project.

1. Roofing Contractor and the General Contractor must notify the owner, prior to submitting their bid, if any warranty item cannot be provided as written.

PART 2 PRODUCTS

2.01 Unauthorized Materials

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyis (PCB) or other hazardous materials identified by the Owner.

2.02 Acceptable Manufacturers

A. General: For the purpose of establishing the minimum functional, aesthetic and quality standards required for the work of this section, products of the following manufacture’s are specified:

B. Basis of Design Product: The design for clay roofing tile is based on U.S. Tile.; 18 inch Spanish Tile. Subject to compliance with requirements and approval of the Owner’s Representative, provide the named product or a comparable product by one of the following:

1. U.S. Tile

C. Final Clay Tile must be approved by Texas State University-San Marcos’, Project Representative.

2.03 Clay Tiles

A. Clay Tile: ASTM C 1167, Grade 1, molded-or extruded-clay roof tile units; kiln fired to vitrification, and free of surface imperfections. Provide with fastening holes prepunched at factory before firing.


2. Campus Standard Profile: One-piece “S” type tile.

SECTION 07 32 00 – CLAY ROOF TILE

Colors based on U.S. Tile:
   a. Smooth “Tuscani”: 30% of Color
   b. Smooth “Red”: 70% of Color

B. Special Shapes and Fittings: Supply special shapes and fittings of the same material and finish as adjacent tile, factory-formed before firing, as indicated on drawings, or specified in manufacturer’s instructions for project conditions including, but not limited to, the following:

1. Hip caps.
2. Ridge caps.
3. Rake edges.
4. Detached gable rake edges.
5. Eave edges.
6. Valley edges.
7. Termination caps.
8. Half tile.
10. Bird Stops

2.04 Materials

A. Membrane Underlayment:

   2. Top sheet: 30 lb. Organic felt, complying with ASTM D226, Type II.

B. Mortar: ASTM C270, Type M, and shall be an approved premixed, high strength, water-resistant mortar mixed with a suitable pigment (high-fired, non-leading mineral colorant type) to produce a color matching the color of the approved clay tile roofing, to be used under hip, ridge and coping tile.
SECTION 07 32 00 – CLAY ROOF TILE

C. For repairs on existing buildings with Mission “Pan and Cover” style Clay Tile provided. Treated Wood Support Battens, Blocking and Stringers: Refer to Section 06 10 00/Rough Carpentry.

1. Battens: 2 x 4 treated yellow pine, spaced under each barrel of Mission “Pan and Cover” clay tile, approximately 12” on center. Not required with “S” Type Clay Tile.
   a. Reference Exhibit 1.

2. Exposed Gable Eave Strips: 2x4 treated yellow pine, clad with dark bronze anodize aluminum or painted with Kynar finish.
   b. Reference Exhibit 2.


E. Metal Flashing: Copper, 16oz., width as required, with ¼” edge turned over and fastened with cleats.

1. Lap joints 4” minimum but do not solder.

F. Roofing Tiles and Accessories: All roof tiles and accessory tiles shall interlock and provide a complete approved weather tight roof.

G. Tile Fastening System:

1. Nails for securing the felt shall have large flat heads and shall be hot-dipped galvanized.

2. Nails for securing the tile shall be solid copper not smaller than 11 gauge, 5/16” head minimum.

3. Nails shall be long enough to penetrate the wood nailers 1” when the tiles are in their final position.

4. Tile wires for tile-tie system shall be brass-14 gauge, copper alloy No. 260, annealed, conforming to ASTM B134, ASTM B159 and ASTM B206.

H. Sealant: Silicone in compliance with ASTM D1002.

I. Gabled Roof Eave Closure Tile
SECTION 07 32 00 – CLAY ROOF TILE

1. Refer to Exhibit 1 for Eave Detail.

PART 3 EXECUTION

3.01 Surface Conditions

A. Inspection: Prior to installation of tile roofing work, carefully inspect the installed work of other trades and verify that all such work is complete to the point where tile roofing installation may properly be commenced.

1. Full acceptance of supporting surfaces as satisfactory to receive work of this Section shall be evidenced by start of installation of tiles.

2. Verify that clay tile roofing can be installed in complete accordance with tile manufacture’s current recommendations.

3. Immediately notify the Architect of all such areas of defective construction revealed by inspections and work under this Section.

4. Do not proceed with installation in any areas containing defective construction until all such defects have been fully resolved and corrected.

B. Contractor shall provide a letter of acceptance from the Clay Tile manufacturer and roofing subcontractor, stating that the substrate is acceptable, to the University’s Project Representative.

3.02 Installation of Underlayment and Flashing

A. Secure base membrane to substance and secure overlaps per manufacturers instructions.

1. Lay with minimum 4” head lap and a 6” side lap.

2. Membrane and felt shall extend over hips and ridges and the surfaces left unbroken, applying double membranes.

3. Install flashing at valleys, projections and adjacent surfaces as recommended by manufacturer, applying double membranes.

3.03 Tile Installation

A. Provide wood stringers at hips and ridges of proper height.
SECTION 07 32 00 – CLAY ROOF TILE

B. All hip, ridge and coping tile shall be set in cement mortar and fastened by non-corrosive nails.
   1. All tiles in contact with cement mortar shall be immersed in water for at least 2 minutes before laying.

C. All tiles shall be laid in regular courses parallel with the eaves and no attempt shall be made to stretch the courses.
   1. The courses shall be accurately spaced so as to finish even and parallel at the top of all level terminations
   2. Valleys shall be open with copper flashing (with an opening of 6” minimum) and close tile gap edges with copper flashing.
   3. Tiles shall be laid in random pattern so that similar colors are not grouped together.

D. Secure every piece of tile by at least one nail or screw, and two nails or screws where practicable.
   1. All nails or screws shall be covered in finished work.

E. Lay all tiles with an end lap of at least 3” properly fitted together.
   1. Install short course covers over regular pans at eave and regular covers over short course pans at ridge.
   2. Top edge of cover shall not abut bottom edge of pan in the succeeding course throughout the roof so all covers lay tight to the pans.
   3. Fasten small pieces with copper tie wire and elastic cement.

F. A limited amount of elastic cement may be used for leveling tile, for pointing around the edges of top fixtures and eave enclosures, and between the joints of hip and ridge rolls.
   1. Spaces between field tile and the hip stringers shall be filled with elastic cement to make waterproof joint.
   2. Where tile joins stringer, install plastic cement.
G. Starter tiles shall be of required lengths and where cutting is required against abutting work it shall be neatly done.

H. Tiles that verge along the hips shall be cut close against the hip board and a watertight joint made by cementing cut hip joint to the hip board.

I. Provide clay roof tiles as a completely weatherproof and waterproof system requiring no further maintenance.

J. All sequences of work shall be inspected by the Owner’s and manufacturer’s representatives prior to being covered up by subsequent work.

K. Roofing contractor shall not proceed with subsequent work until inspection and approval by Owner’s and Manufacturer’s representative.

3.04 Cleaning

A. Promptly upon completion of this portion of the work, legally remove from the Project site all tools, equipment and surplus materials of the Section, including tile-ends, and debris resulting from the clay tile roofing installation.
SECTION 07 32 00 – CLAY ROOF TILE

WARRANTIES
MANUFACTURER’S CERTIFICATION OF MATERIALS
(ON ROOFING MATERIAL MANUFACTURER’S LETTERHEAD)

Date

<<OWNERREPP>>
<<OWNERTITLE>>
<<OWNERCOMPANY>>
<<OWNERADDRESS>>
<<OWNERCITY>> <<OWNERZIP>>

Project:

Dear <<OWNERREPP>>,

We are pleased to offer to supply the clay tile roofing materials for the roofing project named above. We hereby certify that (NAME OF CONTRACTOR) is an approved roofing contractor/applicator with our firm for the term or type of warranty stipulated below.

The conditions stipulated and representations in this letter are made by us as an inducement to you to use our materials on your roofing job. We propose to furnish the clay tile roofing materials necessary to provide a watertight roofing assembly on the above project. We hereby represent to you that our materials comply with our standard specifications, and upon specific further request, we will issue a fifty (50) year, “No Dollar Limit” Clay Tile Roof Guarantee on the form required in these specifications.

In addition, we will provide such inspections as we deem necessary. By means of this letter, we also certify that the contractor listed above has applied for the required warranty and made the necessary payment to cause issuance of the warranty. In the event that anything arises during the course of this transaction, including, but not limited to, failure by the contractor to make full payment for the warranty; or quality assurance issues which might jeopardize issuance of this warranty, we will notify you, the owner, immediately, in writing, to give you the chance to rectify such problems and cause issuance of the warranty as stipulated above.

Yours very truly,

COMPANY NAME
Signature by Authorized Representative
WARRANTIES
ROOFING UNDERLAYMENT’S CERTIFICATION

Re: Roof Replacement of Designated Areas at Texas State University

__________________________________________________________, certifies that
Roofing Underlayment Manufacturer
__________________________________________________________ is currently approved by
Roofing Contractor

the roofing system manufacturer to install the specified roofing system for the referenced project
and that the above named Roofing Underlayment Manufacturer is ISO 9000 certified, has
reviewed bidding documents in their entirety, and has approved them as they are written and drawn.
The above named Roofing Underlayment Manufacturer will provide field inspection services by
a full time employee of the manufacturer, no less than three times per week, during and until all
roof construction work is completed and accepted by the Owner.

The above named Roofing Underlayment Manufacturer will provide the manufacturer’s
guarantee as stipulated in the contract documents upon completion of the project.

By: ______________________________________________________________
    Name

    ______________________________
    Signed

    ______________________________
    Title

Date: ______________________________   (Affix Corporate Seal)

Revised Jan-15   Clay Roof Tile-07 32 00-11
CONSTRUCTION STANDARDS

SECTION 07 32 00 – CLAY ROOF TILE

CONTRACTOR’S WARRANTY

Project Warranty for ______________________________________________________
Whereas _____________________________________________________ (Contractor),
Address ________________________________________________________________
Telephone ( ___ ) ______-_______ has performed _______________________ (Work)
on the following Project: ___________________________________________________
_______________________________________________________________________,
Address: ________________________________________________________________

WHEREAS, the Contractor has agreed to Warrant said Work ______________________
________________________________________________________________________
NOW, THEREFORE, the Contractor hereby Warrants said Work in accordance with the terms
hereof, complying with the terms of the Contract with the Owner dated _________,
that ______________________ WARRANTY PERIOD Two (2) years, STARTING _____,
TERMINATING ____________ IN WITNESS THEREOF, this instrument has been duly
executed this _____ day of ______, 20__, for the Contractor __________________
as its __________________________ (position).
Name of firm: ____________________________________________________________
Address: ________________________________________________________________
And has been countersigned in accordance with the terms and conditions, for the Manufacturer
_________________________ as its _____________________ (position).
Name of firm:____________________________________________________________
Address: ________________________________________________________________
Signed:  ___________________________________________
Date:  _____________________________________________

Revised Jan-15     Clay Roof Tile-07 32 00-12
SECTION 07 32 00 – CLAY ROOF TILE

CLAY TILE MANUFACTURER’S WARRANTY

Project Warranty for ______________________________________________________
Whereas ___________________________________________________ (Manufacturer),
Address ________________________________________________________________
Telephone (___) ______-_______ has furnished/provided _______________________ (product)
on the following Project: ___________________________________________________________________,
Address ________________________________________________________________
Constructed by ________________________________________________ (Contractor),
Address ________________________________________________________________
For ____________________________________________________________ (Owner),
Address ________________________________________________________________

WHEREAS, the Manufacturer, through the Contractor, has agreed to Warrant said product
___________________________________________________________________________
___________________________________________________________________________

NOW, THEREFORE, the Manufacturer hereby Warrants said Product in accordance with the
terms hereof, complying with the terms of the Contract with the Owner dated ______, that
_________________________________________________________________________
WARRANTY PERIOD Fifty (50) years, STARTING _____, TERMINATING ____________ IN WITNESS THEREOF, this instrument has been duly
executed this _____ day of _____, 20__, for the Manufacturer ____________________
as its ________________ (position).
And has been countersigned in accordance with the terms and conditions, for the Contractor
_________________________ as its ________________ (position).

Signed: ___________________________________________

Date: _____________________________________________
CONSTRUCTION STANDARDS  DIVISION 07 – THERMAL & MOISTURE PROTECTION

SECTION 07 32 00 – CLAY ROOF TILE

INSTALLATION SYSTEM AND FLASHING

Project Warranty for ______________________________________________________

Whereas _____________________________________________________ (Contractor),

Address ________________________________________________________________ Telephone ( ___ ) ______-_______ has performed _______________________ (Work)
on the following Project: ___________________________________________________

Address: ________________________________________________________________

WHEREAS, the Contractor has agreed to Warrant said Work ______________________

________________________________________________________________________

NOW, THEREFORE, the Contractor hereby Warrants said Work in accordance with the terms
hereof, complying with the terms of the Contract with the Owner dated __________,
that _______________________ WARRANTY PERIOD Twenty (20) years, STARTING _____,
TERMINATING ____________ IN WITNESS THEREOF, this instrument has been duly
executed this _____day of _____, 20__, for the Contractor ________________
as its __________________________ (position).

Name of firm: ____________________________________________________________

Address: ________________________________________________________________

And has been countersigned in accordance with the terms and conditions, for the Manufacturer
_________________________ as its _____________________ (position).

Name of firm: ____________________________________________________________

Address: ________________________________________________________________

Signed: ________________________________________________________________

Date: ________________________________________________________________
SECTION 07 32 00 – CLAY ROOF TILE

BASE SHEET MEMBRANE UNDERLAYMENT

Project Warranty for ______________________________________________________
Whereas _____________________________________________________ (Contractor),
Address ________________________________________________________________
Telephone (___ ) ______-_______ has performed _____________________________ (Work)
on the following Project: __________________________________________________________________________
Address: ______________________________________________________________________________________,

WHEREAS, the Contractor has agreed to Warrant said Work ______________________
________________________________________________________________________

NOW, THEREFORE, the Contractor hereby Warrants said Work in accordance with the terms
hereof, complying with the terms of the Contract with the Owner dated __________,
that __________________________ WARRANTY PERIOD Twenty (20) years, STARTING _____,
TERMINATING ____________ IN WITNESS THEREOF, this instrument has been duly
executed this _____ day of _____, 20__, for the Contractor __________________
as its __________________________________ (position).
Name of firm: ________________________________________________________________________________
Address: ____________________________________________________________________________________

And has been countersigned in accordance with the terms and conditions, for the Manufacturer
_________________________ as its _____________________ (position).
Name of firm: __________________________________________________________
Address: ________________________________________________________________

Signed: ____________________________________________________________________________________

Date: _____________________________________________________________________________________

Revised Jan-15 Clay Roof Tile-07 32 00-15
Exhibit 1:

Clay Tile

2x6 treated wood trim

Dark Bronze Alum. Cladding

Exterior Brick or other Mat'l.

3" exposed min.
SECTION 07 32 00 – CLAY ROOF TILE

Exhibit 1:

General Note:
1. Use only for existing campus buildings with "Pan & Cover" mission style clay tile roofs.

Mission Tile ("Pan & cover")
2” x 4” treated yellow pine batten, trimmed to fit under tile. (Only use for "Mission Pan & cover shape tile.

Top sheet 30 lb. organic felt.

Base sheet waterproof membrane.

Seal each screw head.

1 1/2” x 2” alum. angles, alternating, at 2'-0” O.C.

1 1/2” x 2” alum. angles, alternating, at 2'-0” O.C.

Roof decking

END OF SECTION 07 32 00
SECTION 07 52 16 – STYRENE BUTADIENE STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. This standard provides general guidance concerning the specific performances of the Texas State University for modified bitumen membrane roofing systems.

B. Texas State University recognizes that projects conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

C. Roof systems shall be designed in accordance with ASCE 7, the International Building Code, and the International Plumbing Code, 2006 Edition.

D. Roof edge assemblies and attachment shall be provided in compliance with the most recent edition or version of the SPRI/ANSE ES-1 standard.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

   1. Rough Carpentry
   2. Roof Tile
   3. Roof Deck
   4. Roof Insulation
   5. Flashing and Sheet Metal.
   6. Plumbing
   7. Lightning Protection

1.3 SYSTEM DESCRIPTION

A. The intent of the specification is for the Contractor to provide a two-ply torch-down modified bitumen roofing system over R-22 roof insulation on an approved substrate, and to furnish a 20 Year No Dollar Limit Total System Manufacturers’ Warranty upon completion of the project.

B. The use of hot asphalt on the campus of Texas State University is prohibited and therefore shall not be a part of the roof assembly.
SECTION 07 52 16 – STYRENE BUTADIENE STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING

1.4 DESIGN REQUIREMENTS

A. Low slope-roofs:
   1. Where low-slope roofs are present, the roof perimeter shall have a steep sloped mansard Spanish tile system at the perimeter.
   2. As one of the means for creating visual unity on the roof of campus buildings, use a cap sheet with colored roof granules, to match Johns Manville cap sheet “Brick Red” color.

B. Roof Drainage:
   1. Low slope roofs shall be designed for a slope of ¼” per foot with crickets to divert rain water to drains and/or scuppers.
   2. Roof shall provide slope and drainage to accommodate rainfall in accordance with the International Building Code and International Plumbing Code, 2006 Edition. Overflow drains or scuppers shall be provided as stipulated in the Code.
   3. The roofing system shall be deemed to drain satisfactorily if standing water from any source drains or evaporates from the roof with 48 hours.
   4. Primary roof drains shall be sumped in a 48 inch by 48 inch area, but overflow roof drains shall not be sumped.

C. Safe Roof Access
   1. Roofs are not to be intended to be accessible to the public except as may be required by the International Building Code.
   2. Provide access for authorized persons to every roof section, either by a roof hatch with contiguous ladder, access door, stairs or exterior mounted ladder.
   3. Provide permanent G.I. safety railing around all roof hatch openings. Plastic or composite railings are not acceptable.
   4. All roof sections shall have OSHA compliant safety tie-offs wherever roof edges are not protected by parapet walls meeting approved height requirements.

D. Roof Protection
   1. Provide roof protection walk pads at the following locations.
      a. At all roof hatches, penthouse doors, crossover steps, head and foot of roof ladders, and any other roof access points.
SECTION 07 52 16 – STYRENE BUTADIENE STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING

b. Around all motorized equipment.

c. Around the perimeter where window washer equipment may be used.

d. Beneath all surface mounted equipment such as satellite antennae.

e. At any other known or obvious high mechanical or foot traffic locations.

E. Other Requirements

1. Roof penetration flashings shall be wood or prefabricated curbs extending 12 inches above the plane of the finished roof with metal covers. Pitch pans are not permitted.

1.5 PERFORMANCE REQUIREMENTS

A. Factory Mutual: All roofing shall be in accordance with Factory Mutual Class I-75 requirements.

B. American Society of Civil Engineers (ASCE): ASCE 7, Minimum Design Loads for Buildings and Other Structures.

1.6 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D41, Specifications for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

2. ASTM D312, Specification for Asphalt Used in Roofing


4. ASTM D1079, Terminology Relating to Roofing, Waterproofing, and Bituminous Materials

5. ASTM D1227, Specification for Emulsified Asphalt Used as a Protective Coating for Roofing

6. ASTM D1863, Specification for Mineral Aggregate Used on Built-up Roofs

7. ASTM D2178, Specification for Asphalt Glass Felt Used in Roofing and Waterproofing

8. ASTM D2822, Specification for Asphalt Roof Cement
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9. ASTM D2824, Specification for Aluminum-Pigmented Asphalt Roof Coating

10. ASTM D4601, Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing


12. ASTM E108, Test Methods for Fire Test of Roof Coverings


D. UL, Underwriters Laboratories

1.7 CONTRACTOR REQUIREMENTS

A. The roofing contractor shall be experienced in modified bituminous roof application with a minimum of five (5) years experience and who is certified by the roofing system manufacturer as qualified to install manufacturer’s roofing materials.

B. Torch applicators shall have completed a certified training course such as the NRCA Certa Program, and the contractor shall submit the Certificates of Completion for each individual person contemplated for work as a torch applicator on the project. Such certificates shall be provided in the submittal package.

C. The contractor shall have demonstrated its proficiency by having a satisfactory record of performance in the following areas:

1. On-time completion of previous work of a similar size and scope.

2. No history of litigation, claims, or lawsuits relating to past or on-going performance that may affect current performance.

3. Proven safety record demonstrated by company documentation and insurance Experience Modifier.

4. Record of post-completion warranty service to clients.

D. Roofing contractor shall maintain a full-time, non-working, non-changing, English-speaking Supervisor/Foreman on the job site during all phases of modified bituminous sheet roofing work and at any time roofing work is in progress. A copy of the construction documents shall be in the possession of the Supervisor/Foremen and on the roof at all times.
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1.8 SUBMITTALS

A. Submittals shall be provided in accordance with the General Conditions of the Contract. Provide a submittal cover sheet identifying the project by name and number and listing the following columns for review by the design professional with a separate sheet for each roof section.

1. Specification section
2. Description of brand and product
3. “Accepted”
4. “Rejected”
5. “Resubmit”
6. “Comments”

B. Provide a place for the design professional’s signature.

C. Manufacturer’s Letter of Certification: Provide a letter from the roofing material manufacturer using the exact language on the attached letter and listing all materials comprising any part of the roof assembly and stipulating that such materials are acceptable to the manufacturer and will be covered under the manufacturer’s Twenty (20) Year No Dollar Limit Total Roof System Guarantee.

D. Product Data for each type of product specified include manufacturer’s technical product data, installation instructions, and recommendations for each type of roofing product required. Include data substantiating that materials comply with specified requirements.

E. Show evidence that the products and materials are manufactured in the United States. Provide information showing that materials provided conform to all requirements specified herein, are chemically and physically compatible with each other, are suitable for inclusion within the total roof system specified herein and have a successful application record for at least five years of in field service. In such cases where conflicting requirements exist between authoritative industry testing laboratories, trade associations, and the manufacturer's requirements, the most stringent requirements shall govern.

F. Provide a sample of each product.

G. Unexecuted Manufacturer’s 20 year warranty, including complete assembly and flashings.
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H. Shop Drawings: Before submitting to the Architect, shop drawings shall be reviewed and signed by the roofing manufacturer indicating acceptance of the roofing details. Submittals and/or shop drawings shall include the following information.

1. Deck type and outline of roof and roof size (square footage).
2. Roof slope and designated direction of slope.
3. Key plan (on multiple roof areas).
4. Location and each type of roof penetration.
5. Each type of flashing detail including perimeter and penetration details.
6. Membrane layout and sizes.
7. Insulation board types, thickness and manufacturer.
8. Layout of insulation showing joints and slopes to drains.
9. Method of installing each type of insulation boards.
10. Fastener manufacturer, brand, length, location and spacing.
11. Method of installing roofing membrane.
12. Warranty type and period.
13. Evidence of Underwriter’s approval and uplift capacity.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: Roofing system manufacturer shall have a minimum of five years experience in manufacturing modified bitumen roofing products in the United States.

B. Manufacturer Inspections: As part of the cost of the roofing assembly the roofing system manufacturer shall provide control inspections by an authorized representative as outlined below:

1. Manufacturer shall make at least three inspections, including at the beginning of construction, at 50% roof completion, and at 100% completion. The inspections shall be provided at no additional cost to the owner.
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2. Manufacturer shall notify the owner in advance of such inspections and provide a copy of each inspection report to the owner within seven days of completion of the inspection.

3. Report to the Owner in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor’s attention.

4. Confirm, after completion of the project and based on manufacturer’s observations and tests, that manufacturer has observed no applications procedures in conflict with the specifications other than those that may have been previously reported and corrected.

C. Pre-application Roofing Conference: Following the approval of submittals, and prior to the delivery of any roofing materials, conduct a pre-roofing conference with the following parties present:

1. Owner’s representative
2. Architect’s representative
3. General contractor’s representative
4. Roofing contractor’s Project Manager, Superintendent, and both roofing and sheet metal foremen.
5. Roofing material manufacturer’s representative.
6. Mechanical contractor representative.
7. Plumbing contractor representative.
8. Masonry, EIFS, plaster, or fireproofing contractor’s representative.
9. Glazing or skylight representative.

D. Objectives of the pre-roofing conference shall include:

1. Ensure that the contractor’s field supervisors have read and understand the plans and specifications.
2. Review roofing systems requirements (drawings, specifications, and other contract documents).
3. Review the contractor’s safety plan for the project.
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4. Review foreseeable methods and procedures related to roofing work including coordination of the work of other trades.

5. Review required submittals. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer’s personnel, equipment, and facilities needed to make progress and avoid delays.

6. Tour representative areas of roofing substrates (decks) inspect and discuss condition of substrate, roof drains, curbs, penetrations, and other preparatory work performed by other trades.

7. Review required inspection and testing, procedures.

8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement).

9. Review notification procedures for weather or non-working days and requests for time extensions.

10. Prepare minutes of conference, including decisions and agreements (or disagreements) reached, and furnishes copy of record to each party attending.

E. Mock-ups.

1. The contractor shall construct a mock-up of each sheet metal flashing or through-wall flashing detail and notify the architect when such mock-up is ready for approval. Sheet metal and flashings installed without prior approval of the mock-up shall be subject to removal if disapproved.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site with seals and labels intact, in manufacturer’s original containers, dry and undamaged.

B. Roof materials shall not be stocked or stored on the roof overnight.

C. Store roof insulation, rolled goods, lumber, and fasteners in covered storage trailers or enclosed containers. Storing such materials with covered tarpaulins, plastic covers or other temporary coverings is not acceptable. Store all rolled goods on end.
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1.11 HANDLE AND STORE MATERIALS OR EQUIPMENT ON THE ROOF IN A MANNER TO AVOID SIGNIFICANT OR PERMANENT DEFLECTION OF DECK. PROJECT SITE CONDITIONS

A. Weather Condition Limitations: Means and method is the responsibility of the contractor. Time extensions for inclement weather shall be granted, when applicable, within the terms of the General Conditions of the Contract.

B. Proceed with roofing work only when existing and forecasted weather conditions will permit unit of work to be installed in accordance with manufacturer’s recommendations and warranty requirements.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.12 SEQUENCING AND SCHEDULING

A. Sequence installation of modified bituminous sheet roofing with related units of work specified in other sections to ensure that roof assemblies, including roof accessories, flashing, trim, and joint sealers, are protected against damage from effects of weather, corrosion, and adjacent construction activity.

B. Sequence roofing work in such a manner as to preclude construction or foot traffic over the completed roof, i.e. commence roofing at the furthest point from the roofing contractor’s loading and access points.

C. The contractor shall protect the roof with plywood from traffic, work, or damage by other trades during construction.

D. Set up charge points, debris chutes, loading and stocking points, drinking water containers, and all other destination facilities shall be located in such a way as to preclude traffic over the newly installed membrane.

1.13 WARRANTIES

A. The contractor shall provide three warranties for the project. The warranties shall be as follow:

1. Provide two (2) year roofing contractors warranty on the form provided herein.

2. Provide a Twenty (20) Year Total System No Dollar Limit warranty from the roofing material manufacturer.

3. Provide a Twenty (20) Year finish warranty from the sheet metal manufacturer on the prefinished sheet metal.
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4. All warranties shall carry a concurrent effective date, and that date shall be the Date of Substantial Completion as certified by the Architect/Engineer.

PART 2 PRODUCTS

2.1 GENERAL

A. When performance standards are specified, such shall be indicative of a minimum standard required.

B. Substitutions shall be permitted in accordance with the provisions of the General Conditions of the Contract. Approval of a substitution does not change the original standards for performance nor relieve the contractor from complying with the original specifications.

2.2 APPROVED MATERIALS

A. All roofing system components shall be manufactured, labeled, or specifically approved in advance in writing by the membrane manufacturer issuing the roofing system warranty.

2.3 ROOFING MATERIALS

A. Lightweight Insulating Concrete Substrate

1. Venting base sheet: The following products and manufacturers are acceptable for the venting base sheet to be applied over lightweight insulating concrete substrates.

   a. Soprema, Inc.
   
   b. Siplast
   
   c. U.S. Ply, Inc.
   
   d. Johns Manville Ventsulation Base
   
   e. GAF Stratavent Base Venting Base

2. Firestone Building Products Co.Base Ply Fasteners: The following manufacturers are acceptable for Lightweight Base Ply Concrete Anchors

   a. LWC-FM90 Base Ply Fasteners as manufactured by Celotex Corporation
   
   b. Zonotite FM-90 Base Ply Fasteners as manufactured by ES Products, Inc.
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c. Olympic Base Ply Fasteners as manufactured by Olympic Fasteners, Agawam, MA.

B. All Substrates

1. Approved Roof Membrane Systems: The following manufacturers are acceptable for the Total Roof System assembly.
   a. Soprema, Inc., Wadsworth, OH.
   b. Siplast, Inc., Irving, TX
   c. U.S. Ply, Inc., Fort Worth, TX.
   d. Johns Manville Corporation, Denver, CO.
   e. GAF Building Materials Corporation, Wayne, NJ.

C. Firestone Building Products Company, Indianapolis, IN. Approved cant and tapered insulation materials.

   1. Wood Fiber Cants - Products shall be as manufactured by Cant Products Inc., Desoto Cant or approved equal, and shall measure 5” across the face unless shown otherwise on Drawings.

   2. Wood Cants - Wood cants shall be fabricated from 4” x 4” No. 2 YP, Kiln Dried (KD). Components shall be used as braces in nailer details as shown in the Drawings.

D. Approved Related Bituminous Materials

   1. Asphalt Primer - Use for priming metal flanges, concrete, and rough, sandy, or dirty surfaces to receive bitumen. Materials shall comply with ASTM D41.

   2. Granule-surface Roofing Membrane Cap Sheet: ASTM D 6163, Grade G, Type I or II, SBS modified asphalt sheet (reinforced with glass fibers); surfaced with colored granules to match Johns-Manville “Brick Red” color, suitable for application method specified, and as follows:
      c. Weight: 96 lbs. Per 100 sq. ft. minimum.
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3. #30 Plain Felt - #30 asphalt saturated, unperforated felt meeting the requirements for ASTM D-226-87 may be used for temporary waterproofing or sealing during construction.

4. #15 Plain Felt - #15 asphalt saturated, perforated felt meeting the requirements for ASTM D-226-87 shall be used for temporary waterstops and set in approved compatible adhesive.

E. Approved Non-bituminous Related Materials

1. Nails - Minimum 1-1/2" hot-dipped galvanized with minimum 3/8" head for nailing sheet metal flanges and concealed cleats.

2. Capped Nails - 1" hot-dipped galvanized threaded nails with minimum 15/16" head, as made by Simplex Nail Company, for top nailing of membrane plies at nailers and wood blocking.

3. Lumber and Wood Blocking - All wood blocking and lumber coming into direct contact with roofing materials and fasteners shall be kiln-dried after treatment (KDAT).

4. Drain Flashing - 4 lb. sheet lead with a minimum sheet size of 30" x 30".

5. Sealant - Sonneborn Sonolastic NP-150 with VLM technology, one-part polyurethane sealant for sealing pipe collars, lap joints in metal above plane of roof, and at nail on wall flashings.

6. Walkway Protection - DynaTred as manufactured by Johns Manville, or Tamko Awaplan as manufactured by Awaplan. Other brands may be submitted subject to the approval of the roofing material manufacturer.

7. Termination or Retainer Bars - Pressure bar - Product No. AL200, as manufactured by JBD Supply of Canton, Ohio, with slotted holes pre-punched 8" O.C., to top anchor membranes to concrete parapet walls. The use of termination bars to secure the base flashing shall not be construed to replace the need for sawcut reglets or through-wall flashings in contiguous walls.

8. Masonry Anchors - Use #14 Factory Mutual approved fastener, fluorocarbon coated with a minimum .200 diameter shank and .250 diameter thread, as manufactured by Olympic Manufacturing Group Inc., Agawam, MA. Fastener is to be used to fasten approved pressure, termination, or retainer bars.
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PART 3 EXECUTION

3.1 INSPECTION AND PREPARATION OF DECK

A. Inspect the deck to see that all requirements for deck preparation specified elsewhere have been met and that the deck meets the following requirements for application of the roof materials:

1. The deck must be smooth, free of voids and holes, and all damaged areas replaced or repaired.

2. The deck must be dry, hard and able to withstand the minimum pullout resistance necessary to meet the wind uplift requirements of the Specifications.

3. The roof substrate shall be inspected by and approved in writing by the roofing material manufacturer providing the warranty prior to commencement of roof application.

3.2 APPLICATION TO VARIOUS SUBSTRATES

A. Lightweight insulating concrete

1. The lightweight insulating concrete substrate is specified elsewhere.

2. When the substrate is lightweight insulating concrete, a venting base sheet shall be mechanically fastened to the substrate.

3. The mechanical fastening pattern shall meet the stipulated wind uplift requirements for the project.

4. Over the lightweight concrete decks, nail down a Venting Base Sheet with approved fasteners at a frequency and in a pattern certified to meet Factory Mutual 1-90 requirements. In the absence of other fastening patterns specified or approved elsewhere, the fasteners shall be at a maximum distance of 7” O.C. on the side laps and 12” O.C. staggered down the middle of the sheet.

5. Base ply fasteners shall utilize the 2.7” plates required for FM Class 1-90 or UL-90 wind uplift requirements.

6. Fastener frequency shall be increased by 50% at the outside perimeter of the building and 100% at all outside building or roof area corners, or in compliance with FM 1-90 requirements, whichever is greater. The perimeter is as defined in ASCE 7.
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7. Failure to install fasteners at the required spacing interval will be considered a serious act of defective workmanship and may cause replacement of the entire roof assembly.

8. Where roof insulation is required to be applied over the base sheet to achieve the desired R-value, all insulation shall be applied using low-rise foam adhesive.

9. Following application of the base sheet, all other plies shall be installed the same is if the substrate is roof insulation.

B. Metal Deck

1. Metal decks shall be covered with rigid roof insulation.

2. The rigid roof insulation is specified elsewhere.

3. When metal decks are the substrate, the bottom layer of roof insulation shall be mechanically fastened, and all subsequent layers installed using low rise foam adhesive.

4. Such roof insulation assembly shall consist of two layers of polyisocyanurate insulation with the joints double-staggered horizontally and vertically. Board sizes shall be no larger than 48”x 48” x 2”. Over the polyisocyanurate roof insulation a perlite, or approved cover board shall be applied.

5. Cementitious or gypsum based cover boards are not acceptable.

C. Structural Concrete Deck

1. When the substrate is structural concrete or structural lightweight concrete the deck shall be primed with an asphaltic primer.

2. A vapor barrier consisting of a torch-down base sheet shall be applied over the full area.

3. Rigid roof insulation shall be applied as specified on Section 2.4(A)(4).

3.3 ROOF MEMBRANE INSTALLATION

A. Roof Insulation. Where roof insulation is the substrate, apply roofing plies as follows:

1. One Ply Torch-Down Base Sheet - Starting at the low point of the roof torch down one ply shingle fashion keeping all lines straight and true. Side and end laps shall conform to the manufacturer’s published specifications.
2. Modified Bitumen FR Rated Cap Sheet - The final ply may be delayed up to five days upon advance written approval of the material manufacturer warranting the roof. Prior to installation of the FR cap sheet, inspect the underlying plies, repair all voids, fishmouths, cuts, or abrasions, and completely clean the roof. Sweep off all loose dirt; where dirt has become imbedded, prime the area prior to commencing application of the FR cap sheet. The FR cap sheet is the second ply in addition to the base ply.

3. Relax Modified Bitumen Cap Sheet - Prior to application of the modified bitumen cap sheet, the material shall be unrolled, and turned upside down to allow for relaxation. The material then may be re-rolled loosely for final application.

4. No Phased Roofing - Unless approved by the roofing material manufacturer issuing the roof warranty, in writing in advance of starting the project, no phased roofing will be permitted. Installing the cap sheet within the five days permitted following application of the base ply will not be considered phasing for purposes of this Specification.

5. Cap Sheet Installation - The cap sheet shall be cut into lengths no longer than ½ the roll length and torched down by a trained applicator. Cap sheet shall be torched down or heat welded. Each piece shall be back-nailed at 3" O.C. at the top. End laps shall be staggered ½ roll so that nowhere is an end lap on one piece contiguous to an end lap on an adjacent roll. End laps shall be a minimum of 9” laps or as otherwise specified by the manufacturer whichever is greater. Side laps shall be securely heat welded without voids or dry laps.

6. End Laps - All end laps shall be lapped a minimum of 6", or as specified by the manufacturer, and all membrane laps shall show a "bleed-out" of between 1/2" and 2". Round corners of roll ends.

7. No Voids or Fishmouths - All plies shall be continuous with no voids, and plies shall be rolled smooth and broomed into place without fishmouths or wrinkles. Fishmouths shall be marked, cutout and a full ply extending 18" on either side of the fishmouth shall be installed prior to installing of the following ply.

8. No Foot Traffic on New Membrane - No workers shall walk on the newly completed membrane for at least thirty minutes after installation to allow for cooling of the asphalt to prevent compression and displacement of asphalt due to point loading or concentration of weight due to a person's foot or equipment.

9. Membrane 2" Above Top of Cant - All roof membrane plies shall extend approximately 2" above the top of the cant at all perimeters and at all roof projections, and bonded securely into place without wrinkles or bridging.
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10. Delayed Flashings - Upon advance written approval of phasing of certain operations, installation of wall flashings and gravel stop strip in may be delayed until completion of the membrane, provided all water entry points at top of cant and walls are sealed to prevent water penetration.

11. Touch-Up Granules - Apply loose touch-up granules to match the granulated surface of the roof membrane at all laps and locations where asphalt bleed-out or spillage shows. Finished product shall be a neat professional and uniform surface.

12. Ridge and Hip Cap Ply - One full width sheet modified bitumen granulated surface sheet is to be run the full length of the ridge and/or hips and carefully mopped in place. All run-out asphalt at the laps and sides are to be covered with granules.

13. Water Cutoffs and Temporary Roofing Daily Water Stops - The Contractor shall provide water stops or temporary roofing daily to prevent moisture from penetrating the integrity of the roofing system and building interior.

B. Wall Flashings

1. Prime Walls - Prime all concrete, block, dusty, or dirty surfaces prior to application of wall flashings.

2. Modified Bitumen Base Flashing - The manufacturers' premium two ply base flashing shall be used in these Specifications. Upon completion of the roof membrane, with all plies extended approximately 2" above the top of the cant, install an additional ply of modified bitumen sheet at least 9" above the plane of the roof, and extending at least 6" out onto the completed roof membrane. Be careful to imbed all flashings particularly at the top and bottom of the cant to avoid bridging. Bridging of wall flashings shall be considered defective workmanship and flashings with voids or bridging shall be removed and replaced. Stagger the laps of the base flashing ply sheet with the cap sheet so that nowhere does the cap sheet end lap fall over the ply sheet end lap.

3. Use Short Flashing Pieces - Cut base flashing modified bitumen flashing materials into pieces no longer than the width of the roll each. Do not attempt to use flashing pieces which cannot be easily handled with one person.

4. Torched Base Flashings - Where an open flame torch is the application method for the flashings, the Contractor shall take full fire precautions as recommended by the NRCA and shall conduct a fire watch for a minimum of two hours following the last use of the open flame torch. All torch application equipment including propane torches and storage containers shall be removed from the roof each day at the end of work.
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5. Nail Flashings at Top - Use Simplex nails to fasten the wall flashing at the top at 6” O.C. when attached to wood nailers, and Olympic #14 screws pre-drilled with metal disks when being fastened into concrete. Seal the top edge of the base flashing.

6. Termination Bars - When flashings are being bonded to concrete or block walls, install termination bars fastened at 8” O.C. at the top of the flashing prior to application of metal counterflashing. Seal the top edge of the base flashing.

7. All base flashings are to be installed and work completed on a daily basis. No condition should exist that will permit moisture entering behind, around, or under the roof or flashing membrane.

C. Roof Drain Flashing:

1. Set 30-inch by 30-inch 4 pound lead flashing sheet in a bed of roofing cement on completed base ply substrate. Wire brush or score the lead flashing prior to applying primer. Prime lead on both sides of the lead; cover lead sheet with one ply of 120-mil SBS stripping, extending a minimum of 12 inches beyond edge of lead flashing onto base plies. Clamp roof membrane and lead flashing into roof drain clamping ring and tighten bolts while adhesive is still damp to ensure setting the flashing in adhesive securely.

2. All existing roof drains shall receive new, stainless steel clamping ring bolts. Redrill and tap new threads as necessary for the new bolts.

3. Roof drains shall receive a four hour standing water test at the completion of roofing work. Drains shall be close using inflatable plugs and water filled to a level at the top of the sump and permitted to stand for four hours. Check the interior of the building for leaks before removing plugs. Remove all plugs at the end of the day and do not leave drains obstructed over night or under threat of rain..

D. Related Work

1. Plumbing Vents
   a. Plumbing vents and lightning protection penetrations shall be flashed with 4 pound lead flashing jacks and extend 11” above the plane of the finished roof surface.

2. Through-Wall Scuppers
   a. Through-Wall Scuppers - All through-wall scupper metal shall be primed with asphalt primer, and stripped in with two plies of modified bitumen flashing premium grade material adhered with an approved flashing mastic.
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All corners, splices, and joints shall be sealed with mastic as required to provide a watertight seal.

b. Nail Flanges - All flanges shall be securely fastened to wood blocking installed as detailed.

3. Metal Edges

a. Clean Substrate - After all blocking has been cleaned, deteriorated wood, if any, replaced, and the new modified bitumen roofing system has been installed over the wood edge blocking, install the metal edging.

b. Prime Metal - Prime the top flange of the metal with asphaltic primer and allow it to dry tacky to the touch.

c. Strip-In Flashing - Prime the top surface of the metal and roof membrane, and install a 12" wide strip of the modified ply sheet being used followed by an 18" modified bitumen strip-in to the edge using modified bitumen granule surfaced material, installed with hot asphalt with bleed-out at both edges.

3.4 FINAL INSPECTION

A. Upon completion of roofing installation and associated work, the contractor and representative of the roofing material manufacturer shall accompany representatives of the owner and design professional in conducting a final inspection of the Work.

B. A final punch list shall be prepared by the design professional and circulated to all parties present. The contractor shall complete all items listed on the final inspection punch list within fourteen (14) days from the date of receipt of the list. The contractor shall notify the owner in writing when all work listed has been completed.

C. The roof material manufacturer may direct such testing as may be required to confirm that all work has been completed in accordance with the manufacturers published specifications and requirements for issuance of the warranty. Such testing shall be performed at no additional expense to the owner.

D. Following the final inspection, the material manufacturer will make acceptance in writing and issue the specified warranty.
MANUFACTURER'S CERTIFICATION OF MATERIALS  
(ROOFING MATERIAL MANUFACTURER'S LETTERHEAD) 

Date

Subject:

Dear «OWNERREP»,

We are pleased to offer to supply the roofing materials for the roofing project named above. We hereby certify that (Name of Contractor) is an approved roofing contractor/applicator with our firm for the term or type of warranty stipulated below.

The conditions stipulated and representations in this letter are made by us as an inducement to you to use our materials on your roofing job. We propose to furnish roofing materials necessary to provide a watertight roofing assembly on the above project. We hereby represent to you that if our materials are selected for use on your job complying with our standard specifications, upon specific further request, we will issue a twenty (20) year "No dollar Limit" Total System Roof Guarantee on the entire roofing assembly, including the membrane, insulation, and flashings, on the form required in these specifications, so long as the assembly consists of the materials listed below. We approve the following materials for use as components of the roofing assembly we offer to guarantee, and such materials are approved as components of a roof assembly using our materials whether or not we issue a manufacturer's guarantee:

(List specifically by brand name, material number, and ASTM designation)

Bituminous roofing system and components
Roofing membrane
Roofing asphalt
Roof insulation
Secondary moisture protection
Mastics and adhesives
Roof or insulation fasteners
Wood, carpentry, or lumber
Other miscellaneous components, expansion joints, drains, vents, flashings and sheet metal
Special requirements or installation conditions not published in standard specifications
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In addition, we will provide such inspections as we deem necessary. By means of this letter, we also certify that the contractor listed above has applied for the required warranty and made the necessary payment to cause issuance of the warranty. In the event that anything arises during the course of this transaction, including, but not limited to, failure by the contractor to make full payment for the warranty, or quality assurance issues, which might jeopardize issuance of this warranty, we will notify you, the owner, in writing timely to give you the chance to rectify such problems and cause issuance of the warranty as stipulated above.

Yours very truly,

COMPANY NAME
Signed by
Authorized Representative
CONSTRUCTION STANDARDS DIVISION 07 – THERMAL AND MOISTURE PROTECTION

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CONTRACTOR'S ROOF WARRANTY

Project Warranty for ______________________________________________________
Whereas _____________________________________________________ (Contractor),
Address ________________________________________________________________
Telephone ( ___ ) ______-_______ has performed _______________________ (Work)
on the following Project: ___________________________________________________
_______________________________________________________________________,
Address: ________________________________________________________________

NOW, THEREFORE, the Contractor hereby Warrants said Work in accordance with the terms
hereof, complying with the terms of the Contract with the Owner dated _________,
that ______________________ WARRANTY PERIOD of Two (2) years, STARTING
_________, TERMINATING ____________.

Such Warranty shall cover without exception all of the work performed and materials either
placed and/or supplied by the undersigned under this contract against defective workmanship
and/or materials for a period of two (2) years following the date of completion and the Owner's
acceptance of the work performed in accordance with the General Conditions of the
Specifications, and the contract for this project.

Upon notice by the Owner, the undersigned Contractor will replace faulty workmanship and/or
materials furnished or installed by the undersigned contractor which may be evidenced during
the guarantee period without cost or charge to the Owner, whether or not such faulty
workmanship results in moisture leaks. Faulty workmanship and materials shall include but not
be limited to the following:

- Leaks in the roofing system or components installed as part of this job.
- Blisters, slippage or delamination of the membrane or flashings.
- Failure of the attachment, adhesion, or bonding of any component of the roof assembly,
  whether leaking or not.
- Buckling, cupping, or other dimensional instability of the insulation, if part of the assembly.
- Excessive loss of granules beyond that reasonably expected due to normal wear and tear.

Contractor agrees to inspect the roof with the Owner or Owner's representative within sixty (60)
days prior to the expiration of this warranty. If defects as noted above are not corrected by the
expiration date of this guarantee, this guarantee shall be extended until such time as all defects
present at the time of the inspection noted above have been corrected to the Owner's satisfaction.
In case the undersigned Contractor fails to remedy such defects within a reasonable period of
time following notice, the Owner may furnish such materials or labor as may be necessary to
bring or restore the work to the standards originally specified and the undersigned Contractor
agrees to reimburse the Owner fully and promptly for all costs incurred in obtaining such
compliance. Correction of defects in workmanship and materials shall not, however, relieve the
Owner of responsibility for normal and routine maintenance and cleaning of the roof, and the
Contractor shall not be held responsible for routine maintenance.

Revised Jan-15

Bituminous Membrane Roofing-07 52 16-21
SECTION 07 52 16 – STYRENE BUTADIENE STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING

IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, 20___, for the Contractor ________________________________
as its ________________________________ (position).

Name of firm: __________________________________________________________________
Address: ______________________________________________________________________

And has been countersigned in accordance with the terms and conditions, for the General Contractor
________________________________ as its ________________________________ (position).

Name of firm: __________________________________________________________________
Address: ______________________________________________________________________

Signed: ________________________________________
Date: _________________________________________
SECTION 07 52 16 – STYRENE BUTADIENE STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING

END OF SECTION 07 52 16
PART 1 - GENERAL

1.1 SCOPE OF STANDARD

A. This standard provides general guidance concerning the specific preferences of Texas State University for Standing Sheet Metal Roofing.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

C. Roof systems shall be designed by, and with plans and specifications sealed by, a Licensed Architect or Engineer in accordance with ASCE 7, the International Building Code, and the International Plumbing Code.

D. Roof edge assemblies and attachment shall be provided in compliance with the most recent edition or version of the SPRI/ANSI ES-1 Standard.

E. Scope of Work - The scope of Work covered under this Section is as follows:
   1. Water Conveyance Sheet Metal
   2. Water Shedding Sheet Metal
   3. Imbedded Sheet Metal

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Rough Carpentry

B. Roof Deck

C. Roof Insulation

D. Modified Bitumen Roofing

E. Roof Specialty and Accessory Items

F. Lightning Protection

G. Metal Roofing

1.3 PROJECT / SITE CONDITIONS

A. Dimensions Approximate - Dimensions as contained in these Specifications or as scaled from Detail Drawings shall be presumed to be approximate. In the event that site conditions uncovered during the Work require modification to, or alteration of those specifications, the Contractor shall make adjustments as required to comply with that intent.

B. Coordination with Other Trades - The Work of this Section shall be coordinated with and properly integrated into related Work covered by other Sections.
1.4 CONTRACTOR REQUIREMENTS

A. The roofing contractor shall be experienced in commercial, institutional, and industrial metal roofing systems with a minimum of five (5) years experience and who is certified by the metal roofing system manufacturer as qualified to install the manufacturer’s systems.

B. Contractor must be certified by manufacturer specified as supplier of structural standing seam system and obtain written certification from manufacturer that installer is approved for installation of specified system. If requested, contractor must supply owner with a copy of this certification.

C. The Contractor shall have demonstrated its proficiency by having a satisfactory record of performance in the following areas:
   1. On-time completion of previous work of a similar size and scope.
   2. No history of litigation, claims, or lawsuits relating to past or ongoing performance that may affect current performance.
   3. Proven safety record as demonstrated by company documentation and workers compensation insurance Experience Modifier.
   4. Positive record of post-completion warranty service to clients.

D. The roofing contractor shall maintain a full-time, non-working, non-changing, English-speaking Supervisor/Foreman on the job site during all phases of roofing and sheet metal work and at any time roofing work is in progress. A copy of the construction documents shall be in the possession of the Supervisor/Foremen and on the roof at all times.

1.5 SUBMITTALS

A. Submittals shall be provided in accordance with the General Conditions of the Contract. Provide a submittal cover sheet identifying the project by name and number and listing the following columns for review by the design professional with a separate sheet for each roof section.
   1. Specification section
   2. Description of brand and product
   3. “Accepted”
   4. “Rejected”
   5. “Resubmit”
   6. “Comments”

B. Provide a place for the design professional’s signature.

C. Submit Samples - Prior to mass fabrication, submit to the Architect/Engineer physical samples of each of the following:
   1. All fasteners to anchor metal work
SEC 07 60 00  SHEET METAL FLASHINGS

2.  Color sample for prefinished metal

D.  Product Data Sheets - Submit product data sheets on all the following items:
  1.  Prefinished metal
  2.  Elastomeric flashing cement
  3.  Sealant tape
  4.  Elastomeric sealant
  5.  Sealant primer
  6.  Backer rod
  7.  Paint
  8.  Paint primer.

E.  Submit Proposed Changes - If Contractor proposes changes to flashing assemblies, he shall submit detailed shop drawings as necessary to illustrate the changes, and shall obtain Architect/Engineer’s written approval prior to fabrication.

1.6 QUALITY ASSURANCE

A.  Skilled Workmen - All sheet metal work shall be fabricated and installed by fully trained, qualified sheet metal mechanics properly skilled to perform the Work in accordance with the standards set forth in these Specifications. Substandard Work will be rejected.

B.  Accepted Flashing Details - In the event field conditions make installation of a flashing detail in accordance with SMACNA or NRCA Details impractical, the Contractor shall submit a shop drawing design to the Owner for approval to fit the particular conditions present.

1.7 DELIVERY, STORAGE, AND HANDLING

A.  Storage Compliance - Deliver, store, and handle all sheet metal work in accordance with the provisions of the General Conditions of the contract.

B.  Fabricator’s responsibility:

  1.  Deliver products to the site with seals and labels intact in manufacturer’s original containers, dry and undamaged.
  2.  Protect components during fabrication and packing from mechanical abuse, stains, discoloration, and corrosion.
  3.  Provide protective interleaving between contact areas of exposed surfaces to prevent abrasion during shipment, storage, and handling.

C.  Installer’s responsibility:

  1.  Store materials off ground providing for drainage; under cover providing for air circulation; and protected from wind movement, foreign material contamination, mechanical damage, cement, lime or other corrosive substances.
  2.  Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from the site.
  3.  Protect materials from wind-related damages.
4. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

1.8 PRODUCTS WARRANTIES

A. Sheet metal flashings shall be included in the Manufacturer’s 20 Year No Dollar Limit Total System Warranty without exclusions.

PART 2 -

2.1 SHEET METAL

A. It is the intent of this section that all exposed sheet metal shall be made of 20 oz. copper unless specifically specified or noted otherwise.

B. The following materials may be used in appropriate locations as detailed:

1. Copper Sheet Metal - Flashing material shall be 20 oz. per square foot copper, H01 or H02 temper, smooth as per ASTM B370-92.

2. Galvalume Sheet Metal - 24 Ga. Galvalume coated steel, (aluminum-zinc allow coated steel) sheet coated on both sides with a layer of aluminum-zinc alloy by continuously hot dip method (approximately 55% aluminum, 45% zinc). Triple spot minimum 0.55 oz. per square foot as determined by ASTM A-792.

3. Galvanized Sheet Metal - 22 Gauge with G-90 Coating, unless otherwise shown in Detail Drawings shall be used for all cleats and continuous wind clips in accordance with Factory Mutual requirements.

4. Galvanized Sheet Metal - 24 Gauge with G-90 Coating, unless otherwise shown in Detail Drawings shall be used for all metal flashings and at equipment curbs unless otherwise specified to be prefinished or a different gauge. All materials to be soldered shall be 24 Ga., G-90 G.I.

5. Prefinished Sheet Metal - 24 Gauge with G-90 galvanized coating and Kynar 500 finish in the color of the Owner’s choosing for exposed details where color matching is desirable. Unless otherwise specified, the color selected will be a standard manufacturer’s color.


7. Stainless Steel Sheet Metal: ASTM A 240/A 240M, Type 304; No. 2B finish; 24 gauge.

2.2 RELATED MATERIALS – SOLDERING

A. Solder - 50% Tin, 50% lead - (ASTM D 32), for galvanized sheet metal, and ASTM Specification B-32, composition 50% tin and 50% lead for copper sheet metal.

B. Flux - Rosin, Muriatic acid filled with zinc or non-acid type paste.

2.3 RELATED MATERIALS – FASTENERS

A. Fastener Compatibility – Fasteners shall be made of a material compatible with the underlying sheet metal to be fastened.
SECTION 07 00 00 SHET METAL FLASHINGS

B. Copper Nails – Nails for wood and concrete shall be flathead, barbed nails, not less than No. 12 gauge, 1” LONG AND MADE OF EITHER COPPER OR BRASS. Expansion shields shall be lead sleeves. Copper or brass fasteners shall be used wherever copper flashings are used.

C. Copper Screws – Screws shall be of hard copper or brass and shall have round heads. A lead washer shall be placed between the copper and screw head. Expansion shields used with copper flashings shall have lead sleeves.

D. Roofing Nails - Minimum 1-1/2", hot-dipped galvanized, ring shank, with minimum 3/8" head - for nailing concealed cleats to wood substrates, and sheet metal flanges built into membrane.

E. Flashing Nails - Flashing nails shall be of sufficient length to penetrate a minimum of 1" into receiving member, hot dipped galvanized, ring shank, with minimum 15/16" head, as manufactured by Simplex Nail Company, Americus, GA, for top-nailing plies, base flashings, and membrane flashing at "L" nailers and curbs.

F. Hex-Head Wood Screws - 1-1/2", stainless steel, prefinished using coating to match the color and finish of the sheet metal to which it is attached, with neoprene washers, to fasten square-to-round counter flashings at curbed penetrations, new expansion joint covers, and copings.

G. Pop Rivets - Pop rivets shall be #44 stainless steel with stainless steel shafts. Pop rivets shall be prefinished using coating to match the color and finish of the sheet metal to which it is attached.

H. Sheet Metal Screws - All exposed screws used in sheet metal applications shall be stainless steel and be prefinished using coating to match the color and finish of the sheet metal to which it is attached.

2.4 RELATED MATERIALS - BITUMINOUS

A. Paint Primer - (ASTM D 41) - for priming metal flanges

B. Secondary Waterproofing Membrane
   2. GAF StormGuard Film Surfaced Leak Barrier as made by GAF Materials Corporation.

C. Flashing Cement - Asphalt Built-Up Roofs - Industrial roof flashing cement, as manufactured by Johns Manville Corp., to embed all flanges of metal flashings in all areas; to embed backer plate/cover plate assemblies in gravel guard; and to provide seal as shown in Detail Drawings.

D. Flashing Cement - Modified Bitumen Roofs - MBR Utility Cement as made by Johns Manville Corporation, or approved equal.

2.5 RELATED MATERIALS - NON BITUMINOUS

A. Manufactured Expansion Joint Covers - Factory manufactured EJ covers shall not be used in lieu of shop fabricated 20 Oz. Copper or 24 Ga. sheet metal covers unless specifically detailed.

B. Elastomeric Sealant - one part polyurethane Sonolastic 150 with VLM, as manufactured by Sonneborn shall be used at all flashings including, but not limited to, hips, ridges, vents, collars, counterflashing, and lap joints.
C. Elastomeric Sealant Primer - Prime all surfaces to receive elastomeric sealant using compatible material approved by the manufacturer of the sealant such as Sonneborn Primer No. 733, or approved equal.

D. Sealant Tape - polyisobutylene butyl elastic tape, such as Tremco 440 tape, minimum thickness of 1/8” with a 3/4” minimum width, unless otherwise instructed for use between metal connections, behind flashing termination bars, lap joints in metal flashings, and at coping seams.

E. Paint Primer - Pittsburgh Paint Galvanized Primer No. 6-209 or approved equal for priming all metal surfaces to be field painted. Color to be chosen by the Owner.

F. Paint - Pittsburgh Paint Industrial Metal Enamel No. 54-352 or approved equal for field painting of exposed visible face of all metal flashings constructed of paint grip metal. Color to be selected by Owner.

G. Instant Cold Galvanize Compound - Aerosol spray instant cold galvanizing compound as manufactured by LPS Inc., or approved equal.

H. Through-Wall Flashing - Cop-R-Tex Plus Lead 5 Oz. per sq. ft.. The material shall have a creped kraft paper reinforced with fiberglass adhered to one side of the bimetallic sheet.

I. Cast Iron Downspout Boots - Cast Iron Downspout Boots as manufactured by McKinley Iron Works, Inc. 901 Throckmorton, Fort Worth, TX 76106, (817) 429-0791, or approved equal. Rectangular boots, Types DS1, DS2, DS4, or DS8, whichever are shown, shall be provided. Aluminum downspout boots are not acceptable with G.I. sheet metal. Prime and paint cast iron downspouts boots color selected by Owner.

PART 3 - EXECUTION

3.1 GENERAL

A. Precision Fabrication - Fabricate all flashings to exact, uniform, and consistent dimensions and ensure that same are properly fitted and well seated, particularly backer plates and cover plates.

B. Mock-ups – Construct an in-place mockup of each sheet metal flashing detail and receive the Architect’s approval in writing before proceeding with installation of additional sections or components. Sheet metal installed without a mock-up or the Architect’s prior approval may be required to be removed at the Architect’s request.

C. Minimize Joints - Install all continuous flashings of the longest practical length.

D. Terminations and Intersections - Where flashings terminate or intersect, utilize and comply with methods and procedures as outlined in the latest edition of the "Architectural Sheet Metal Manual" as distributed by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), the NRCA Roofing and Waterproofing Manual, latest edition, or "The Copper/Brass/Bronze Design Handbook" published by the Copper Development Association, Inc. Construct terminations and intersections as separate, fixed components independent from intersecting, continuous flashings in such a manner as to absorb thermal movement of adjacent components without stress on mitered joints of terminations and intersections. Each corner leg shall be approximately 18” long on each leg.
SECTION 07 60 00 SHEET METAL FLASHINGS

E. Conflict Resolution and Authority - In the event any metal flashing component of any flashing is not specifically covered by the Specifications, or Drawings, each shall comply with the theory and intent of "NRCA Construction Details" and those of the "Architectural Sheet Metal Manual", Fifth Edition, 1989, as published by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

F. No Dissimilar Metals - In no case, shall dissimilar metals come into contact with each other, nor shall a flashing be constructed in such a way as to permit water from running off one type metal onto another where chemical reaction or corrosion may occur.

G. Treated Lumber - Sheet metal components, other than nails or screws, shall not come into direct contact with treated lumber. Wherever treated lumber is used, a bituminous barrier such as Ice and Water Shield, or a #30 asphalt saturated roofing felt shall be used as a permanent separator.

H. Use of Sealants - Sealants shall be used to provide secondary moisture protection, not primary. Wherever elastomeric sealant is used, it shall be applied beneath the component to be sealed, and both surfaces shall be primed with the primer recommended by the manufacturer. Failure to prime the surfaces of components to be sealed will be considered grounds for removal. Sealant shall match the color of the material to which it is being applied. Non-matching color sealant shall be completely removed, the substrate material cleaned, and new matching sealant applied. Where the sealant cannot be removed or the surface cleaned, the substrate material, or sheet metal shall be removed and replaced with clean material.

3.2 WOOD BLOCKING AND NAILERS

A. Materials and installation of wood blocking and nailers are specified elsewhere. Contractor providing Work under this Section shall, however, comply with the following procedures.

B. Securement - All wood blocking and nailers of any type intended to receive sheet metal attachment are to be securely anchored to the building in accordance with FM 1-90 requirements or the Texas Windstorm Act, whichever is the prevailing authority for the geographical area. The Contractor shall notify the Architect/Engineer of any securement deficiency prior to installation of any metal components. Any metal attached to improperly secured wood blocking or nailers shall be removed at the Contractor’s expense and reinstalled after the securement has been corrected.

C. Level and Continuous Nailers - The Contractor is cautioned to ensure that during the installation of all wood blocking a continuously level and smooth elevation is provided to insure a simplicity of installation.

D. Copings and Parapet Caps - All copings and metal parapet wall caps shall be installed over tapered or beveled wood blocking securely anchored to the structure. The slope or bevel shall be installed in a manner to drain the water to the roof side of the building, not the outside face.

E. Flange Supports - All metal flanges in imbedded metal details shall bear over wood nailers, not roof insulation, and shall be fully supported by such wood nailers with no gaps.

F. Expansion Joint Curbs - Expansion joint curbs shall be sloped to drain.
3.3 **SOLDERING**

A. Solder Using Irons - All soldering is to be done using soldering irons heated conventionally in a pot. The use of propane or other types of torches will not be permitted.

B. Corners and Intersections - Solder only those fixed components such as corners, intersections, terminations, skirts, collars, and covers. Do not solder joints between adjacent 10' lengths of flashings.

C. Cleaning Joints - When forming soldered joints, apply flux to surface and lift overlapping sheet to apply between sheets to minimum 1/2" depth. Thoroughly sweat joint drawing solder between sheets to minimum 1/2" depth and apply uniform surface without excess build-up.

D. No Exposed Nails - Do not nail metal components in place and solder over nail heads. If necessary to join components prior to soldering, use only stainless steel pop rivets. Cut, notch, miter, and provide tabs as necessary to properly join and interlock individual components for soldering.

E. Surface Treatment - Immediately neutralize all flux from surfaces after soldering, using cloth saturated with 10% solution of washing soda and water, and wipe again using separate cloth and water. Upon completion of pop riveting and soldering spray soldered joint and pop rivet heads with "Instant Cold Galvanizing Compound" to prevent rusting.

3.4 **WATER CONVEYANCE SHEET METAL**

A. Gutters and Downspouts

1. Gutters shall be fabricated from prefinished 20 Oz. Copper. Downspouts shall be made of the same material, except interior downspouts, which shall be PVC, or cast iron as may be required by local codes or specified differently elsewhere.

2. All detailing shall be in accordance with SMACNA unless otherwise indicated in the Contract Documents to the contrary.

3. Gutters shall be formed in such a manner as to provide positive slope to downspouts. Standing water in gutters is not acceptable.

4. Support spacers shall be 1/8” thick brass or copper and attached with stainless steel screws, not pop rivets.

5. Gutter support brackets consisting of 1/8” brass or copper. shall be installed every 3’-0” in accordance with Factory Mutual 1-90 requirements. Support brackets shall be covered with prefinished metal of a matching color to the gutter to provided continuity of appearance. Field painting is not acceptable.

6. Downspouts shall be supported with a minimum of two straps per downspout regardless of length and shall have additional straps as required by SMACNA for greater lengths. Straps shall be in the same finish as the downspout and shall be fastened behind the downspout to conceal the flanges.

7. Gutters shall have expansion joints at a maximum spacing of 50’ O.C. or as specified by SMACNA, whichever is the more stringent.

8. Unless otherwise detailed on the Drawings, the maximum downspout spacing permitted is 30’ O.C.

9. Gutters shall be formed and joined in such a manner as not to leak at the joints. Leaking gutter joints are a defect and will not be accepted.

10. Downspouts shall not be located at or near corners which require water to turn a corner to drain.
SECTION 07 60 00  SHEET METAL FLASHINGS

B. Scuppers - All scuppers, either through-wall or spill-out, shall be constructed of 20 Oz. Copper, unless otherwise detailed.
   1. Scuppers shall have a minimum 1” drip edge turned down 45° on the outside with a 1/2” hem.
   2. All scuppers shall have an escutcheon plate on the outside attached to the exterior wall with concealed fasteners. The escutcheon shall fully cover the rough opening and be sealed with an approved elastomeric sealant to prevent moisture entry.
   3. All scuppers shall be fully supported by wood blocking extending to the deck and a minimum of 1” beyond the scupper flange in all directions.

C. Conductor Heads - Where shown, conductor heads shall be fabricated in accordance with SMACNA procedures.
   1. Conductor heads shall be securely attached to the structure without permitting leakage around the conductor head.
   2. Conductor heads shall either be installed a minimum of 1” below the level of the scupper or shall have overflow scallops in accordance with SMACNA details.

D. Downspout Boots
   1. All downspouts extending to the ground shall have cast iron downspout boots or heavy gauge protective covers as detailed.

3.5 WATER SHEDDING SHEET METAL

A. Copings And Cap Flashings
   1. Secondary waterproofing consisting of a self-adhering modified bitumen membrane shall be installed over the wood blocking and extending down to 1” below the bottom of the nailer and over the top of the base flashing material or other wall moisture protection a minimum of 1”.
   2. A continuous metal clip shall be attached to the outside of the nailer made one full gauge heavier than the metal coping itself. The clip shall extend 1 1/2” below the wood blocking and shall be nailed at 6” O.C.
   3. The metal cap shall be fabricated and installed precisely and large enough not to cause a curving, bowing and “bellying” on the top. Coping that is not flat on top when a straight edge is laid across the top may be considered grounds for rejection.
   4. Joints shall be secured by means of a single lock, button punched standing seam. Cover plates are not acceptable.
   5. Coping terminating into a higher wall shall be turned up the wall 6”, have a complete though-wall flashing above with a two-piece receiver/counterflashing imbedded in the wall.
   6. The coping shall be secured on the outside by means of crimping the outside flange tightly over the continuous clip and on the reverse side with screws through a slotted hole with neoprene washers at 24 “ O.C.
   7. Where fascias are required with face width or height greater than 7-1/2 inches, such fascia shall be fabricated and installed in multiple pieces of equal face width. That is to say that if a fascia height of 10 inches is required, such fascia shall be fabricated with two 5 inch faces rather than a 7 inch and 3 inch face. Each fascia piece shall have a continuous cleat. The contractor shall discuss with the Architect in advance of construction whether the Architect wishes the fascia pieces to be aligned or staggered.

B. Expansion Joints
SECTION 07 60 00 SHEET METAL FLASHINGS

1. Factory-Made Components - All terminations, tees, crossovers, and other necessary assemblies shall be as manufactured for that purpose, and installed in accordance with the manufacturer's printed instruction, SMACNA or NRCA, whichever is the more stringent.

2. Shop Fabricated Sheet Metal Type - Where shown in the Drawings, expansion joint covers shall be constructed of 24 Ga. G.I., G-90. Such expansion joint covers shall have vertical standing seam ribs at all end laps or joints.

3. Roof to Wall Expansion Joints - Where shown on the Drawings, roof to wall expansion joints shall have secondary waterproofing beneath the metal cover.

C. Counterflashings

1. Walls and Elevation Changes - Fabricate counterflashings, using sheet metal of the approximate dimensions and configurations shown on the Detail Drawings, or as necessary to overlap base flashings a minimum of 4". Materials shall be compatible and shall match the material already present on the building in similar details.

2. Equipment Cannot Be Its Own Counterflashing - Equipment flanges cannot be a substitute for separate two-piece counterflashing. All equipment must have a separate receiver and counterflashing beneath the equipment flange.

3. Vents and Plumbing and HVAC Equipment - At power exhaust units, fabricate counterflashing of 20 Oz. copper or 24 Ga. galvalume as detailed with reverse open hem (approximately 1") on the vertical face extending under unit housing. Fasten 16" O.C. with approved fasteners with a minimum of two fasteners per side. All vent and plumbing and HVAC flashings shall have soldered and pop riveted seams. Seams and joints are not to be sealed with sealant as primary waterproofing.

4. Expansion Provisions - Fabricate all counterflashings in such a manner that each may be removed and reinstalled if necessary. Provide for differential movement between base flashing and counterflashing assemblies at all locations.

5. Wind Clips - All counterflashings at walls shall have 2" wide wind clips at 24" O.C. in accordance with SMACNA provisions.

D. Mechanical Equipment Flashings

1. Seal and Fill Flashing Openings - Where existing pitch pans and metal penetration flashings are replaced with curbed assemblies, stuff opening with non-combustible fill insulation. All "gooseneck" or "T" flashings shall be filled with expanding foamed in place polyurethane foam.

2. Mechanical Fastening of Flanges - All flanges of metal flashings larger than 24" in diameter, except lead, shall be securely fastened to wood or concrete substrates.

3. Vent Covers - All vent pipes with covers shall have new covers made of like materials.

4. Fit and Finish - All curb flanges and counterflashings shall be fabricated and installed so as not to cut or gouge the base flashings. Curb flanges that are cut at corners or elsewhere to fit over base flashings shall be replaced.

E. Umbrella Flashings

1. Umbrella flashings shall be used for round vertical pipes, and shall be securely welded at the top with a continuous weld bead. Umbrella flashings shall cover the top of the underlying flashing by a minimum of 1".

F. Through-Wall Flashings - Where through-wall flashings are installed in masonry walls, the procedure shall be the following:

1. The through wall flashing shall be constructed of 20 Oz. Copper or 24 Ga. Stainless Steel, as detailed, and shall lapped a minimum of 2” at the joints and sealed at the joints by sealant tape.
SECTION 07 60 00 SHEET METAL FLASHINGS

2. Over the Stainless Steel through-wall flashing shall be a secondary layer of moisture protection consisting of York Cop-R-Tex Plus Lead flashing or approved equivalent.

3.6 IMBEDDED SHEET METAL

A. General - The following instructions apply to all imbedded metal details and conditions.
   1. Prime Flanges - Flanges of all sheet metal shall be primed on both sides with an approved primer prior to installation. Lead flanges shall be wire brushed to rough the surface prior to priming.

B. Gravel Guard - All gravel guard shall be installed in the following manner.
   1. Imbed Flange Edges - The edge of all metal flanges to be built into or covered by roof membranes or strip-in plies shall be turned down or "kicked-down" slightly to prevent cut edge from wearing through the roof membrane. The "kick-down" shall not exceed 1/2" wide or be more than a 5-degree break. Prime the top side and bottom side of all flanges and build into the roof membrane within 24 hours or re-prime.
   2. Secondary Waterproofing - All gravel guard shall have secondary waterproofing made of self-adhering modified bitumen material beneath the base sheet and extending over the edge of the blocking and into the gutter, where applicable, and to a distance of 1” below the bottom of the wood nailer otherwise.
   3. Back-Up and Cover Plates - All gravel guard shall have both backup and cover plates in accordance with SMACNA requirements.
   4. Continuous Clips - Unless otherwise stipulated elsewhere, all gravel guard shall be attached to a continuous clip made one full gauge heavier with the clip nailed at 6” O.C. The clip or cleat shall be nailed no more than 1-3/4 inches from the bottom of the cleat or clip.

C. Pitch Pans - Pitch pans are not permitted. Alternative hooded flashings shall be used in lieu of pitch pans.

D. "T" Tops - "T" Tops shall be used only where shown and otherwise such flashings shall consist of a wood curb with a metal hood.

E. Equipment Curbs - Light gauge equipment flashings are not permitted, and wherever such conditions occur, a wood curb of the proper height shall be provided. Heavier gauge curbs such as air conditioning curbs shall have a counterflashing added as specified elsewhere.

F. Roof Drain Gravel Guard - All roof drains shall have gravel guard installed around the perimeter and stripped in as provided by standard NRCA details.

END OF SECTION 07 60 00
PART 1 GENERAL

1.1 SCOPE OF STANDARD

A. This standard provides general guidance concerning the specific preferences of Texas State University for Standing Sheet Metal Roofing.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

C. Roof systems shall be designed by, and with plans and specifications sealed by, a Licensed Architect or Engineer in accordance with ASCE 7, the International Building Code, and the International Plumbing Code.

D. Roof edge assemblies and attachment shall be provided in compliance with the most recent edition or version of the SPRI/ANSI ES-1 Standard.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Rough Carpentry

B. Roof Deck

C. Roof Insulation

D. Flashing and Sheet Metal

E. Roof Specialty and Accessory Items

F. Lightning Protection

1.3 SYSTEM DESCRIPTION

A. The intent of the specification is for the Contractor to provide a copper standing seam metal roofing system on a steep roof with a minimum slope of 5:12 over an approved substrate and to furnish a 20-Year No Dollar Limit Total System Manufacturer’s Warranty on the form approved herein upon completion of the project.

1.4 DESIGN REQUIREMENTS

A. Work described in this section includes a pre-formed or job fabricated copper metal roofing system complete with clips, perimeter and penetration flashing, closures, and fascia metal.
SECTION 07 61 13 – STANDING SEAM SHEET METAL ROOFING

B. Steep-sloped roofs
   1. The standing seam assembly shall have excellent architectural appeal with a minimum 2-inch high double-lock standing seams and approximately 11-inch wide panels. The use of transverse seams shall be avoided.
   2. Copper panels and flashings shall be a minimum of 20 oz. copper.
   3. Systems employing snap-on battens or snap together panels are not acceptable.
   4. Flashings, trim, and related roof components shall be copper.
   5. The roof shall have a full secondary moisture protection barrier consisting of a self-adhering base sheet applied to the approved substrate.

C. Safe Roof Access
   1. Roofs are not intended to be accessible to the public, except as may be required by the International Building Code.
   2. Provide access for authorized persons to all roof sections, either by a roof hatch with a contiguous ladder, an access door, stairs, or an exterior mounted ladder.
   3. All roof sections shall have OSHA compliant permanent safety tie-offs wherever roof edges are not protected by parapet walls meeting approved height requirements.

D. Lightning Protection.
   1. Lightning protection systems shall be integrated into the roofing system with proper flashing or all penetrations.
   2. All materials used in the anchorage of the lightning protection cables or rods shall be fully compatible with the copper roofing system and approved by the manufacturer.

1.5 DESIGN AND PERFORMANCE CRITERIA

A. Thermal Expansion and Contraction:
   1. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on the structure, anchors, or fasteners, or reducing performance ability.
   2. The design temperature differential shall not be less than 180 degrees F.
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3. Interfaces between panels and clips shall provide for unlimited thermal movement in each direction along the longitudinal direction.

4. Locations of metal roofing rigid connectors shall be at roof ridge unless otherwise approved by the Project Architect and designed per job conditions by specified manufacturer.

B. Uniform Wind Uplift Load Capacity:

1. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria. Anchor clips shall not be installed closer than the spacing given in Section 3.2 C.

   a. Design Code: ASCE 7-98, Method 2 for Components and Cladding
   b. Safety Factor: 1.650 after any load reduction or material stress increase
   c. Category III Building with an Importance Factor of 1.15
   d. Wind Speed: 100 mph
   e. Ultimate Pullout Value: 428 pounds per each of the two fasteners holding the panel anchor to the roof decking or framing system
   f. Exposure Category: C
   g. Roof Slope: Varies

2. Capacity shall be determined using pleated airbag method in accordance with ASTM E1592, Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above.

C. Uniform Positive Load Capacity:

1. The installed roof system shall be capable of resisting the following positive uniform roof loads: Roof Live Load of 20 psf.

2. Capacity to resist positive loads shall be determined by empirical calculations in accordance with AISI. Calculation shall be sealed by a registered professional engineer.

3. Installed roof system shall carry positive uniform design loads with a maximum system deflection of L/180 as measured at the rib (web) of the panel.
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D. Underwriters’ Laboratories, Inc. (UL) fire resistance P ratings for roof assemblies: If applicable, panel system shall be approved for use in an appropriate Construction Assembly, as defined by UL 263.

E. Underwriters’ Laboratories, Inc. (UL) and wind uplift resistance classification: Roof assembly shall be classified as Class 1-90, as defined by UL 580.

F. Underwriters’ Laboratories, Inc. (UL) Class A fire rating per UL 790.

G. ASTM E1680: Static pressure air infiltration (roof panels):

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Leakage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.57 PSF</td>
<td>0.0012 cfm/sq.ft.</td>
</tr>
<tr>
<td>6.24 PSF</td>
<td>0.0001 cfm/sq.ft.</td>
</tr>
<tr>
<td>20.0 PSF</td>
<td>0.0011 cfm/sq.ft.</td>
</tr>
</tbody>
</table>

H. ASTM E1646: Static pressure water infiltration (roof panels):

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Gal/Hr per S.F.</td>
<td>No Leakage</td>
</tr>
<tr>
<td>Pressure of 20.0 PSF for 15 minutes</td>
<td>No Leakage</td>
</tr>
</tbody>
</table>

I. Water penetration (dynamic pressure): No water penetration, other than condensation, when exposed to dynamic rain and 70 mph wind velocities for not less than five minutes duration, when tested in accord with principles of AAMA 501.1.

J. Capacities for gauge span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolation for conditions outside test range (other than for material type; see Section 1.4.D) are not acceptable.

1.6 PERFORMANCE STANDARDS

A. American Iron and Steel Institute (AISI): 1996 Ed. Specification for the Design of Cold-Formed Steel Structural Members.

B. American Society of Civil Engineers (ASCE): ASCE 7-98 Minimum Design Loads for Buildings and Other Structures.


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1.7 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):
   2. B101-96, Specification for Lead-Coated Copper Sheet and Strip for Building Construction
   5. D3575-84, Test Methods for Flexible Cellular Materials made from Olefin Polymers
   8. E1680-95, Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems

B. Underwriters’ Laboratories (UL):
   2. UL-580 Tests for Uplift Resistance of Roof Assemblies.

1.8 CONTRACTOR REQUIREMENTS

A. The roofing contractor shall be experienced in commercial, institutional, and industrial metal roofing systems with a minimum of five (5) years experience and who is certified by the metal roofing system manufacturer as qualified to install the manufacturer’s systems.

B. Contractor must be certified by manufacturer specified as supplier of structural standing seam system and obtain written certification from manufacturer that installer is approved for installation of specified system. If requested, contractor must supply owner with a copy of this certification.
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C. The Contractor shall have demonstrated its proficiency by having a satisfactory record of performance in the following areas:

1. On-time completion of previous work of a similar size and scope.

2. No history of litigation, claims, or lawsuits relating to past or ongoing performance that may affect current performance.

3. Proven safety record as demonstrated by company documentation and workers compensation insurance Experience Modifier.

4. Positive record of post-completion warranty service to clients.

D. The roofing contractor shall maintain a full-time, non-working, non-changing, English-speaking Supervisor/Foreman on the job site during all phases of roofing and sheet metal work and at any time roofing work is in progress. A copy of the construction documents shall be in the possession of the Supervisor/Foremen and on the roof at all times.

1.9 SUBMITTALS

A. Submittals shall be provided in accordance with the General Conditions of the Contract. Provide a submittal cover sheet identifying the project by name and number and listing the following columns for review by the design professional with a separate sheet for each roof section.

1. Specification section

2. Description of brand and product

3. “Accepted”

4. “Rejected”

5. “Resubmit”

6. “Comments”

B. Provide a place for the design professional’s signature.

C. Manufacturer’s Letter of Certification: Provide a letter from the roofing material manufacturer using the exact language on the attached letter and listing all materials comprising any part of the roof assembly and stipulating that such materials are acceptable to the manufacturer and will be covered under the manufacturer’s 20-Year No Dollar Limit Total Roof System Guarantee.
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D. Shop Drawings: Show roofing system with flashings and accessories in plan, sections, and details. Include metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations; thermal expansion provisions and special supports. Indicate relationships with adjacent and interfacing work. Indicate fastener types and spacing, and provide fastener pullout values.

E. Product Data: Include manufacturer’s detailed material and system description, sealant and closure installation instructions, engineering performance data and finish specifications. Indicate fastener types and spacing; and required fastener pullout values.

F. Design Loads: Submit copy of manufacturer’s minimum design load ratings according to ASCE 7-98, Method 2 for Components and Cladding.

G. Design Test Reports: Provide certified test reports from an independent testing laboratory to show compliance with the performance criteria specified in Section 1.9. For system comparison purposes, tests performed on steel panels shall be acceptable for the specialty material specified herein.

1. ASTM E1592-95: Test results must clearly demonstrate compliance with the following requirements:

   a. The ultimate test failure load shall be reduced by the safety factor specified in Section 1.9 to determine the allowable working load for the panel system.

   b. The proposed system has been tested to insure that the allowable working load of the panel system meets or exceeds the specified negative wind uplift pressures listed in Section 1.9 of this specification for all roof zones.

   c. The test results are applicable for the thickness, width, and profile specified. Results are not applicable for systems that are thicker or wider than the system which was tested. If the tested material was not the specialty material specified herein (for instance, the tested material was galvalume steel), then the test results shall be reduced by the ratio of the yield strength (Fy) of the specified material to the tested material.

   d. The results must clearly show that the allowable clip spacing meets or exceeds the requirements specified in Section 3.2.C for all roof areas. Clip spacing shall not be reduced for any roof zone from that which is specified.

2. UL 580: The test report shall clearly show a rating of Class 90 over the same substrate as specified for this project. The clip spacing as tested for UL approval must be in compliance with the required clip spacing specified for this project in Section 3.2.C.

3. UL 790: The test report shall clearly show a rating of Class A roofing material.
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4. UL 263: The panel system shall clearly be shown as approved for use in an UL Construction Assembly which conforms to the construction of this project.

5. Samples: Provide full-scale mock-ups of the following materials and system components: roof underlayment, edge flashing, metal panel clips, metal panels, eave, rake, ridge cap, gutter, downspout, and any other unique conditions. Samples shall be of identical material type, thickness, panel width, and material grade/alloy/temper as the system specified for this project.

1.10 QUALITY ASSURANCE

A. Manufacturer Qualifications: The roofing system manufacturer shall have a minimum of five years experience in manufacturing metal roofing systems in the United States.

B. Manufacturer Inspections: As part of the roofing assembly, the roofing system manufacturer shall provide quality control inspections by an authorized representative as outlined below:

1. Manufacturer shall make at least three inspections, including at the beginning of construction, at approximately 50% completion, and at 100% roof completion. The inspections shall be provided at no additional cost to the owner.

2. Manufacturer shall notify the Owner in advance of such inspections and provide a copy of each inspection report to the Owner within seven (7) days of the inspection.

3. Manufacturer shall report to the Owner in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor’s attention by the Manufacturer.

4. Manufacturer shall confirm, after completion of the project and based on the Manufacturer’s observations and tests, that the Manufacturer has observed no application procedures in conflict with the specifications other than those that have been previously reported and corrected.

C. Pre-application Roofing Conference: Following the approval of submittals, and prior to the delivery of any roofing materials, conduct a pre-roofing conference with the following parties present:

1. Owner’s representative

2. Architect’s representative

3. General contractor’s representative

4. Roofing contractor’s Project Manager, Superintendent, and both roofing and sheet metal foremen
5. Roofing material manufacturer’s representative
6. Mechanical contractor representative
7. Plumbing contractor representative
8. Masonry, EIFS, plaster, or fireproofing contractor’s representative
9. Glazing or skylight representative

D. Objectives of the pre-roofing conference shall include:

1. Ensure that the Contractor’s field supervisors have read and understand the plans and specifications.
2. Review roofing system requirements (drawings, specifications, and other contract documents).
3. Review foreseeable methods and procedures related to roofing work, including coordination of other trades.
4. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations, and other preparatory work performed by other trades.
5. Review required submittals. Review and finalize construction schedule related to roofing work and verify availability of materials, Contractor’s personnel, equipment, and facilities needed to progress and avoid delays.
6. Review required inspection and testing procedures.
7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement).
8. Review notification procedures for weather or non-working days and requests for time extensions.
9. Prepare minutes of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending.

1.11 DELIVERY, STORAGE, AND HANDLING.

A. Manufacturer’s responsibility:

1. Deliver products to the site with seals and labels intact in manufacturer’s original containers, dry and undamaged.
2. Protect components during fabrication and packing from mechanical abuse, stains, discoloration, and corrosion.

3. Provide protective interleaving between contact areas of exposed surfaces to prevent abrasion during shipment, storage, and handling.

B. Installer’s responsibility:

1. Store materials off ground providing for drainage; under cover providing for air circulation; and protected from wind movement, foreign material contamination, mechanical damage, cement, lime or other corrosive substances.

2. Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from the site.

3. Protect panels from wind-related damages.

4. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

5. Store roof insulation, rolled goods, membrane materials, lumber, and fasteners in covered storage trailers or enclosed containers. Storing such materials with covered tarpaulins, plastic covers, or other temporary coverings is not acceptable. Store all rolled goods on end on pallets.

6. Metal roof panels may be stocked on the roof immediately prior to use. Other materials may not be stocked on the roof but shall be brought to the roof the day of application, and unused materials other than panels shall be removed at the end of the day and returned to proper storage.

7. Handle and store materials or equipment in such a manner as to avoid damage or permanent deflection of the roof deck or substrate.

1.12 PROJECT SITE CONDITIONS

A. Weather Condition Limitations: Means and method is the responsibility of the Contractor. Time extensions for inclement weather shall be granted, when applicable, within the terms of the General Conditions of the Contract.

B. Proceed with roofing work only when existing and forecasted weather conditions will permit the unit of work to be installed in accordance with the manufacturer’s recommendations and warranty requirements.

C. Do not expose vulnerable materials to water or sun damage in quantities greater than can be weatherproofed during the same day. Insulation becoming wet due to rain shall be removed and replaced.
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D. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal roofing system.

E. Protection:
   1. Provide protection or avoid traffic on completed roof surfaces.
   2. Do not overload roof with stored materials.
   3. Support no roof-mounted equipment directly on roofing system.

F. Ascertain that work of other trades which penetrates the roof is made watertight and is in place and approved prior to installation of roofing.

1.13 WARRANTIES

A. Texas State University shall receive ONE (1) WARRANTY from manufacturer of roof panels and modified roofing assembly covering ALL of the following criteria. Multiple warranties are NOT acceptable.
   1. The warranty shall consist of a 20-Year Manufacturer’s No Dollar Limit Total System Weathertight Guarantee including coverage for all trim, flashings, and penetrations associated with the standing seam roof area.
   2. Twenty-year coverage on finish including checking, crazing, peeling, chalking, fading, and/or adhesion.
   3. Warranty shall commence on date of substantial completion.
   4. Installer shall provide manufacturer with 2-year warranty covering roofing system installation and watertightness.
   5. ONE manufacturer shall provide a single warranty for standing seam roof areas, membrane roof areas, and transitions between the two material types.

PART 2 PRODUCTS

2.1 STANDING SEAM ROOFING SYSTEM

A. General:
   1. Whenever a particular make of material, trade name, and/or manufacturer’s name is specified herein, it shall be regarded as being indicative of the minimum standard of quality required.
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2. Product names for the metal roof panel system and waterproofing materials used in this section shall be based on performance characteristics and shall form the basis of the contract documents.

B. Materials:

1. Panel material: 20 oz. per square foot copper, H01 or H02 temper, smooth as per ASTM B370-92.

C. Finish on surfaces:

1. Exposed and unexposed surfaces for uncoated panels shall be as-shipped from the mill.

D. Characteristics:

1. The same panel profile from a single manufacturer shall be used for ALL standing seam roof areas.

2. Configuration: Standing seams incorporating mechanically interlocked, concealed anchor clips allowing unlimited thermal movement, and of configuration which will prevent entrance or passage of water.

   a. Panel/Cap configuration must of multiple layers of copper surrounding anchor clip for prevention of water infiltration and increased system strength designed to limit potential for panel blow-off.

   b. Profile of panel shall have stiffeners to clear hardware. These will also absorb thermal stresses, reduce oil canning in panel, and increase load carrying capacity.

   c. Exposed fasteners, screws, and/or roof mastic are unacceptable and will be rejected. System configuration only allows for exposed fasteners at panel overlap (if required) and trim details (as per manufacturer’s guidelines).

   d. Panels must be furnished in lengths as shown on plans.

   e. Panels: panels shall be formed from a single piece of metal. Panels formed from multiple pieces of joined metal are unacceptable. All performance tests must be applicable for the greatest panel width of the panels. Panels must be designed to accommodate thermal expansion and contraction while fixed at the middle of the panel.

3. Seam must be 2-3/8-inch minimum height for added upward pressures and aesthetic appeal. Seam shall have continuous anchor reveals to allow anchor clips to resist positive and negative loading and allow unlimited expansion and
SECTION 07 61 13 – STANDING SEAM SHEET METAL ROOFING

contraction of panels due to thermal changes. Integral (not mechanically sealed) seams are not acceptable.

a. Concealed Standard Anchor Clips: Clips must be 16-gauge stainless steel, alloy 316L, ONE (1) piece clip with projecting legs for additional panel alignment and provision for unlimited thermal movement in each direction along the longitudinal dimension.

b. Two-piece (2) clips must provide adequate movement.

c. Clip design must isolate sealant in panel cap from clip to insure that no sealant damage occurs from the clip during expansion and contraction.

d. Clip must maintain a clearance between panel and substrate for proper ventilation to help prevent condensation on underside of panel and eliminate the contact of panel fastener head to panel.


5. Stiffening ribs: Located in flat of panel to minimize oil canning and telegraphing of structural members.

6. Replaceability: Panels shall be of a symmetrical design with configuration such that individual panels may be removed for replacement without removing adjacent panels.

7. Panel ends shall be panned at ridge, headwall, and hip conditions where applicable.

8. Panel length: Full length without joints, including bends.

9. Gable anchor clips: Standing Seam style 16-gauge stainless steel alloy 316L.

10. Fasteners:

   a. Concealed fasteners: Fasteners designed for cementitious wood fiber decks such as Tectum as manufactured by Olympic, Deckfast, Buildex or as tested and approved by metal panel manufacturer.

   b. Exposed fasteners: Series 410 stainless steel screws or 1/8-inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to simulate material/color of the standing seam panels.

11. Closures: Factory precut closed cell foam meeting ASTM D1056 and/or D3575, enclosed in metal channel matching panels when used at hip and ridge.

12. Provide all miscellaneous accessories for complete installation.
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2.2 ACCESSORY PRODUCTS

A. Membrane Underlayment:
   2. Slip Sheet: minimum 5 lb/100 sq. ft. rosin-sized building paper.

B. Sealant:
   1. Acceptable product: Sonolastic 150 with VLM.
      a. Other products to be submitted shall meet the following criteria.
         1) 100% Elongation
         2) Federal specification TT-S-001534A, Type II, Class A, Type Non-sag
         3) Federal specification TT-S-00230C, Type II, Class A
         4) ASTM C920, Type S, Grade NS, Class 25. Use NT, M, A, G and O
         5) Corps of Engineers CRD-C-541, Type II, Class A
         6) JIS A5758, Type F, Class 20LM, Type 25HM
         7) ISO 11600, Class F, Type 20 LM, Type 25HM

   2. Colors: As selected by Architect from sealant manufacturer’s standard selection.

C. Bearing Plates:
   1. Install bearing plates directly over rigid board insulation/underlayment at each anchor clip location.
   2. Bearing plates shall be 3 inches x 5 inches x 16-gauge (minimum) galvanized steel.
   3. Bearing plates shall be pre-punched with a hole pattern matching that of the panel anchor clips. Slotted holes are acceptable.

D. Thermal Spacers: Where panels attach directly to purlins, provide thermal spacers recommended by panel manufacturer.

E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat exposed edges of flashing.

F. Form flashing components from full single width sheet in minimum 10’-0” sections. Provide mitered corners, joined using closed end stainless steel pop rivets and joint sealant.
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G. Fabricate roofing and related sheet metal work in accord with approved shop drawings and applicable standards.

H. Safety Tie-offs: Provide OSHA approved safety tie-offs properly flashed and anchored into the structure suitable for providing fall-protection for workers on the roof.

PART 3 EXECUTION

3.1 PREPARATION

A. Inspection: Examine the alignment and placement of the building structure and substrate. Correct any objectionable warp, waves, or buckles in the substrate before proceeding with installation of the pre-formed metal roofing. The installed roof panels will follow the contour of the structure and may appear irregular if not corrected.

B. Establish straight side and crosswise benchmarks.

C. Use proper size and length fastener for strength requirements. Approximately 5/16 inch is allowable for maximum fastener head size beneath the panel.

D. Rectangular Roofs shall be checked for square and straightness. Gable ends may not be straight; set a true line for the gable clips and flashing with string line.

E. Measure the roof lengthwise to confirm panel lengths, overhangs, and coverage of flashings at eaves and ridges, and verify clearances for thermal movement.

3.2 ROOFING AND FLASHING INSTALLATION

A. All details will be shown on manufacturer’s shop drawings to successful bidder; install roofing and flashings in accordance with approved shop drawings and manufacturer’s product data, within specified erection tolerances.

B. Prepare roof for the installation of standing seam panels, including installing all underlayments and/or temporary waterproofing materials as required in this specification and bid documents.

C. Directly over the prepared roof substrate, install one-piece panel anchor clips. All anchor clips will be set on 16-gauge galvanized pre-punched bearing plates to distribute the loads on the board insulation. All anchor clips will be fastened into the structural roof substrate based on the spacing pattern certified and tested by the roofing material manufacturer for the required wind uplift rating. This clip spacing must be followed to ensure integrity of the completed installation. These have been determined based on the uplift calculations for the specified roof and the test results of ASTM E1592.

D. Installation of Roof Panels: Roof panels can be installed by starting from either end and working toward the opposite end. Due to the symmetrical design of the specified panel...
SECTION 07 61 13 – STANDING SEAM SHEET METAL ROOFING

system, it is also acceptable to start from the middle of the roof and work toward each end.

1. A stainless steel pop rivet shall be secured through the anchor reveal of the panel leg and extend into the arms of the panel clip located at the ridge of the system. This is done at each arm of the clip along the ridge. The panel is then anchored at both sides of the clip.
   a. Be sure to capture all drilling debris during this operation with a rag or cloth placed on the panels at the drilling operation.
   b. Panels are not securely attached to the roof until fixed to the anchor clip. To avoid damage and injury, all panels shall be fixed to the anchor clip immediately as they are installed.

2. To install the panels, hook one side of the ridge over the panel edge and rotate over the opposite panel leg. For ease of installation, start at one end of the panel and work toward the opposite end.

3. A hand crimping tool is used to crimp the seam around the top of two adjacent panels.

4. Seams shall then be permanently seamed with manufacturer’s mechanical seamer.

5. At the end of each day’s work, seams shall be mechanically seamed or hand crimped (crimp 4 inches every 8 feet) to reduce the possibility of wind damage prior to completion of the project.

6. Uninstalled panels which are temporarily stored on the ground or roof shall be secured in place at the end of each day’s work to prevent possible damage or injury.

E. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.

F. Limit exposed fasteners to extent indicated on shop drawings.

G. Anchorage shall allow for temperature expansion/contraction movement without stress or elongation of panels, clips, or anchors. Attach clips to structural substrate using fasteners of size and spacing as determined by manufacturer’s design analysis to resist specified uplift and thermal movement forces.

H. Seal laps and joints in accordance with roofing system manufacturer’s product data.
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I. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in accordance with standards of SMACNA Sheet Metal, 6th Edition.

J. Provide for temperature expansion/contraction movement of panels at roof penetrations and roof mounted equipment in accordance with system manufacturer’s product data and design calculations.

K. Installed system shall be true to line and plane and free of dents and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.

L. Maximum variation from true planes or lines shall be 1/4 inch in 20 feet and 3/8 inch in 40 feet of more.

M. Form joints in linear sheet metal to allow for 1/4 inch minimum expansion at 20’-0” o.c. maximum and 8’-0” from corners.

N. At joints in linear sheet metal items, set sheet metal items in two 1/4-inch beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

O. Remove damaged work and replace with new, undamaged components.

P. Touch-up exposed fasteners using paint furnished by roofing panel manufacturer and matching exposed panel surface finish.

Q. Clean exposed surfaces of roofing and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.
MANUFACTURER’S CERTIFICATION OF MATERIALS

(ROOFING MATERIAL MANUFACTURER’S LETTERHEAD)

Date

«OWNERREP»
«OWNERTITLE»
«OWNERCOMPANY»
«OWNERADDRESS»
«OWNERCITY» «OWNERZIP»

Subject:

Dear «OWNERREP»,

We are pleased to offer to supply the roofing materials for the roofing project named above. We hereby certify that (Name of Contractor) is an approved roofing contractor/applicator with our firm for the term or type of warranty stipulated below.

The conditions stipulated and representations in this letter are made by us as an inducement to you to use our materials on your roofing job. We propose to furnish roofing materials necessary to provide a watertight roofing assembly on the above project. We hereby represent to you that if our materials are selected for use on your job complying with our standard specifications, upon specific further request, we will issue a twenty (20) year "No dollar Limit" material and labor guarantee on the entire roofing assembly, including insulation system and flashings, on the form required in these specifications, so long as the assembly consists of the materials listed below.

We approve the following materials for use as components of the roofing assembly we offer to guarantee, and such materials are approved as components of a roof assembly using our materials whether or not we issue a manufacturer's guarantee:

(List specifically by brand name, material number, and ASTM designation)

Metal Roofing System and components
Roofing underlayment and secondary moisture protection
Roof insulation
Mastics and adhesives
Roof or insulation fasteners
Wood, carpentry, or lumber
Other miscellaneous components, expansion joints, drains, vents, flashings and sheet metal
Special requirements or installation conditions not published in standard specifications
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In addition, we will provide such inspections as we deem necessary. By means of this letter, we also certify that the contractor listed above has applied for the required warranty and made the necessary payment to cause issuance of the warranty. In the event that anything arises during the course of this transaction, including, but not limited to, failure by the contractor to make full payment for the warranty, or quality assurance issues, which might jeopardize issuance of this warranty, we will notify you, the owner, in writing timely to give you the chance to rectify such problems and cause issuance of the warranty as stipulated above.

Yours very truly,

COMPANY NAME

Signed by
Authorized Representative
CONSTRUCTION STANDARDS                DIVISION 07 – THERMAL & MOISTURE PROTECTION

SECTION 07 61 13 – STANDING SEAM SHEET METAL ROOFING

CONTRACTOR’S CERTIFICATE OF GUARANTEE

TO: «OWNERREP»
PROJECT: «PROJSITE»
«SITEADDRESS»
«SITECITY» «SITEZIP»

OWNER: «OWNERCOMPANY»

EFFECTIVE DATE:

We, the undersigned, hereby GUARANTEE all of the work performed and materials either placed and/or supplied by the undersigned under this contract against defective workmanship and/or materials for a period of two (2) years following the date of completion and the Owner's acceptance of the work performed in accordance with the General Conditions of the Specifications, and the contract for this project.

Upon notice by the Owner, the undersigned Contractor will replace faulty workmanship and/or materials furnished or installed by the undersigned contractor which may be evidenced during the guarantee period without cost or charge to the Owner, whether or not such faulty workmanship results in moisture leaks. Faulty workmanship and materials shall include but not be limited to the following:

Leaks in the roofing system or components installed as part of this job
Faulty attachment or leaks resulting from metal roofing, sheet metal, flashings or any other components furnished under this contract
Flaws or deficiencies in the metal finish.
Flaws or deficiencies in sealants
Flaws or deficiencies in the underlayment or secondary moisture protection.

We agree to inspect the roof with the Owner or Owner's representative within sixty (60) days prior to the expiration of this warranty. If defects as noted above are not corrected by the expiration date of this guarantee, this guarantee shall be extended until such time as all defects present at the time of the inspection noted above have been corrected to the Owner's satisfaction. In case the undersigned Contractor fails to remedy such defects within a reasonable period of time following notice, the Owner may furnish such materials or labor as may be necessary to bring or restore the work to the standards originally specified and the undersigned Contractor agrees to reimburse the Owner fully and promptly for all costs incurred in obtaining such compliance. Correction of defects in workmanship and materials shall not, however, relieve the Owner of responsibility for normal and routine maintenance and cleaning of the roof, and the Contractor shall not be held responsible for routine maintenance.
SECTION 07 61 13 – STANDING SEAM SHEET METAL ROOFING

Certified this _____ day of _________________________, 20____.

CONTRACTOR:
BY:
TITLE:
DATE:
CONSTRUCTION STANDARDS

DIVISION 07 – THERMAL & MOISTURE PROTECTION

SECTION 07 61 13 – STANDING SEAM SHEET METAL ROOFING

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SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for assemblies of doors, sidelights, bulkheads, sills, etc., including, but not limited to, glass doors for exterior or interior applications.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Avoid use of pocket sliding doors.

B. Avoid use of folding doors.

C. No sliding or folding doors in path of exit access.

D. In door clearance selection consider the possibility of future change of floor surface height such as is occasioned by the addition of carpet.

E. Wherever possible use single doors rather than pairs of doors.

F. Generally use doors which are flush or which utilize the simplest form of trim.

G. Do not use louvered doors for decorative purposes.

H. Provide positive slope away from exterior side of exterior door to prevent water backup.

I. Where consistent with building design, protect exterior door with vestibules, canopies or the like.

J. For energy conservation where practical, incorporate an air lock vestibule in main (heavy traffic) doors opening to the outside.

K. Use removable mullions in pairs of doors to provide best locking condition.

L. Doors on electrical rooms or closets should swing out.

M. Doors on transformer vault rooms are required to swing out to conform to NFPA
SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

Standards.

N. Glass with Door.

1. Use Tempered or safety glass in entrance doors and in sidelights at entrances.

2. Provide suitable rail protection or decals as warning at glass doors and glass sidelights where glass panels extend down near floors.

3. Generally avoid extending glass down to floor level.

4. Provide curbs at base of glass panels to protect glass from cleaning equipment and to prevent furniture from being pushed into glass.

5. Avoid use of excessively large glass panels in doors and sidelights.

6. In fire rated wall or partition, glass vision panels or glass sidelights must comply with International Building Code and the NFPA Life Safety Code.

7. Provide vision panels at interior occupied room locations.

O. Wires for electrified hardware must be in conduit.

1.03 Reference Standards

A. Steel Door Institute (latest version of Recommended Specifications)

1.04 Quality Control

A. Comply with ANSI/SDI 100.

B. Fire/Smoke Doors.

1. Where required by NFPA Standard 101, Life Safety Code, only tested & labeled fire rated door/frame assemblies will be installed.

2. Electronic hold-open and release mechanisms on fire doors can be used where approved by the Project Representative.

3. Comply with NFPA 80 Fire Doors and Other Opening Protectives.

PART 2: PRODUCTS
SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

2.01 General

A. Frame gauge (minimum): 16 for interior & 14 for exterior.

B. Door face sheet gauge (minimum): 18 for interior & 16 for exterior.

C. Interior doors: Grade II-Heavy Duty, Model 2-Seamless.

D. Exterior doors: Grade III-Extra Heavy Duty, Model 2-Seamless.

E. Frames welded & mitered smooth. Knock-down frames are not acceptable.

F. Sizes: Generally, provide minimum 36” wide single doors to ensure accessibility to the handicapped. Use standard size doors, not exceeding 7’-0” height & 3’-6” width. Insure doors are sized to permit movement of furnishings, supplies & equipment.

G. Provide adequate reinforcements for anchors & hardware.

H. Close top of door, do not leave an open channel.

PART 3: EXECUTION

A. Consultants shall coordinate security system & hardware requirements with this section to provide necessary hardware preps, mortar boxes, & reinforcing as part of the construction contract.

B. Hardware submittal must be reviewed and approved before frames and doors are ordered.

C. After installation of frames, insure frames are plumb, level and square.

END OF SECTION 08 11 13
SECTION 08 14 16 – FLUSH WOOD DOORS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for wood doors and panels; fire-rated and non-fire-rated; flush wood doors and panels with veneer facings.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Avoid use of pocket sliding doors.

B. Avoid use of folding doors.

C. No sliding or folding doors in path of exit access.

D. In door clearance selection consider the possibility of future change of floor surface height such as is occasioned by the addition of carpet.

E. Wherever possible use single doors rather than pairs of doors.

F. Generally use doors which are flush or which utilize the simplest form of trim.

G. Do not use louvered doors for decorative purposes.

H. For energy conservation where practical, incorporate an air lock vestibule in main (heavy traffic) doors opening to the outside.

I. Use removable mullions in pairs of doors to provide best locking condition.

J. Doors on electrical rooms or closets should swing out.

K. Doors on transformer vault rooms are required to swing out to conform to the NFPA Standards.

L. Wood doors should not be used on the exterior.

M. Flush bolts should not be used on wood doors.
SECTION 08 14 16 – FLUSH WOOD DOORS

N. Glass with Door.
   a. Use Tempered or safety glass in entrance doors and in sidelights at entrances.
   b. Provide suitable rail protection or decals as warning at glass doors and glass sidelights where glass panels extend down near floors.
   c. Generally avoid extending glass down to floor level.
   d. Where light kits are used a 10” stile is required on latch side.
   e. Provide curbs at base of glass panels to protect glass from cleaning equipment and to prevent furniture from being pushed into glass.
   f. Avoid use of excessively large glass panels in doors and sidelights.
   g. In fire rated wall or partition, glass vision panels or glass sidelights must comply with International Building Code and the NFPA Life Safety Code.
   h. Provide vision panels at interior occupied room locations.

O. Wires for electrified hardware must be in conduit.

1.03 Quality Control

A. Doors shall comply with National Wood Window and Door Association Standards (NWWDA).


C. Contractor shall comply with Architectural Woodwork Institute (AWI)

D. Warranty: Maximum warranty available will be required. Lifetime warranty preferred.

E. Contractor shall not be permitted to install doors prior to building having conditioned air.

F. Fire/Smoke Doors

1. Where required by NFPA Standard 101, Life Safety Code, only tested & labeled fire rated door/frame assemblies will be installed.
SECTION 08 14 16 – FLUSH WOOD DOORS

2. Electronic hold-open and release mechanisms on fire doors can be used where approved by the Project Representative.

3. Comply with NFPA 80 Fire Doors and Other Opening Protectives.

PART 2: PRODUCTS

2.01 General

A. Grade: AWI Premium

B. Faces: Selected veneers and Cutting (Quarter Cut or Rift Cut), Matching (Center Match), and Coloring by Texas State University and Consultant.

C. Finish: Transparent finish AWI-TR3 Water Based Acrylic Lacquer, semi-filled, factory applied. Sheen to be satin.

D. Construction: 7 ply, 1 ¾” minimum door thickness.

E. Core: Solid block staved lumber; fire-rated mineral core. Hollow core doors are not acceptable.

F. Edges: Same species as face lumber or veneer; sanded ease, no visible joints allowed. Fire-rated mineral core doors to have minimum 1 3/8” thick solid edges or solid blocking at hinge lockset and closer locations, 4 ½” top & bottom rails.

G. Face veneers for building renovations:
   1. Match existing doors.

H. Face veneers for new buildings:
   1. Architect specified as approved by Project Representative.

I. Face veneers for Round Rock Campus Building:
   1. White maple veneer (SR#13017 with “bronze” finish, by Buell Door Co.)
   2. Plain cut
   3. Book matched
   4. Stained Cherry color to match existing doors.
SECTION 08 14 16 – FLUSH WOOD DOORS
   a. Satin sheen

PART 3: EXECUTION

A. Consultants shall coordinate security system & hardware requirements with this section to provide necessary hardware preps & reinforcing as part of the construction contract.

B. Hardware submittal must be reviewed and approved before doors are ordered.

END OF SECTION 08 14 16
SECTION 08 15 13 – LAMINATED PLASTIC FACED DOORS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for wood doors and panels; fire-rated and non-fire-rated; flush wood doors and panels with veneer facings.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Avoid use of pocket sliding doors.

B. Avoid use of folding doors.

C. No sliding or folding doors in path of exit access.

D. In door clearance selection consider the possibility of future change of floor surface height such as is occasioned by the addition of carpet.

E. Wherever possible use single doors rather than pairs of doors.

F. Generally use doors which are flush or which utilize the simplest form of trim.

G. Do not use louvered doors for decorative purposes.

H. For energy conservation where practical, incorporate an air lock vestibule in main (heavy traffic) doors opening to the outside.

I. Use removable mullions in pairs of doors to provide best locking condition.

J. Doors on electrical rooms or closets should swing out.

K. Doors on transformer vault rooms are required to swing out to conform to NFPA Standards.

L. Laminated plastic faced doors should not be used on the exterior.

M. Flush bolts should not be used on laminated plastic faced doors.
SECTION 08 15 13 – LAMINATED PLASTIC FACED DOORS

L. Glass with Door.

1. Use Tempered or safety glass in entrance doors and in sidelights at entrances.

2. Provide suitable rail protection or decals as warning at glass doors and glass sidelights where glass panels extend down near floors.

3. Generally avoid extending glass down to floor level.

4. Provide curbs at base of glass panels to protect glass from cleaning equipment and to prevent furniture from being pushed into glass.

5. Avoid use of excessively large glass panels in doors and sidelights.

6. In fire rated wall or partition, glass vision panels or glass sidelights must comply with International Building Code and the NFPA Life Safety Code.

7. Provide vision panels at interior occupied room locations.

8. Where light kits are used a 10” stile is required on latch side.

O. Wires for electrified hardware must be in conduit.

1.03 Quality Control

A. Doors shall comply with National Wood Window and Door Association Standards (NWWDA).


C. Contractor shall comply with Architectural Woodwork Institute (AWI)

D. NEMA LD3-High Pressure Laminates

E. Warranty: Maximum warranty available will be required. Lifetime warranty preferred.

F. Contractor shall install doors prior to building having conditioned air.

G. Fire/Smoke Doors

1. Where required by NFPA Standard 101, Life Safety Code only tested & labeled fire rated door/frame assemblies will be installed.
SECTION 08 15 13 – LAMINATED PLASTIC FACED DOORS

2. Electronic hold-open and release mechanisms on fire doors can be used where approved by the Project Representative.

3. Comply with NFPA 80 Fire Doors and Other Opening Protectives.

PART 2: PRODUCTS

2.01 General

A. Grade: AWI Premium. AWI 1300; PC-HPDL-3


C. Construction: 7 ply, 1 ¾” minimum door thickness.

D. Core: Solid block staved lumber; fire-rated mineral core. Hollow core doors are not acceptable.

E. Edges: Plastic laminate edge trim to match face; no visible joints allowed. Fire-rated mineral core doors to have minimum 1 3/8” thick solid edges or solid blocking at hinge lockset and closer locations, 4 ½” top & bottom rails.

F. Verify plastic laminate door appearance matches or coordinates with plastic laminate used elsewhere on project.

PART 3: EXECUTION

A. Consultants shall coordinate security system & hardware requirements with this section to provide necessary hardware preps & reinforcing as part of the construction contract.

B. Hardware submittal must be reviewed and approved before doors are ordered.

END OF SECTION 08 15 13
SECTION 08 31 00 – ACCESS DOORS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for access doors and frames for ceilings, floors, and walls.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. General locations:
   1. Access doors are to be provided for all maintenance points where immediate access is required.
   2. A/E is to specify that contractor shall coordinate trades to locate items needing maintenance access in grouped locations to minimize access doors.
   3. Contractor shall coordinate access door layout with Texas State University Project Representative in advance of constructing door(s).

B. Locking: Provide lockable access doors when they are located in public areas or where providing access to crawl spaces. Utilize Access Panels that will accept a mortise or rim cylinder. Cylinders and cores should be specified in Finish Hardware 087100.

C. Minimum sizes: Coordinate with Specification Division 22, 23, and 26, and with specific job requirements.
   1. In wall, 18” x 18” square door: Plumbing valves, arrestors, hammers, reset buttons, controls manometers, etc.
   2. In wall, 24” x 24” square door: Plumbing fittings at toilets, mechanical filters banks, access hatches, areas requiring work access for unit replacement, etc.
   3. In ceiling, 24” x 24” square door: Above ceiling cut-off valves, duct dampers, fire and/or smoke dampers, meters, registers, etc.
SECTION 08 31 00 – ACCESS DOORS

4. In ceiling, 24” x 30” square door: HVAC filter units, remote duct dampers, remote fire dampers, remote electrical J-boxes, access hatches, etc.

D. For concealed dampers, provide extended operators to be easily reachable from access door.

E. Provide galvanized and painted finish on all exterior access doors.

F. Wires for electrified hardware must be in conduit.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 08 31 00
SECTION 08 33 13 – OVERHEAD COILING COUNTER DOORS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for swing-up, sectional, paneled doors with operators, tracks, controls, etc.; includes operators and special hardware for upward acting doors.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Operation: Motorized. Provide access to motor in the ceiling. Provide access at the jamb for the chain operation assembly.

B. Fire rated: When in a fire rated assembly, the overhead coiling counter door shall be rated appropriately. The unit shall be connected to the fire alarm system and shall not be a “release and gravity drop” type.

C. Locking: Locking device shall be mechanical type. Lock cylinder to be Schlage Full Size Interchangeable Core and compatible with building keying schedule. Core should be specified in Finish Hardware 087100 and core should be keyed into the Master Key System.

1.03 Quality Control

A. Type: Metal is preferred. Shutters shall be fire-rated when opening onto corridors.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 08 33 13
SECTION 08 35 13.13 – ACCORDION FOLDING DOORS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for accordion folding doors.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Use of accordion folding doors is not preferred on the Texas State University campus.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 08 35 13.13
PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Bronze Framed Entrances and Storefronts.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. All exterior storefront entry doors will have 5” stiles, 4”-6” horizontal rail centered on mounting height of exit device hardware, and a 10” bottom rail.

B. All entrances and storefronts will have an anodized dark bronze finish.

C. All entrances and storefronts at the Round Rock Campus will have an anodized clear finish.

D. All door hardware should be specified in Finish Hardware 087100.

E. Glass with door sidelights:

1. Use tempered or safety glass in entrance doors and in sidelights at entrances.

2. Provide suitable rail protection or decals as warning at glass doors and glass sidelights where glass panels extend down near floors.

3. Generally avoid extending glass down to floor level.

4. Provide curbs at base of glass panels to protect glass from cleaning equipment and to prevent furniture from being pushed into glass.

5. Avoid use of excessively large glass panels in doors and sidelights.

6. In fire rated wall or partition, glass vision panels or glass sidelights must comply with International Building Code and the NFPA Life Safety Code.
SECTION 08 41 16 – BRONZE FRAMED ENTRANCE & STOREFRONTS

1.03 Warranty

A. Comply with Uniform General Conditions and Division 00, except extend to 3 years, agreeing to repair or replace materials or workmanship that has failed within the warranty period.

PART 2: PRODUCTS

2.01 Acceptable Manufacturers

General: For the purpose of establishing the minimum functional, aesthetic and quality standards required for the work of this section, products of the following manufacturer are specified:

Kawneer Company Inc./Norcross, Georgia.

<table>
<thead>
<tr>
<th>Hardware</th>
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</thead>
<tbody>
<tr>
<td><strong>Pairs of Entry Doors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pull Bar</td>
<td>2 each</td>
<td>Kawneer Style CD-12, 630 Satin Stainless Steel</td>
</tr>
<tr>
<td>Overhead Stop/Holder</td>
<td>1 each</td>
<td>GJ 104H x 110 deg. x US 10B</td>
</tr>
<tr>
<td>Removable Aluminum Mullion</td>
<td>1 each</td>
<td>Kawneer, Dark bronze</td>
</tr>
<tr>
<td>(No Exterior Exposure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exit Device Lockset</td>
<td>2 each</td>
<td>Von Duprin CD, 98 Rim Device, EO, Duranodic Dark Bronze, With dogging cylinder</td>
</tr>
<tr>
<td>Cylinders, Interchangeable</td>
<td>2 each</td>
<td>Schlage Primus Rim, 20-740, 613 oiled rubbed bronze</td>
</tr>
<tr>
<td>Cylinders, Interchangeable</td>
<td>2 each</td>
<td>Schlage Primus Mortised, 20-740, 613 oiled rubbed bronze</td>
</tr>
<tr>
<td>Floor Closer</td>
<td>2 each</td>
<td>Rixon PH 27105, NHO x 613 oiled rubbed bronze</td>
</tr>
<tr>
<td>Intermediate Pivot</td>
<td>4 each</td>
<td>Kawneer, offset pivot, dark bronze</td>
</tr>
<tr>
<td>Bottom Pivot</td>
<td>2 each</td>
<td>Kawneer, bottom</td>
</tr>
<tr>
<td>Top Pivot</td>
<td>2 each</td>
<td>Kawneer, top offset pivot, Dark bronze</td>
</tr>
<tr>
<td>Threshold</td>
<td>2 each</td>
<td>Rixon</td>
</tr>
</tbody>
</table>

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Bronze Framed Entrance-08 41 16-2
SECTION 08 41 16 – BRONZE FRAMED ENTRANCE & STOREFRONTS

PH x 3 x 700 x x 72” x 1 ¼” x x PH 27 x BZ (613E),
with mitered returns

PART 3: EXECUTION

A. Consultants shall coordinate security system & hardware requirements with this section to provide necessary conduit, wire runs, hardware preps & reinforcing as part of the construction contract.

B. Hardware submittal must be reviewed and approved before frames and doors are ordered.

C. After installation of frames, insure frames are plumb, level and square.

END OF SECTION 08 41 16
SECTION 08 51 13 – ALUMINUM WINDOWS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for aluminum windows for exterior applications.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Window Design


2. Windows shall be vertically proportional.

3. Horizontal proportioned windows are forbidden.

4. Use aluminum windows with dark bronze anodized finish. Do not use windows of wood or steel.

5. Glaze windows and any fixed glass panels with heat absorbing glare reducing bronze tone glass.

6. Consider use of double-glazing for windows. For energy conservation windows facing west, southwest, east and southeast should be designed to be shaded from the morning and afternoon sun. Low-E coatings are encouraged.

7. Design fenestrations (deeply recessed, splayed, sculptured rectangular window cavities) which become a major motif in the overall design of the building envelope.

8. All windows sills shall be sloped for drainage. Exploit design of fenestration to reinforce unity with other recently constructed university buildings.

9. Avoid the excessive use of glass. Avoid the use of glass blocks.
SECTION 08 51 13 – ALUMINUM WINDOWS

10. Use either tempered or safety glass as required by codes.

11. Avoid placing of devices such as exterior louvers or decorative pierced masonry, over windows, which would interfere with the washing of windows.

PART 2: PRODUCT (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 08 51 13
PART 1: GENERAL:

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for door hardware.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

C. Door hardware must balance aesthetics and function, with function taking priority.

D. Door hardware, locks, and security components must be approved by the Texas State University Access Services/Locksmith/Carpenter Shop Department prior to the Owner signing off on Substantial Completion.

1.02 Design Guidelines:

A. Finish Hardware Specification including hardware sets for all openings should be provided to Texas State University Access Services/Locksmith at the 50%, 75%, 100% Review Construction Document stage.

B. Finish Hardware for Entrance and Storefronts, Storefronts, Curtain Wall and Glazed Assemblies – Section 084400 should be specified in Finish Hardware 087100.

C. New Buildings – Hardware finish shall be 613 Satin Bronze, oil rubbed, 626 Satin Chrome, 630 Satin Stainless Steel or 313 to match doors/frame, except for handles and push plates and pulls which shall be 630 Stainless Steel. Coordinate with door/frame specification.

D. Existing Building – Match existing.

PART 2: PRODUCTS

A. The following products should not be used on Texas State University projects without approval of Texas State University Access Services/Locksmith/Carpenter Shop:

   Pivots
   Spring hinges
SECTION 08 71 00 – HARDWARE

Overhead concealed closers
Floor closers
Vertical rod exit devices
Manual Flush Bolts
Automatic Flush Bolts
Electromagnetic locks
Electric strikes

B. Constant Latching Flushbolts should only be used on hollow metal doors.

C. Cylindrical Locks/Latches:
Corridor to dorm should be ND73 Sparta lever on the corridor side, Athens lever on the interior side.
Classrooms should be ND97.
Card read doors must be ND80EU RX.
Maintenance, custodial, storage should be ND80.

Acceptable Manufacturers:
Schlage – ND Series – NO SUBSTITUTION

D. Cylinders:
Include cylinders and cores for Access Doors located in public areas or where providing access to crawl spaces, Coiling Doors and Grilles.

E. Exit Devices:
Utilize Rim Panic Devices only.
At pairs of doors use key removable mullion and mullion storage kit.
Classrooms:
Fire rated - 2 double cylinders with thumb turn cylinder.
(98-L-F-2-996-17 with XB11-979 Thumb-turn Rim Cylinder)
Non Fire rated - cylinder dogging with thumb turn cylinder.
Card read doors:
Card read door should include RX request to exit and E996L electrified trim.
Card read doors with automatic operators should be EL electric latch retraction and QEL quiet electric latch retraction RX request to exit and E996L electrified trim.
Acceptable Manufacturers:
Von Duprin – 98 Series – NO SUBSTITUTION

Exit Devices on wood exterior and interior doors only, shall be supplied and installed with thru-bolts.

F. Key System:
Large Format Interchangeable
Acceptable Manufacturers:
Schlage – Primus XP – NO SUBSTITUTION

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SECTION 08 71 00 – HARDWARE

G. **Kick Plate:**
   Custodial closets should have kick plates.

H. **Door Stops and Holders:**
   Where wall stop are used, provide and install blocking in the wall.

I. **Power Supply:**
   Coordinate power supply location with Access Services. Make sure to show location on electrical drawings.

J. **Alarmed Egress:**
   Where delayed egress is desired, but not allowed due to code utilize Chexit or Chexit module with 0 second nuisance and 0 second delay.

K. **Gate Hardware:**
   Specify the hardware for the personnel gates in Finish Hardware.

L. **Door Closers:**
   Closers on wood doors only shall be supplied and installed with thru-bolts.

PART 3: **EXECUTION:**

A. The following Finish Hardware Specification should be used for additional construction standards, for all project manuals and should include the hardware sets for all openings.
SECTION 08 71 13 – AUTOMATIC DOOR EQUIPMENT

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University, for actuating devices that allow doors to automatically open and close.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Texas State University campus preferences for ADA special closer systems are those as manufactured by LCN or Record USA.

1. The interior and exterior activator control shall be no lower or higher than 36” AFF.

B. Actuator type: Texas State University campus prefers hardwired actuators that are manually operated rather than automatically operated by a motion sensor.

C. Pneumatic automatic operators should only be used for smoke evacuation.

PART 2: PRODUCTS

2.01 Electric Powered Door Opener:

A. Approved Manufacturers:

1. LCN, Series 4000

2. Record USA, Series 8000

2.02 Hardwired Actuators:

A. Approved Manufacturers:

1. LCN, Series 8310
SECTION 08 71 13 – AUTOMATIC DOOR EQUIPMENT

PART 3: EXECUTION (NOT USED)

A. After installation has been completed and again, 3 months later, the manufacturer’s representative shall inspect that automatic operators are operating correctly.

B. Coordinate automatic operators with Access Services.

END OF SECTION 08 71 13
SECTION 08 81 00 – GLAZING

PART 1: GENERAL

1.01 Scope of Standard

   A. This standard provides general guidance concerning the specific preferences of Texas State University for transparent and translucent glass for general and special purpose applications.

   B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Quality Control

   A. In no instance will glass with a reflective film coating be acceptable.

   B. Wire glass: Use of this type product is not preferred.

1.03 General Requirements

   A. Other: For exterior glazing, use heat absorbing glare reducing of bronze tone, low E insulated glass, is preferred. Reflective glass is not to be used. Refer also to the “Texas State University Campus Master Plan Design Guidelines”, for additional information.

   B. Manufacturers stamp is to be provided on all glass required by code to be heat tempered, heat strengthened or safety.

   C. Asbestos: In no instance will any product containing asbestos be acceptable for use.

   D. Lead: In no instance will any product containing lead be acceptable for use.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 08 81 00
SECTION 08 81 13 – DECORATIVE GLASS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for etched, stained, beveled, sandblasted, or carved glass; includes decorative plastic films and overlays.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Quality Control

A. In no instance will glass with a film coating be acceptable.

B. Historic glass is to be replaced with a reproduction of like kind. In other instances, consult with the Texas State University Project Design Manager.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 08 81 13
DIVISION 09: FINISHES

09 21 13  Plaster Assemblies
09 21 16  Gypsum Board Assemblies
09 30 13  Ceramic Tile
09 51 13  Acoustical Panel Ceiling
09 53 23  Metal Acoustical Ceiling Suspension Assemblies
09 65 19  Resilient Tile Flooring & Base
09 66 00  Terrazzo Flooring
09 68 13  Carpet Tiles
09 68 16  Sheeting Carpeting
09 72 00  Vinyl Coated Fabric Wall Coverings
09 80 00  Sound Isolation
09 91 00  Paint
SECTION 09 21 13 – PLASTER ASSEMBLIES

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for plaster Assemblies.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specification for Texas State University-San Marcos projects.

1.02 Design Guidelines

A. Interior Plaster:

1. Plaster interior ceiling systems is not to be used on the Texas State University and satellite Campuses.

2. Interior Plaster Walls:

   a. On interior plaster walls, provide expansion joints or control joints at corners, windows/door openings, or other penetration openings.

   b. Outside corners are to be rounded with metal casing bead.

B. Exterior Plaster Ceilings

1. Exterior plaster ceilings shall be adequately braced for upward wind shear by the use of steel struts. Edges connections and penetrations shall be “bat and insect proofed”.

2. Provide access doors in exterior plaster ceilings, under accessible equipment, dampers, etc., for servicing.

C. Exterior Plaster Walls:

1. The approved plaster color for Texas State University is:

   Manufacturer: Lahabra

   Color: X-81 Oatmill – Base 200

   NOTE: Other manufacturers must custom match this color.
SECTION 09 21 13 – PLASTER ASSEMBLIES

2. On exterior plaster walls, provide expansion joints and or control joints, both horizontally and vertically, as recommended by ASTM C1063-Installation of Lath and Furring for Portland Cement Based Plaster.

3. Exterior Plaster Walls:
   a. On exterior plaster walls, provide expansion joints or control joints at corners, windows/door openings, or other penetration openings.
   b. Outside corners are to be rounded with metal casing bead.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 21 13
SECTION 09 21 16 – GYPSUM BOARD ASSEMBLIES

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for unfinished and pre-finished gypsum board, gypsum and cementations backing board, metal framing, trim, and accessories.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Plumb: All assemblies shall have a tolerance of 1/8” in 10’ maximum, non-cumulative.

B. Finish Standards: Level Four and Level Five Refer to Paint – Section 09 91 00.

C. Trim: All outside corners shall be floated with metal trim.

D. Partitions that are part of a perimeter security system, a fire rated assembly, or an acoustical assembly shall extend to structural deck.

E. All office partitions shall extend to structural deck, and have acoustical batt insulation providing a STC 45 rating, minimum.

F. Non-Fire rated partitions or non-acoustical partitions shall extend 6” above ceiling. Partition head tracks are not allowed to anchor to ceiling grids.

G. Wood blocking (2x10) shall be provided at all locations that will have door wall stop installed.

H. Gypsum Board Ceilings:

1. This ceiling type shall be minimally used; use only at areas where security, privacy, aesthetics, sound control, or fire ratings are required.

2. Provide access doors in gypsum board ceilings, for servicing equipment, filters, dampers, valves, etc.
SECTION 09 21 16 – GYPSUM BOARD ASSEMBLIES

1.03 Related Standards

A. Floor to floor full height assemblies: Refer to Section 09 80 00: Sound Isolation of Texas State University Design and Construction Standards.

B. Fire Stopping: Provide Fire stopping where required by Building Codes.

1.04 Reference Standards

A. Refer to UL rated assemblies manual for construction required to be rated by code.

B. Refer to US Gypsum Standards for control joints.

1.05 General Requirements

A. Asbestos: In no instance will any product containing asbestos be acceptable for use.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 21 16
SECTION 09 30 13 – CERAMIC TILE

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for tile surfaced units made of fired clay.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Where to use: Provide tile on all floors and walls up to ceiling height, including recessed cove lighting, in all toilets, locker rooms, showers, toweling areas and kitchens. Floor tile shall contain non-slip grit and be of appropriate hardness for the intended use.

B. Tile (ceramic and/or quarry) may be used at building entrance lobbies. Tile shall have a non-slip surface.

C. Finish: Finish shall be glazed on walls, matte on floors. Grout must be sealed per manufacturer’s written recommendations. A dark color grout shall be used on floors and walls.

D. Size, dimensions: Minimum tile size is 12” x 12” on floors and walls. Align grout joints at wall and floor. For exceptions, consult with the Texas State University project representative.

E. Patterns: Patterns shall be approved by the Texas State University project representative. Coordinate tile layout with room dimensions and modular trim pieces. Include cove base, manufactured corners and modular trim pieces.

1.03 Reference Standards

A. Tile Council of America assemblies: The Texas State University campus standards shall adhere to these guidelines.

1.04 General Requirements

A. Over-stock: Provide 5% overage except at large jobs, over 10,000 s.f., where only 2% overage shall be required. Verify storage with project representative.
SECTION 09 30 13 – CERAMIC TILE

B. Contractor shall provide shop drawings indicating location of all expansion joints.

C. Contractor shall provide written cleaning and maintenance instructions with substantial completion close-out documentation.

D. Contractor shall provide information on tile in substantial completion close-out documentation. Include manufacturer, type, grade, pattern and color.

PART 2: PRODUCTS

A. Substrate: Use cement board in lieu of using water resistant gypsum board (greenboard).

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 30 13
SECTION 09 51 13 – ACOUSTICAL PANEL CEILING

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for acoustical ceiling tiles and panels, perforated metal panel ceiling systems, and materials manufactured as finished acoustical ceiling surfaces.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Patterns: Patterns shall be fissured and non-directional.

B. Color: White, unless otherwise approved by Texas State University project representative.

C. Edge conditions: Panels shall be no less than 6” where adjacent to walls. Edge trim shall be “L” type.

D. Fire resistant assemblies: Acoustical ceilings are not to be used.

E. Asbestos: In no instance will any product containing asbestos be acceptable for use.

1.03 General Requirements

A. Over-stock: Provide 5% overage for attic stock.

PART 2: PRODUCTS

2.01 Ceiling Panel

A. Panel

1. Panel: 24” x 24” x 5/8” lay-in acoustical ceiling tile, Cortega 770, square edge, non-directional, fissured, as manufactured by Armstrong.
2. Building or Room Renovations: Use acoustical tiles, which match existing panels in space.

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 51 13
PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for exposed or concealed grid systems for suspension of gypsum board; acoustical panel, metal panels, and other ceiling finish materials.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 Design Guidelines

A. Concealed grid systems: In no instance will this system be acceptable.

B. Exposed grid lay-in panel system: This system shall be utilized as the Texas State University-San Marcos campus preferred system. Grid and panel system size shall be 2’ x 2’ only.

C. Asbestos: In no instance will any product containing asbestos be acceptable for use.

D. The ceiling grid is not to be suspended off anything in plenum, except the structure. Provide trapeze hanging supports to miss large plenum items, where ceiling grid support is required.

PART 2: PRODUCTS

2.01 Grid: Standard DX grid (15/16”), 2’ x 2’ only, as manufactured by Armstrong, or equal.

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 53 23
SECTION 09 65 19 – RESILIENT TILE FLOORING & BASE

PART 1: GENERAL

1.01 Scope of Standard

A. These standards provide guidance concerning the specific preferences of Texas State University for resilient flooring of asphalt, cork, vinyl, rubber, etc.; includes stair nosing, treads, base, and trim of resilient materials.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Asbestos: Asbestos-containing materials shall not be used.

B. Base material shall be rubber, not vinyl. Corners shall be premolded rubber.

C. Floor Color: Use of solid color tile is discouraged except possibly when the tile contains a three-dimensional pattern (raised).

D. Preformed Rubber: Preformed rubber flooring strips shall be used on pedestrian-type stairwells. Other stairwells i.e. exit stairs, shall be concrete finish only.

E. Rubber flooring: May be used in areas where there is a need to provide sound control. In wet & non-slip areas rubber flooring is not to be used.

F. Cleaning: Adhere to the recommendations of the product manufacturer for cleaning and/or finishing.

1. The contractor shall provide the cleaning and finishing procedures as specified in the Design Guidelines Section III., 3.05 Building Custodial Design Standards.

G. Contractor shall include written cleaning and maintenance instructions with substantial completion closeout documentation.

H. Contractor shall include information on tile used as part of substantial completion close-out documentation. Include manufacturer, type, grade, pattern and color. If multiple types are used, provide locations.
SECTION 09 65 19 – RESILIENT TILE FLOORING & BASE

1.03 General Requirements

A. Over-stock: Provide 5% overage of each product utilized, except at large jobs over 10,000 sf where only 2% overage shall be provided.

B. Existing Buildings and Room Renovations:
   1. Before removal: Resilient flooring shall be tested for asbestos, by the Owner.

PART 2: PRODUCTS

2.01 Vinyl Composition Tile

A. General
   1. Vinyl Composition Tile: 12” x 12” x 1/8”, ASTM F 1066, Comp. 1, Class 2 through pattern.
   2. Approved manufacturers:
      a. Armstrong, StoneTex

2.02 Rubber Base

A. General
   1. Base: 4” x 4’ coved strips are preferred. In a large open area, continuous-type base may be appropriate. Product used shall be Roppe or equal.
   2. Approved Manufacturer:
      a. Roppe or Equal

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 65 19
SECTION 09 66 00 – TERRAZZO FLOORING

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Terrazzo Flooring.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines – Terrazzo

A. Terrazzo is the preferred floor material for heavy foot traffic areas such as entryways, elevator lobbies, corridors, toilets, etc.

B. Cementitious material is preferred; epoxy type may be used in certain specific instances with prior University approval.

C. Terrazzo aggregate shall be stone, plastic or glass, use of metal as aggregate material is not allowed.

D. Avoid use of white terrazzo

E. Terrazzo must be cut and then ground/honed to between a 200-400 grit finish dependent upon the level of grinding and appearance desired using a machine that captures dust to prevent it from becoming airborne. *For Epoxy, surfaces must be kept wet.

F. Any/all sealers must be thoroughly removed.

G. Floor must be thoroughly dried.

H. Floor must be thoroughly sealed to the point of rejection with a Liquid Densifier (lithium silicate) product and allowed to cure.

I. After floor has dried completely, continue grinding and increasing to a finer grit until reaching 3000 grit using a machine that captures dust to prevent it from becoming airborne. *For Epoxy, surfaces must be kept wet.

J. Apply permanent floor seal/Polish Guard uniformly to floor.

K. Use high speed burnisher to obtain high sheen.
L. Contractor shall coordinate all chemicals with Texas State University Custodial Operations prior to start of project to verify compatibility between contractor products and Texas State University maintenance finishes.

1.03 Design Guidelines – Concrete

A. Concrete must be cut and then ground/honed to between a 200-400 grit finish dependent upon the level of grinding and appearance desired using a machine that captures dust to prevent it from becoming airborne.

   a. Salt and pepper – fine aggregate intentionally exposed.
   b. Large aggregate and/or pea gravel aggregate intentionally exposed.

B. Any/all sealers must be thoroughly removed and surface imperfections treated to include but not limited to, holes, cracks, air holes, pop-outs and voids.

C. Floor must be thoroughly dried.

D. Floor must be thoroughly sealed to the point of rejection with a Liquid Densifier (lithium silicate) product and allowed to cure.

E. After floor has dried completely, continue grinding and increasing to a finer grit until reaching 3000 grit using a machine that captures dust to prevent it from becoming airborne.

F. Apply permanent floor seal/Polish Guard uniformly to floor.

G. Use high speed burnisher to obtain high sheen.

H. Contractor shall coordinate all chemicals with Texas State University Custodial Operations prior to start of project to verify compatibility between contractor products and Texas State University maintenance finishes.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 66 00
SECTON 09 68 13 – CARPET TILES

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for carpet manufactured in the form of precut surfacing units.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Carpet affords advantages for specific situations, but carpet is not a universally desirable floor covering.

B. In general, carpet private offices, but not hallways or public areas.

C. The use of carpet anywhere in Residence Halls is discouraged.

D. Where carpet is scheduled for spaces within a new or renovated building, include the carpet as a part of the general construction contract.

E. Do not provide for carpet by a cash allowance in the construction contract.

F. Do not plan for the bidding of carpet as a separate subcontract item after the award of the general construction contract.

G. Static control: Static rating shall be under 2 kV in all areas.

H. Size: There is currently no Texas State University-San Marcos campus standard for carpet tile size.

I. Carpet Construction: 1/12 gauge, 10 stitches per inch, tufted, level loop, with appropriate backing to provide moisture barrier, and post-consumered recycled product/cradle-to-grave certified.

1.03 General Requirements

A. % Over-stock: Provide 5% overage, with a minimum of one (1) box of tile for attic stock.
SECTION 09 68 13 – CARPET TILES

B. Asbestos: In no instance will any product containing asbestos be acceptable for use.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 68 13
SECTION 09 68 16 – SHEET CARPETING

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for sheet carpet.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 Design Guidelines (NOT USED)

1.03 Section Includes:

A. Testing Protocols

B. Performance Requirements

C. Product Specifications

D. Environmental Requirements

E. Warranties

F. Exclusions

G. Installation

H. Maintenance

I. Accessories

1.04 References

A. American Association of Textile Chemists and Colorists (AATCC):

1. AATCC 16, Test Method of Colorfastness to Light.

2. AATCC 107, Test Method for Colorfastness to Water.

3. AATCC 129, Test Method for Colorfastness to Ozone in the Atmosphere under High Humidity.
SECTION 09 68 16 – SHEET CARPETING

5. AATCC 165-(93), Test Method for Colorfastness to Crocking: Carpets – AATCC Crock meter Method.
6. AATCC 175-(98), Test Method for Stain Resistance: Pile Floor Coverings
7. AATCC 189, Test Method for Fluorine Content of Carpet Fibers
8. AATCC 164, Test Method for Colorfastness to Oxides of Nitrogen in the atmosphere under High Humidity.

B. American Society for Testing and Materials (ASTM):

1. ASTM D418-(12), Methods for Testing Pile Yarn Floor Covering Construction (Finished Pile thickness Only)
3. ASTM D5823, Standard Test Method for Tuft Height of Pile Floor Coverings
4. ASTM D5793, Standard Test Method for Binding Sites per Unity Length or Width of Pile Yarn Floor Coverings.
SECTION 09 68 16 – SHEET CARPETING

C. International Standards Organization (ISO):
   1. ISO 2551, Test Method for Dimensional Stability (Aachen test)

D. Supplemental Testing Procedures:
   1. PT-155-Rev. 86, Loop Pile Run Resistance test

E. Carpet and Rug Institute (CRI):
   1. CRI Indoor Air Quality Testing and Labeling Program

F. U.S. Department of Housing and Urban Development (HUD):
   1. HUD UM 44D-(93), HUD Building Product Standards and Certification Program for Carpet.

1.05 Performance Requirements

A. Comply with the following performance requirements:
   1. Radiant Panel: ASTM E648: >.45 watts/sq. cm: Class 1
   2. Smoke Density: ASTM E662: 450 Flaming Mode – Maximum
   3. Static Generation: AATCC 134: 3.5 KV – Maximum
   4. Light fastness: AATCC 16E: Min 4.0 at 40 hrs.
   5. Crocking: AATCC 165: 4.0 – Wet/Dry
   6. Cold Water Bleed: AATCC 107: 3.0 – Minimum
   7. Ozone Fade: AATCC 129: 3.0 – Minimum
   8. Soil Protection: AATCC 189: 500 PPM Min.
   9. CRI Green Label Air Quality Certification: Pass

B. Warranty Performance Requirements:
   1. Warranties must be for Lifetime on all items.
   2. Lifetime warranties must cover face components and backing components
SECTION 09 68 16 – SHEET CARPETING

3. Warranties must be non-prorated.

4. Carpet manufacturer must warrant both product and adhesive systems.

C. Special Performance Requirements

1. Must have Soil and Stain resist treatment

2. Must have minimum 20 dpf fiber.

3. Must have permanent anti-stat yarn.

4. Must be type 6 or 6, 6 fiber.

1.06 Submittals

A. Manufacturer’s Data

1. Submit two (2) copies of manufacturer’s specifications and installation instructions for Broadloom carpet and related items specified.

B. Fiber Requirements

1. Submit certification from the fiber producer verifying the following:
   a. Use of the specified fiber in the submitted carpet product.

C. Warranties

1. Submit warranties as described in Section 1.13

D. Maintenance


E. Certificate of Compliance

1. Submit certified test reports that carpet meets all the performance requirements stated above in section 1.3 Performance requirements. Submit certified test reports from a NVLAP Certified Lab that carpet meets all performance criteria.
SECTION 09 68 16 – SHEET CARPETING

F. Shop Drawings

1. For carpeted areas submit shop drawings showing installation of carpeting, pattern direction, necessary installation accessories, and provisions for work of other trades. Show location of different patterns or styles of carpet. Also show locations of any threshold conditions.

   a. The contractor will supply reproducible prints on request, to facilitate shop drawing preparation.

G. Samples

1. Submit standard-size carpet samples of each type of carpet, in each specified pattern, color and construction.

   a. Final Sample Submittal

      1). Submit two (2) sets of samples for each carpet type.

   b. No carpet shipments are permitted until acceptance of final samples is given by representative of the end user or architect/design firm, certifying that samples are the approved color, pattern and texture.

   c. Custom Color only

      1). A representative of the end user or architect/design firm, certifying that the samples are the approved color, pattern and texture, shall sign high quality color samples.

   d. Samples submitted are assumed to be the manufacturer’s best obtainable match to the color described under Materials Section.

   e. Must have federally registered Branded trademark.

1.07 Closeout Submittals

A. Maintenance Data

1. Include maintenance procedures, recommended cleaning and stain removal materials, and recommended cleaning schedule. Include product data and Material Safety data Sheets (MSDS) for cleaning and stain-removal materials.
SECTION 09 68 16 – SHEET CARPETING

B. Installation Instructions

1. Include detailed installation procedures. Include carpet installation procedures, adhesive types, trowel sizes, spread rates, open times, and Material Safety data sheets (MSDS) for all carpet adhesives.

C. Warranties and Performance Certifications

1. Submit written warranties for all products as well as Performance testing results on all items included in Warranty section and Performance section of this specification.

1.08 Quality Assurance

A. Single Source Responsibility: Provide products from a single manufacturer.

1. Warranties must be standard and not job specific.

2. All styles must come from the same manufacturer.

3. Must be single source fiber extrusion and yarn manufacturing.

1.09 Qualifications

A. Manufacturer

1. Company specializing in manufacturing commercial carpet with minimum five (5) years (documented) experience.

B. Installer/Flooring Contractor Qualifications

1. Carpet contractor must provide all the necessary licenses, performance bonds, and insurance certificates that comply with all local, state, and federal laws, ordinances, or codes prior to the start of the installation.

2. Carpet contractor shall be a firm established not less than five (5) years and, if requested, shall submit evidence of having furnished and installed commercial carpet projects of similar size and scope for at least five (5) years.

3. Flooring Contractor to provide references at the request of the owner.

4. Carpet Contractors must also be mill certified for installing products.
SECTION 09 68 16 – SHEET CARPETING

5. Carpet Contractor will be responsible for the proper product installation, including floor preparation, in those areas indicated in the Drawings.

6. Carpet Contractor to provide owner a written warranty that guarantees the completed installation free from defects in materials and workmanship for a period of two (2) years after job completion.

1.10 Pre-Installation Meetings

A. Convene one (1) week prior to commencing work of this section.

B. Require attendance of (manufacturer), (installer), (contractor), (owner), (architect) and other parties directly affecting the work of this section.

1.11 Delivery, Storage and Handling

A. Deliver carpet in sealed protective rolls and accessories in sealed containers. Segregate each product (if several product styles are involved), according to style, color, pattern, dye lot, run number, and quantity.

B. Store products in an enclosed and dry area protected from damage and soiling.

1.12 Environmental Requirements

A. Do not install carpet until areas have been fully enclosed and environmental conditions have reached the levels indicated during occupancy.

B. Maintain ambient temperature and humidity conditions during and after installation of carpet at levels indicated during occupancy.

C. Allow carpet to reach room temperature or minimum temperature recommended by manufacturer before beginning installation.

D. Protect adhesives from freezing. Follow manufacturer’s recommendations for minimum temperatures to which adhesives are exposed.

E. IAQ Requirements, Green Label: All products must be CRI Green Label Certified.

F. Must be 100% recyclable.

1. Contribute minimum 80% of product cost toward LEED Recycled Dollar value from fiber.
SECTION 09 68 16 – SHEET CARPETING

2. Must have 50% recycled content face fiber. 25% must be Post Consumer and 25% must be Post Industrial.

1.13 Field Measurements

A. Verify that field measurements are as indicated on drawings.

1.14 Sequencing

A. Sequence installation so as to minimize possibility of damage and soiling of carpet.

B. Do not commence installation until painting and finishing work are complete and ceiling and overhead work have been tested, approved and completed.

C. Remove and replace existing carpet (renovations) in accordance with pre-approved architectural plan.

1.15 Warranty

A. Provide carpet manufacturer’s warranty against defects in materials.

B. Fiber must have lifetime static warranty.

C. Warranty – include coverage for:

1. Provide carpet installer’s warranty against defects in installation.

2. Provide full spectrum of Manufacturer’s Lifetime warranties as outlined below:

   a. Wear
   b. Tuft Bind
   c. Static Protection
   d. Edge ravel
   e. Zippering
   f. Delamination
   g. Dimensional Stability

3. All warranty items are to be non-prorated for the entire warranty period.

4. Supplemental Warranty items:

   a. Must keep warranties intact through flooding.
SECTION 09 68 16 – SHEET CARPETING

D. Supplemental Fiber Warranty Items:

1. Colorfastness to Light
2. 10 Year Stain Warranty
3. 10 Year – Colorfastness to Atmospheric contaminants

1.16 Extra Materials

A. Provide percent overage of calculated yardage for each type of carpet (include carpet needed for complete installation plus waste and usable scraps in calculated yardage) as specified by architect and/or end user. Recycle waste, unusable scrap and any carpet damaged during installation through manufacturer’s environmental program.

B. Deliver specified attic stock to Owner’s designated amounts and to designated storage space, properly packaged and identified. Redirect small pieces of waste to be appropriately recycled.

PART 2: PRODUCTS

2.01 Products

A. Product Must Meet The Following Criteria:

1. Must have choice of at least ten running line products.

2.02 Carpet Construction

A. All yarn and other carpet materials shall be manufacturer’s first quality.

1. Detailed Product Construction Specifications

a. Product Type: Broadloom
b. Construction: Tufted
c. Surface Appearance: Textured Multicolored Loop
d. Pitch/Gauge: 135 (197 ends per meter)
e. Pile Weight: 28.0 Oz. per sq. yd. (949 g/m2)
f. Pile Thickness: .137” (3.48 mm)
g. Stitches/Rows per Inch: 11.00 (43.31 per 10 cm)
h. Dye Method: Solution Dyed
i. Nylon Type: Nylon 6 or 6,6
j. Density: 7,358
SECTION 09 68 16 – SHEET CARPETING

k. Weight Density: 206,024
l. Primary Backing: Woven Polypropylene
m. Pattern Repeat: None
n. Secondary Backing: Woven Polypropylene
o. Width: 12’ (3.66m)

2.03 Accessories

A. Leveling Compound: Latex type as recommended by carpet manufacturer; compatible with carpet adhesive and curling/sealing compound used on concrete.

B. Multipurpose Adhesive: Low VOC as recommended by carpet manufacturer for direct glue down of carpeting; comply with CRI Green Label Certification Program.

C. Non-Metallic Carpet edge Guard: Extruded or molded heavy-duty vinyl or rubber carpet edge guard of size and profile indicated; minimum two (2) inch wide anchorage flange; colors selected by (Owner) (Architect) (Designer) from manufacturer’s standard range of colors.

D. Miscellaneous Materials: As recommended by manufacturer of carpet, cushion, and other carpet products; as required to complete installation.

PART 3 EXECUTION

3.01 Examination

A. Examine substrates for conditions under which carpeting is to be installed.

B. Verify that floor surfaces are smooth and flat within tolerances specified in Section 3.2 and are ready to receive work.

C. Beginning of installation means installer accepts existing substrate conditions.

3.02 Preparation

A. Allow new concrete to cure for 90 days before carpet installation starts.

B. Perform moisture content testing as required by manufacturer’s instructions to ensure pH readings of no more than nine (9). Moisture transmission of 5.0-lbs/sq. ft per 24 hours is acceptable. If values exceed this level, follow manufacturer’s
recommendations for moisture transmission mitigation. Do not proceed until unsatisfactory conditions have been corrected.

C. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes and other defects with sub-floor filler.

D. Fill, level and make smooth cracks 1/16 inch or more, holes, unevenness, and roughness with compatible latex floor patching compounds. Feather floor filling or leveling compound a minimum of four (4) ft. Sweep floor of loose granular debris prior to filling. After filling, allow filler to dry. Damp mop floor with warm water and allow to dry. Vacuum after mopping to ensure that loose granular debris is removed and to provide a proper substrate to install Broadloom carpet. Prohibit traffic until filler is cured.

E. Vacuum floor again immediately before installation of carpeting.

F. Confirm compatibility of premium multipurpose adhesive with curing compounds on concrete floors.

G. Preheat areas to receive carpet to a minimum temperature of 68°F for 72 hours prior to installation, with a relative humidity of not more than 65 percent. Maintain minimum temperature of 50°F thereafter. Carpet and adhesive must be stored at a minimum temperature of 68°F, for 72 hours prior to installation.

H. Store premium multi purpose adhesive and other liquid materials in same atmospheric conditions as carpet, 68°F for at least 72 hours.

3.03 Installation

A. Install carpet in accordance with the Technical Bulletins provided by the manufacturer for tufted and/or woven products. These technical bulletins will offer the proper instructions to install carpet including: (1) Conducting Site Testing and conditioning, (2) Floor Preparation, (3) Installation of the carpet, including layout (seaming, carpet layout and cutting, power stretching, approved adhesives systems and seam sealers, etc.) As a supplement, the CRI 104, section 8 will supply additional installation support guidance for your installation.

B. Adhesives and Sealers: Carpet adhesives and sealers include, but may not be limited to, premium multipurpose adhesive, Latex Carpet Edge Sealers, and Solvent Free Carpet Seam Sealer.

C. Install carpet under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets in each space.
SECTION 09 68 16 – SHEET CARPETING

D. Provide cut outs where required. Conceal cut edges with protective edge guards or flanges.

E. Install carpet under open-bottom items and install tight against walls, columns, and cabinets so that the entire floor area is covered with carpet. Cover over floor-type door closers.

F. Install edging guards at openings and doors wherever carpet terminates, unless indicated otherwise.

G. Perform cutting in accordance with manufacturer’s recommendation using tools designed for carpet being installed. Verify carpet match before cutting to insure minimal variation between dye lots.

H. Install carpet from same dye lot and run within each continuous carpet area.

I. Seal seams with manufacturer recommended seam sealer, if applicable.

J. Install carpet with pile-lay in same direction except when indicated otherwise on drawings.

K. Use leveling compound where necessary. Feather floor leveling compounds minimum of 4 ft.

L. Do not bridge building expansion joints with continuous carpeting. Provide for movement.

M. Apply seam adhesive to base of edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

N. Roll with appropriate roller for complete contact of adhesive to carpet backing.

O. Trim carpet neatly at walls and around interruptions or extend carpet at base finish up vertical surface to form base. Terminate top of base with cap strip.

P. Complete installation of edge strips, concealing exposed edges.

Q. Cut carpet at fixtures, architectural elements, and perimeters.

R. Use a fixed reducer trip to secure broadloom area in open perimeter designs.

S. Install carpet on stairs using acceptable permanent adhesive. Furnish and use compatible edge strip and nosing products as required.
SECTION 09 68 16 – SHEET CARPETING

3.04 Field Quality Control

A. Inspect completed carpet installation on each floor

B. Verify that installation is complete; work is properly done and acceptable

C. Remove and replace, at no additional cost to owner, any work found not to be acceptable.

3.05 Cleaning

A. On completion of installation in each area, remove dirt and scraps from surface of finished carpet. Clean soiling, spots, or excess adhesive on carpet with cleaning materials recommended by carpet manufacturer.

B. Remove debris; sort pieces from carpet scraps

C. At completion of work, vacuum carpet using commercial vacuuming equipment as recommended by manufacturer. Remove spots and replace carpet where spots cannot be removed. Remove rejected carpet pieces and replace with new carpeting. Remove any protruding yarns with shears or sharp scissors.

3.06 Protection

A. Do not permit traffic over unprotected carpet surface.

B. Protect carpet against damage during construction. Cover with 6-mil thick polyethylene covering joints during construction period whenever protection is required so that carpet will be without soiling, deterioration, wear, or damage at time of completion.

C. Damaged carpet will be rejected. As carpet is installed, remove trimmings, scraps of carpet and installation materials.

D. Maintain protection of carpeting on each floor or area until work is accepted.

END OF SECTION 09 68 16
SECTION 09 72 00 – VINYL COATED FABRIC WALL COVERINGS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for site-applied wall finishes of materials such as cork, leather, paper, vinyl, etc., in thin, flexible sheets requiring a supporting substratum.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Wall Finishes

1. The use of vinyl wall coverings (vwc) is discouraged.

2. When use is absolutely necessary, use vinyl wall coverings with high permeability ratings and limit use to interior partitions only, such as Break Rooms & Coffee Bars.

3. Use in conjunction with proper wall preparation using sizing or latex paint.

4. Wall coverings of burlap, natural grass, paper, or felt is prohibited.

5. Cork and leather are not to be used, and paper may be used only in special locations, such as historic buildings.

6. Wall finishes must be in compliance with the NFPA standard 101 Life Safety Code requirements based on occupancy, reference NFPA standard 101, Sections 6-5 for appropriate classifications.

B. Type: Standard use shall be vwc with polyolefin coating, type 2.

1.03 General Requirements

A. Asbestos: In no instance will any product containing asbestos be acceptable for use.
SECTION 09 72 00 – VINYL COATED FABRIC WALL COVERINGS

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 72 00
SECTION 09 80 00 – SOUND ISOLATION

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for batts, boards, block infill, etc.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Isolation for sound transmission shall isolate areas such as: Conference rooms, counseling rooms, classrooms, janitor closets, electrical closets containing transformers, toilets, meeting rooms, and other areas requiring confidentiality.

B. Project requirements may dictate having an acoustic consultant on the consultant team. Review acoustic issues with Texas State University early in project planning.

1.03 General Requirements

A. Methods to use shall incorporate sound attenuation blankets, full height drywall assembly to structural deck above ceilings, sound sealant, proper spacing of return air grills, sound transmission boots, etc.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 09 80 00
SECTION 09 91 00 – PAINT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Section, apply to this Section.

1.02 SUMMARY

A. This standard provides guidance concerning the specific preferences of Texas State University for the paint system.

B. Exterior Painting: Traditionally, the palette of color on the exteriors of buildings throughout the campus is derived from the use of “Texas State University Blend” brick and light-colored stone and stucco. When selecting specific colors that will identify location of image, be mindful of the guidelines referenced throughout the Construction Standards. All exterior color of building must be approved by the University.

C. Surfaces to Receive Field Finishing: Areas shall be identified per project documents.

D. Surfaces Not to Receive Field Finishing: Do not paint copper, bronze, chrome-plated items, nickel, stainless steel, lead, prefinished floor covering, items with factory applied final finish, chases and plenums; unless otherwise specified or scheduled.

E. Masonry/Stone Resurfacing: In no instance shall it be acceptable to paint finish masonry, natural stone, or architectural pre-cast stone, without the written approval from the University.

F. For Special Projects, refer to the FPDC Approved Paint Color Schedule Board. Facilities Planning Design and Construction may require in some cases a materials finish and color board be submitted for approval. Refer to 1.04C, Definitions, for “Substitution for Convenience”. No Substitution for Convenience will be allowed.

G. For Capital Projects, the architect shall prepare materials, finish, and color schedule board to be submitted to the University President through Facilities Planning, Design and Construction for approval.
SECTION 09 91 00 – PAINT

H. Close-out Documentation: Contractor shall comply with University contractual requirement for Close-out Documentation and for Special Projects in compliance with this Construction Standard’s General Conditions.

1.03 SUSTAINABLE DESIGN

A. The University promotes efficient green design, construction and building operation.

B. Materials are to be selected and specified following the United States Green Building Council’s LEED (Leadership in Energy and Environmental Design) Green Building Rating System.

   1) Meet LEED Standard 4.2EQ (Indoor Air Quality)

   2) Finishes should not exceed VOC limits established by the South Coast Air Quality Management District (SCAQMD) Rule 1113.

1.04 DEFINITIONS

A. “Paint:” includes coating system materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

B. “Substrates:” as used herein means the surface to which paint is to be applied. In the case of previously painted existing surfaces, substrate means the surface to which the existing paint was applied.

C. “Substitutions:” constitutes changes proposed in products, materials, and methods of construction from those required by the Contract Documents and proposed by Contractor.

   1) “Substitutions for Cause:” Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of warranty terms.

   2) “Substitutions for Convenience:” Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner. – No substitution for convenience is allowed.

D. “Definition Interior and Exterior Paint Gloss Levels:”

   1) Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.
SECTION 09 91 00 – PAINT

2) Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.

3) Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.

4) Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.

5) Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.

6) Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.05 QUALITY ASSURANCE

A. For Capital Projects, contractor shall have a minimum of proven satisfactory experience and shall maintain a qualified crew of painters throughout the duration of the work.

B. Single Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer.

C. Source Quality Control, Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1) Owner will engage the services of a qualified testing agency to sample paint materials.

2) Testing agency will perform tests for compliance with product requirements.

3) Owner may direct Contractor to stop applying paint if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint material from Project site, pay for testing, and repaint surfaces painted with rejected materials.

1.06 SUBMITTALS – CAPITAL PROJECTS

A. Product Data: For each type of product. Include preparation/application instructions.

B. LEED Submittals:

1) Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content.

2) Laboratory Test Report for Credit EQ4: For paints and coatings, documentation indicating that they meet the testing and product requirements.
SECTION 09 91 00 – PAINT

C. Samples for Verification: For each type of paint system and in each color and gloss level of topcoat.

1) Submit Samples on ridge backing, 10 inches square.
2) Identify manufacturer, specification (name/number/formula), and project name on each sample.
3) Step coats on Samples to show each coat required for system.
4) Label each coat of each Sample, including substrate.

D. Product List: for each product indicated, include the following:

1) Cross-reference to paint system, manufacturer, specification (name/number/formula), project, and locations of application areas. Use same designation indicated on drawings and in schedules.
2) VOC content.
3) Include above information in project closeout Operations and Maintenance Manuals.

1.07 SUBMITTALS – SPECIAL PROJECTS/FACILITIES OPERATIONS

A. Product Data/List: Refer to University Contractual requirements and specific project documents.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the source of the run, which match products installed and that are packaged with protective covering for storage and identified with labels describing contents to the Project Manager/Construction Contract Administrator.

1.09 DELIVERY, STORAGE AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees

1.10 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperature are between 50 and 95 degrees F.
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B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

1.11 WARRANTY REQUIREMENTS

A. Includes repair and replacement of work that has failed within the warranty period. Failures include but are not limited to the following: discoloration, yellowing, streaking, mildew, peeling, cracking, delamination, dusting, changing sheen, and softening or becoming tacky.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1) The Sherwin-William Company (Basis of Design)
2) Benjamin Moore & Company
3) PPG Architectural Finishes, Inc.
4) Glidden Professional

B. Products: Subject to compliance with requirements listed by system in the Paint Schedule – General Section 2.04 for the paint category indicated.

2.02 MATERIALS

A. Coatings: Ready mix. Process pigment to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating with good flow and brushing properties; capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners, and other materials not specifically indicated but required to achieve the finishes specified.

2.03 PAINT, GENERAL

A. Masters Paint Institute (MPI) Standards: Provide products that comply with MPI standards and that are listed in its “MPI Approved Product List.

1) Preparation and Workmanship: Comply with requirements in the “MPI Architectural Painting Specification Manual” for products and paint system indicated.
B. Material Compatibility:
   1) Provide materials for use within each paint system that are compatible with one another and substrates indicated, under condition of service and application as demonstrated by manufacturer, based on testing and field experience.
   
   2) Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer’s product instructions.
   
   3) Supply each coating material in quantity required to complete entire project’s work from a single production run.
   
   4) For each coat in a paint system, provide products recommended by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with the most stringent VOC limits of authorities having jurisdiction and, for paint and coatings applied at Project site, the following VOC limits, exclusive of colorants added to tint base, when calculated according to 40 CRF 50 for exterior painting and 40 CFR 59 for interior painting, Subpart D (EPA Method 24).

   1) Exterior Painting:
      a) 40 CFR 59 for testing and calculation.

   2) Interior Painting:
      a) Flat Paints and Coatings: 50g/L.
      b) Non-flat Paints and coatings: 150 g/L.
      c) Dry-Fog Coatings: 400g/L.
      d) Primers, Sealers, and under coaters: 200 g/L.
      e) Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 g/L.
      f) Zinc-Rich Industrial Maintenance Primers: 340 g/L.
      g) Pretreatment Wash Primers: 420 g/L.
      h) Floor Coatings: 100 g/L.
      i) Shellacs, Clear: 730 g/L.
      j) Shellacs, Pigmented: 550 g/L.
CONSTRUCTION STANDARDS

SECTION 09 91 00 – PAINT

2.04 PAINT SCHEDULE - GENERAL

A. Includes coating system materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

B. Where specific finish paint material is not indicated, refer to notes and finish schedules for finish paint material and gloss levels for each surface to be painted.

C. All paint color selections shall be approved per the requirements set forth in Standard Section 1.02 F. & G.

2.05 EXTERIOR PAINT SCHEDULE

A. CONCRETE, COMMON BRICK and PLASTER SUBSTRATES: (Normal Exposure) 2 finish coats of exterior latex over primer:

1) Prime Coat: Basis of Design: Sherwin-Williams Company; Latex System, S-W Loxon Concrete & Masonry Primer Sealer

2) Finish Coat: Latex System; S-W-A-100 Exterior Latex Gloss

3) Early Moisture Resistant Finish; S-W Resilience Latex Gloss, K44 Series

B. CONCRETE MASONRY UNIT BLOCK: 2 finish coats of exterior latex (over block filler on CMU):

1) Block Filler for CMU: Basis of Design; Sherwin-Williams Company; Latex System; S-W PrepRite Block Filler

2) Finish Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W-A-100 Exterior Latex Gloss, K44 Series

3) Early Moisture Resistant Finish: Basis of Design; Sherwin-Williams Company; S-W Resilience Latex Gloss, K44 Series

C. CONCRETE: (Concrete Floors, Patios, Porches, Steps & Platforms, Non-Vehicular) 2 coats of Acrylic Water-Based Floor System (Satin Finish).

1) 1st Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Porch & Floor Enamel, A32-200 Series
SECTION 09 91 00 – PAINT

2) 2nd Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Porch & Floor Enamel, A32-200 Series

3) Alternate: Basis of Design; Sherwin-Williams Company; 2 coats of S-W Sher-Crete Concrete Water proofer

D. METAL – Ferrous (Structural Iron & Steel, Tanks, Water Towers, Sashes, Trim, Conductors, Ducts, Vents): 2 coats of exterior enamel over primer:

1) Prime Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Pro Industrial “Pro-Cryl” Universal Primer; B66-310 Series

2) 2nd Coat: Basis of Design; Sherwin-Williams Company; Hybrid System; S-W Waterbased Alkyd Urethane Enamel Gloss, B53-1050 Series

3) 3rd Coat: Basis of Design; Sherwin-Williams Company; S-W Waterbased Alkyd Urethane Enamel Gloss, B53-1050 Series

4) Alternate: Basis of Design; Sherwin-Williams Company; 2 coats Waterbased Acrolon 100 Acrylic Urethane Gloss, B65-720 Series

D. METAL – ALUMINUM/GALVANIZING (Non Ferrous) 2 finish coats over primer:

1) Galvanized Metal Primer: Basis of Design; Sherwin-Williams Company; Pro Industrial “Pro-Cryl” Universal Primer; B66-310 Series

2) Finish Coat: Basis of Design; Sherwin-Williams Company; Hybrid System; S-W Waterbased Alkyd Urethane Enamel Gloss, B53-1050 Series

3) Gloss Finish Coat: Basis of Design; Sherwin-Williams Company; Hybrid System; S-W Waterbased Alkyd Urethane Enamel Gloss, B53-1050 Series

D. WOOD – (Siding, Trim, Shutters, Sash, Doors, Hardboard, Misc.): 2 coats exterior latex over primer:

1) Prime Coat: Basis of Design; Sherwin-Williams Company; Latex System, S-W Exterior Latex Wood Primer, B42W8041
SECTION 09 91 00 – PAINT

2) 2nd Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Solo Acrylic Semi-Gloss

3) 3rd Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Solo Acrylic Semi-Gloss


5) Satin Finish: Basis of Design; Sherwin-Williams Company, Latex System, 2 coats of S-WA-100 Exterior Latex Satin, A82 Series over Primer

6) Low Sheen: Basis of Design; Sherwin-Williams Company, 2 coats of S-W A-100


E. DRYWALL (Gypsum Board, Exterior Drywall): 2 finish coats of exterior latex over primer.

1) Prime Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Exterior Latex Wood Primer; B42W8041.

2) Finish Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W A-100 Exterior Latex Gloss; A8 Series.

3) Alternate Finish Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Solo Acrylic Semi-Gloss, A76 Series

SECTION 09 91 00 – PAINT

F. ARCHITECTURAL PVC, PLASTIC, FIBERGLASS (Due to the variety of substrate. Check for compatibility): 2 finish coats of exterior latex over primer.

1) Prime Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Extreme Bond Primer, B51W150

2) Finish Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W A-100 Exterior Latex Gloss; A8 Series.

3) Alternate Finish Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Solo Acrylic Semi-Gloss, A76 Series


G. PAVEMENT MARKING PAINT: Alkyd-Resin Type or Waterborne Latex.

1) Alkyd-Resin Type: Basis of Design; Sherwin-Williams Company; lead and chromate free; ready mixed; complying with FS TT-P-115, Type 1 or AASHTO M248, Type N.

2) Latex System: Basis of Design; Sherwin-Williams Company; Latex; waterborne emulsion; lead and chromate free; ready mixed; complying with FS TT-P-1952: with drying time less than 45 minutes.

2.06 EXTERIOR FINISHES AND COLORS

A. Unless otherwise specified, all painting work shall be in accordance with MPI Premium Grade finish Requirements.

B. Colors shall be selected by the Architect/Interior Designer/ and for Special Projects the Construction Contract Administrator, from the manufacturer’s full range of colors based upon the University approved color palette and per Standards Section 1.02 F. & G.

F. Upon approval of the color palette the Architect/Interior Designer/Construction Contract Administrator, will issue a color schedule including the paint manufacturer, specification (name/number/formula), paint system, and locations of application in writing.

G. The following paint specifications outline the University Approved Paint Palette for exterior and interior use by Facilities Planning, Design, and Construction:
SECTION 09 91 00 – PAINT

2.07 INTERIOR PAINT SCHEDULE

A. CONCRETE – (Walls & Ceilings, Poured Concrete, Precast Concrete; Cement Board, Plaster); 2 finish coats over primer:

1) Prime Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Loxon Concrete and Masonry Primer Sealer

2) Finish Coat: Basis of Design; Sherwin-Williams Company; Latex System; WS-W Solo Acrylic Gloss, A77 Series

3) Egg-Shell Finish: Acrylic System; Basis of Design; Sherwin-Williams Company; 2 coats of S-W ProMor 200 Zero VOC Latex Egg-Shell, B20-2600 Series over prime coat

B. CONCRETE FLOORS (Non Vehicular); Acrylic System; 2 coats

1) First and Second Coats: Basis of Design; Sherwin Williams Company; Satin Floor Finish; S-W Porch & Floor Enamel, A32-200 Series

C. CONCRETE MASONRY BLOCK (CMU); Latex System; 2 finish coats over block filler on CMU:

1) Block Filler for CMU: Basis of Design; Sherwin-Williams Company; Latex Block Filler; S-W PrepRite Block Filler, B25W25

2) Finish Coat: Basis of Design; Sherwin-William Company; Latex System; S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series

D. CONCRETE MASONRY BLOCK (CMU); Alkyd System; 2 finish coats over block filler on CMU:

1) Block Filler for CMU: Basis of Design; Sherwin-Williams Company; S-W PrepRite Block Filler; B25W25

2) Finish Coat: Basis of Design; Sherwin William Company; S-W ProClassic Water based Acrylic-Alkyd Semi-Gloss, B34-850 Series
SECTION 09 91 00 – PAINT

E. GYPSUM DRYWALL - LATEX SYSTEM (Walls, Ceiling, Gypsum Board, Wood Pulp Board, Plaster Board, etc.) 2 finish coats over primer:

1) Primer: Basis of Design; Sherwin-Williams Company; Latex System; S-W ProMar 200 Zero VOC Latex Primer, B28W2600


3) Alternate Semi-Gloss: Basis of Design; Sherwin Williams Company; 2 finish coats over primer

   1st Coat; S-W Harmony Interior Latex Primer, B11 Series

   2nd and 3rd coats; S-W Harmony Interior Latex Semi-Gloss, B10 Series

4) Egg-Shell Finish: Basis of Design; Sherwin-Williams Company; Latex System, two finish coats over primer:

   1st Coat: S-W ProMar 200 Zero VOC Latex Primer, B28W2600

   2nd and 3rd Coats: S-W ProMar 200 Zero Latex Egg-Shell, B20-2600 Series

5) Alternate Egg-Shell Finish: Designated Areas, Basis of Design; Sherwin Williams Company; Latex System, 2 finish coats over primer:

   1st Coat: S-W Pro Mar 200 Zero VOC Latex Primer, B28W2600

   2nd and 3rd Coats: S-W Paint Shield Mocrocidial Paint (D12W51), Substitutions must meet EPA Reg. No. 64695-1.

F. GYPSUM DRYWALL – ALKYD SYSTEM (Walls, Ceiling, Gypsum Board, Wood Pulp Board, Plaster Board, etc.) 2 finish coats over primer:

G. FERROUS METAL – LATEX SYSTEM (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Structural Iron) 2 finish coats of semi-gloss acrylic over primer:

1) Prime Coat: Basis of Design; Sherwin-Williams Company, Latex System; S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series

2) Finish Coat: Basis of Design; Sherwin-Williams Company; Latex System
SECTION 09 91 00 – PAINT

3) Low Sheen Finish: Basis of Design; Sherwin-Williams Company; Latex System; two coats over primer:

1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
2nd and 3rd Coats: S-W ProMar Zero VOC Latex Low Sheen Enamel, B24-2600 Series

H. FERROUS METAL – ALKYD SYSTEM (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Structural Iron) 2 finish coats of semi-gloss acrylic over primer:

1) Prime Coat: Basis of Design; Sherwin-Williams Company, Waterbased Acrylic Alkyd; S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series

2) S-W ProClassic Waterbased Acrylic-Alkyd Semi-gloss, B34-850 Series

I. METAL- GALVANIZED/ALUMINUM; 2 finish coats of water based semi-gloss acrylic-alkyd over primer:

1) Prime Coat: Basis of Design; Sherwin-Williams Company; Alkyd System; S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series

2) Finish Coat: Basis of Design; Sherwin-Williams Company; Alkyd System; S-W ProClassic Water based Acrylic-Alkyd Semi-Gloss, B34-850 Series

3) Satin Finish: Basis of Design; Sherwin-Williams Company: Acrylic System; 2 finish coats over primer:

1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
2nd and 3rd Coats: S-W ProClassic Waterbased Acrylic-Alkyd Semi-gloss, B34-850 Series

J. WOOD – LATEX SYSTEM (Walls, Ceilings, Doors, Trim, Cabinet Work, Partitions, and Frames) 2 finish coats over primer:

1) Prime Coat: Basis of Design; Sherwin-Williams Company; Latex System; S-W Multi-Purpose Latex Primer/Sealer, B51 Series
SECTION 09 91 00 – PAINT

2) Finish Coat: Basis of Design; Sherwin-Williams Company; S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series

K. WOOD – (Painted, Stained, Varnished):

1) Wood (floors Light Traffic-Painted, Stained, Varnished); Basis of Design; Sherwin-Williams Company; 2 coats of S-W Porch & Floor Enamel, A32-200 Series

2) Stain & Polyurethane: Latex System; Basis of Design; Sherwin-Williams Company; 2 coats of S-W Minwax Water based Polyurethane, Satin, Semi-Gloss, Gloss over S-W Minwax Stain (Optional)

2.08 INTERIOR FINISHES AND COLORS

A. Unless otherwise specified, all painting work shall be in accordance with MPI Premium Grade finish Requirements.

B. Colors shall be selected by Architect/Interior Designer/Construction Contract Administrator based upon University Approved Color Palette and Per Standards Section 1.02 F. & G. at all building common areas and in coordination with end-user at internal departmental spaces.

1. Paint colors at Common Areas of buildings to be consistent with the established objective of University Campus Architectural Unity per Standards Section I, 1.02 C with the intent of maintaining design continuity between the individual campus structures.

2. Accent colors at Common Areas of buildings shall be limited in application and only applied upon the approval of Facilities Planning, Design, and Construction following the review process outlined in Standards Section 1.02 F & G.

3. For purposes of energy conservation, the use of light colors for interior walls will be specified.

PART 3: EXECUTION

3.01 CONDITION AND PREPARATION OF SURFACES

A. The condition and preparation requirements for all surfaces shall be in accordance with MPI Painting Manual requirements.
SECTION 09 91 00 – PAINT

END OF SECTION
<table>
<thead>
<tr>
<th>Code</th>
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<td>Operable Partitions</td>
</tr>
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<td>10 26 13</td>
<td>Wall &amp; Corner Guards</td>
</tr>
<tr>
<td>10 28 13.13</td>
<td>Commercial Toilet Accessories</td>
</tr>
<tr>
<td>10 44 13</td>
<td>Fire Extinguishers &amp; Cabinets</td>
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</table>
SECTION 10 11 13.13 – FIXED MARKER BOARDS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for chalk and marker writing surfaces and mounting surfaces of various materials; includes framing systems and accessories and manual and motor-operated units with integral projection screens.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 Design Guidelines

A. All White boards – 4’ high 3/flat porcelain on steel surfaces, with aluminum trim and tray, concealed spline connections, set trays at 36” AFF, and provide 25-year warranty against surface defects, shadowing after erasing, etc.

B. Do not place whiteboards behind technology podium area where podium will block view of chalkboard from student seating positions.

C. ITS does not recommend traditional chalkboards in rooms with electronics which rely on intake/exhaust fans or filter mediums for cooling. Chalk silica has a proven damaging effect on open electronics and reduces the life expectancy of projectors, and computers. It is also very difficult to clean from monitor screens and keyboards.

D. Surface: All white board maker surfaces shall be “Claridge magnetic porcelain” or equal.

E. Trim shall be aluminum, dark bronze anodized finish, with a tackable strip full length at the top.

F. Contractor to provide manufacturer’s written cleaning and maintenance instructions as part of pre-substantial completion closeout documentation.
SECTION 10 11 13.13 – FIXED MARKER BOARDS

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 10 11 13.13
SECTION 10 14 01 – EXTERIOR SITE SIGNAGE

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for signage designed and configured for exterior site installation.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Building Identification Signs:

1. Each new building requires a Building Identification Sign which conforms to Texas State Sign Standards. The exterior site signage will be a part of the construction contract.

2. Reference Standards: Vendor to provide signs that comply with the Texas State University design and specifications intent of the exterior signage constructed by Sign Crafters, in San Marcos, Texas, as maintained in Texas State University Facilities Department.

   a. EXHIBIT 1: Building Name Sign for Small Scale.
   b. EXHIBIT 2: Building Name Sign for Large Scale.

3. If required, the contractor shall provide signs which comply with the Americans with Disabilities Act Accessibility Guidelines (ADAAG).

4. Submittals: Full shop drawing of each sign type must be submitted to Texas State University for approval.

   a. One full size mock-up of a typical sign must be submitted for quality of construction approval by Texas State University.
   b. The mock up can be used for installation, once all wording is approved.
SECTION 10 14 01 – EXTERIOR SITE SIGNAGE

B. Regulatory Site Signs (stop, no parking, accessible parking)

1. No construction Standards have been developed for these signs. A/E to select and submit for approval.

2. Support poles and backs of regulatory signs are to be painted Sherwin Williams SW 6258 “Tricorn Black”, semi-gloss finish.
   a. All poles (except Stop Signs): Place 12” high, yellow reflective tape completely around pole, starting 48” off pavement.
   b. Stop Sign Poles ONLY: Place 12” high red reflective tape completely around pole, starting at 48” off pavement.

PART 2: PRODUCTS

2.01 Building Identification Signs

A. Manufacturers are subject to compliance with these requirements.

B. The following manufacturer(s) are acceptable:


C. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB).

PART 3: EXECUTION

A. Installation of Exterior Site Post-Mounted Signs foundation and anchoring plates to conform to latest Texas State University anchoring system as specified by the Facilities Department.

B. Contract drawings and specifications shall contain details and specifications for signs and anchorage installation methods.

C. Perform signage and graphics work in accordance with approved shop drawings and Contract Documents.

D. The completed signage and graphics work shall be square, level, uniform, clean, free or scratches, nicks, discoloration and other conditions which affect the appearance and performance.
SECTION 10 14 01 – EXTERIOR SITE SIGNAGE

1. Use materials and cleaning method recommended by materials manufacturer.

2. Do not use acids, cleaning compounds, wire brushes and other type of abrasives.
Exhibit 1: Building Name Signs for Smaller Scale. (37.5 W x 72” H)

COLOR SPECIFICATIONS

- POST FINISH: MATTE IRIDESCENT ACRYLIC
- POST COLOR: TO MATCH PIGMAN D2 033245 TANER GRAY
- FRAME & FACE FINISH: MATTE IRIDESCENT ACRYLIC
- FRAME COLOR: TO MATCH PIGMAN D2 05058 HEAVY BURGUNDY
- REVEL COLOR: TO MATCH PIGMAN D2 01000 CASTLE TAN
- LOGO & LETTER COLOR: 3M 200-409 BEIGE

Edward Gary Street Garage
405 N. Edward Gary

(1) ID2 SIGN TO BE BUILT AS PER SIGNAGE GRAPHIC STANDARDS.
SIGN TO HAVE VERBIAGE ON ONE SIDE AS PER DRAWINGS (LOGO ON BOTH SIDES).
SIGN TO BE INSTALLED BY OTHERS. CONCRETE FOOTINGS TO BE DONE BY OTHERS.
Exhibit 2: Building Name Signs for Larger Scale.

COLOR SPECIFICATIONS

POST FINISH: MATTEYING ACRYLIC POLYURETHANE
POST COLOR: TO MATCH PPG #32546 TUNNEL GRAY
FRAME & FACE FINISH: MATTEYING ACRYLIC POLYURETHANE
FRAME COLOR: TO MATCH PPG #60168 HEARTY BURGUNDY
REVEAL COLOR: TO MATCH PPG #29000 CASTLE MAUVE
LOGO & LETTER COLOR: 3M 220-49 BEIGE

Science, Technology and Advanced Research Park (STAR Park)
Service Entrance

10-25/64" X 35" PRINTED DECAL
1-1/4" X 1-1/4"
5" X 5" SQUARE POSTS

10" X 10" X 0.5" BASE PLATES
IMPACT BOLTS

1 ID1 SIGN TO BE BUILT AS PER SIGNAGE GRAPHIC STANDARDS FOR TEXAS STATE UNIVERSITY. SIGN TO HAVE VERBIAGE ON BOTH SIDES AS PER DRAWINGS ABOVE (LOGO BOTH SIDES). CONCRETE FOOTINGS & INSTALLATION TO BE DONE BY OTHERS.
Double Pole Sign Foundation

Notes
- 5" conc. base
- All $\frac{3}{8}$ " Ø Rebar
- 14" - 16" turn-downs @ each end
- Simpson Strong Tie Anchor Sys
- $\frac{3}{8}$ " x 4" for 6' signs
Pathmark 30139 V-Bolt Sign Clamp for 2 3/8" O.D. Post

2" GRC Pipe

2" GRC threaded coupling set at finish grade
SECTION 10 14 02 – BUILDING NAME EXTERIOR SIGNAGE

PART 1:  GENERAL

1.01  Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Building Exterior signage designed and configured for exterior installation.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02  Design Guidelines

A. If a new Building’s program requires an exterior sign, the location and size shall be approved by the Texas State University Administration.

B. The Building Sign shall conform to these Standards

1. The location of the Building Name Sign shall only be over the primary entry into the Building. Other secondary entry may be considered upon approval of the Administration.

2. The style of letter shall be “Times New Roman”, all upper caps, ½” to ¾” thick, acrylic, painted dark bronze, to match Sherwin Williams, Bronzetone, BRZ-3 “Chestnut Bronze”, low sheen.

3. The height of letter shall be proportional to the Building architecture and height off the ground. The letter heights shall not be less than 6”, nor more than 12”.

C. The Building Name Sign will be part of the Construction Contract.

D. Submittals: Full shop drawing of each sign type must be submitted to Texas State University for approval.

1. One full size mock-up of a typical sign letter must be submitted for quality of construction approval by Texas State University.

2. The mock up can be used for installation, once all wording is approved.
PART 2: PRODUCTS

A. Manufacturers are subject to compliance with these requirements.

B. The following manufacturer(s) are acceptable:

C. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB).

PART 3: EXECUTION

A. The Building Name Sign shall be anchored to Building with stainless steel studs. The studs are to be mounted into mortar joints only—mounting into brick or stone is not acceptable.

B. Contract drawings and specifications shall contain details and specifications for signs and anchorage installation methods.

C. Perform signage and graphics work in accordance with approved shop drawings and Contract Documents.

D. The completed signage and graphics work shall be square, level, uniform, clean, free of scratches, nicks, discoloration and other conditions which affect the appearance and performance.
   1. Use materials and cleaning method recommended by materials manufacturer.
   2. Do not use acids, cleaning compounds, wire brushes and other type of abrasives.

END OF SECTION 10 14 02
SECTION 10 14 03 – INTERIOR SIGNAGE

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Building Interior signage designed and configured for interior installation.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Each new or renovated building requires Interior Room Identification Signs which conform to Texas State University sign standards. The interior signage will be a part of the construction contract, for new Capital Buildings. For renovation in existing buildings, the interior signage shall not be a part of the construction contract, but contracted directly by Texas State University Facilities Department.

B. Reference Standards: Contractor to provide signs that comply with the Texas State University design specifications intent of the interior signage as maintained in Texas State University Facilities Department.

C. Contractor shall provide signs which are required to comply with the Americans with Disabilities Act Accessibility Guidelines (ADAAG), and the Texas Accessibility Standards (TAS).

1. If a sign is required to comply with ADAAG, the sign manufacture shall provide the following certification:

   a. The product design and construction complies with section 4.30 of the ADAAG.

   b. That all Grade 2 Braille is accurate.

D. Room Numbers:

   Room numbers exhibited on the drawing are to be reviewed and finalized by the Office of the Vice President for Finance and Support Services, before interior signs are ordered. Final room numbers and names must be completed before sign construction documents are issued for construction.
SECTION 10 14 03 – INTERIOR SIGNAGE

Permanent room names, such as Custodial, IDF, Elevator Machine Room, Mechanical, Electrical, etc., shall have the name on the sign.

Room names which are not permanent, shall have the name on the sliding vinyl insert, with vinyl die-cut letters.

E. Floor Designations:

1. Basements are machine spaces; avoid assigning individual occupants, other than operating personnel, to a basement.

2. Ground floor is deemed to be occupied space below natural grade that is not machine area.

3. First floor is at grade, or slightly above, depending on site design.

1.03 Section Includes

A. Interior signage of the following types:

1. ADA compliant interior signage.

2. Interior signage plaque modules.

3. Interior signage overhead modules.

4. Interior signage main directories.

5. Interior signage secondary directories.

1.04 References


B. USATBCB - Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).

1.05 Submittals

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Manufacturer's descriptive literature.

2. Installation methods.
SECTION 10 14 03 – INTERIOR SIGNAGE

B. Shop Drawings: List sign styles, lettering, locations of each interior sign, for each room

C. Standard sign type samples shall match approved samples in the Facilities Department office.
   1. If manufacturer changes previously approved samples, these samples must be submitted for approval.

1.06 Quality Assurance

A. Regulatory Requirements: Comply with requirements of ICC/ANSI A117.1 and ADAAG.

1.07 Warranty

A. Provide one year warranty on the sign installations.

B. Provide two year warranty on the sign material and manufacturing quality.

PART 2: PRODUCTS

2.01 Manufacturers

A. Acceptable Manufacturer: Innerface Sign Systems, Inc.; 5849 Peachtree Road, Atlanta, GA 30341. ASD. Tel: Phone: (770) 921-5566, Toll Free: (800) 445-4796. Fax: (770) 279-1327. Email: Sales@innerfacesign.com. (Exhibit 1)

   1. Local Contact: John Schindler III, at JSCHINDLER@INNERFACESIGN.COM

B. Substitutions: Only permitted if manufacturer has tamper-proof, removable vinyl inserts, which match the removing tool by Innerface Signs. Substitution manufacturers and designs must be submitted and approved by Texas State University Project Manager.

2.02 Interior Signs

A. Standard Products: The following interior sign systems shall be provided in locations indicated.
SECTION 10 14 03 – INTERIOR SIGNAGE

1. Font shall be Helvetica Medium, to meet all USATBCB Americans with Disabilities Act (ADA), Accessibility Guidelines, and Texas Accessibility Standards (TAS).

B. Signature Series.

1. Plaque Modules: Flush modular frames with flush modular inserts.
   a. Module:
      1). Style/Overall Size: (Refer to Exhibits)
      2). Letter Color
         a). #11 Ivory
      3). Sign Color
         a). #5 Slate

   a. Module:
      1). Style/Overall Size: (Refer to Exhibits)
      2). Letter Color
         a). #11 Ivory
      3). Sign Color
         a). #5 Slate

   a. Module:
      1). Style/Overall Size: (Refer to Exhibits)
      2). Letter Color
SECTION 10 14 03 – INTERIOR SIGNAGE

a). #11 Ivory

3). Sign Color

a). #5 Slate


a. Module:

1). Style/Overall Size: (Refer to Exhibits)

2). Letter Color

a). #11 Ivory

3). Sign Color

a). #5 Slate


a. Module:

1). Style/Overall Size: (Refer to Exhibits)

2). Letter Color

a). #11 Ivory

3). Sign Color

b). #5 Slate

C. Construction General:

1. Plaques and Secondary Directories: Routed 1/8 inch (3 mm) thick styrene backplate with a laser cut 1/16 inch (1.6 mm) thick non-glare acrylic polished edge faceplate. Faceplate is reverse screened using Nazdar 9700 Series screen print ink. Backplate is assembled to the faceplate with 3M VHB double sided foam tape .05 inch (1.3 mm) thick in various widths.

2. Wall Mounts, Doorbands and Door Tags Reverse painted 1/16 inch (1.6 mm) thick non-glare laser cut acrylic with polished edge. Painted with Matthews acrylic polyurethane paints. Laminated on the reverse side with
SECTION 10 14 03 – INTERIOR SIGNAGE

1. 1 mil clear polyester over laminating film with adhesive. Surface applied high performance vinyl copy.

3. Ceiling Mounted Directional Units:
   
a. 3/8 inch (10 mm) thick unit: 1/4 inch (6 mm) thick black gloss acrylic laminated on both sides with 1/32 inch (.08 mm) vertical grade laminate using 3M water-base adhesive. Mounting hardware includes a dark bronze aluminum and a galvanized steel u-channel, galvanized decking screws, post binding screws, and threaded 1/4 inch (6 mm)-20 x 4 inch (102 mm) long round head zinc plated steel screws. Surface applied high performance vinyl copy.
   
b. 1-3/4 inch (102 mm) thick unit: Hand routed 1-1/2 inch (12.5 mm) thick fiber core, laminated with 1/32 inch (.08 mm) thick vertical grade laminate using 3M water-base contact adhesive. Mounting hardware includes a dark bronze aluminum and a galvanized steel u-channel, galvanized decking screws, post binding screws, and threaded 1/4 inch (6 mm)-20 x 4 inch (102 mm) round head zinc plated steel screws. Surface applied high performance vinyl copy.
   
c. 3 inch (76 mm) thick unit: Hand fabricated box made of 1/8 inch (3 mm) thick and 3/4 inch thick Luan with 3 inch (76 mm) radius solid wood corners using 0420 yellow wood glue and staples. Laminated with 1/32 inch (.08 mm) thick vertical grade laminate using 3M water-base contact adhesive. Mounting hardware includes a dark bronze aluminum and a galvanized steel u-channel, galvanized decking screws, post binding screws, and threaded 1/4 inch (6 mm)-20 x 4 inch (102 mm) long round head zinc plated steel screws. Surface applied high performance vinyl copy.

4. Main Directories: Hand fabricated box made of 5/8 inch (16 mm) and 1 inch (25 mm) thick fiberboard, 3/4 inch (102 mm) luan, staples, yellow wood glue, vertical grade laminate and 3M dark red solvent-based contact adhesive. Faceplate is 1/4 inch (6 mm) thick clear acrylic with vertical grade laminate and 3M Isotech tape with surface screened copy. Faceplate is attached to box with Velcro tape or a black continuous hinge. Inside of box has 26 gauge steel sign blank painted black. Cleat mounting hardware includes ¾ inch thick fiberboard interlocking cleats, 1/4 inch (6 mm)-20 x 4 inch (102 mm) flat head zinc plated steel screws.

5. Mounts:
   
a. Standard Perpendicular Mount Frames: CNC routed 1/8 inch (3 mm) thick styrene backplate with a laser cut 1/16 inch (1.6 mm) non-glare acrylic polished edge faceplate. Faceplate is reverse screened using Nazdar 9700 Series screen print ink. Backplate is assembled to faceplate with 3M VHB double sided tape of
SECTION 10 14 03 – INTERIOR SIGNAGE

approximately .05 inch (1.3 mm) thickness in various widths. Mounting includes T-shaped aluminum extrusion painted black and R-Tite rivets or post binding screws.

b. Standard Ceiling Mount Frames: CNC routed 1/4 inch (102 mm) thick black gloss acrylic backplate with a laser cut 1/16 inch (1.6 mm) thick non-glare acrylic polished edge faceplate. Faceplate is reverse screened using Nazdar 9700 Series screen print ink. Backplate is assembled to faceplate with 3M VHB double sided foam tape of approximately .05 inch (1.3 mm) thickness in various widths. Mounting hardware includes a dark bronze aluminum and a galvanized steel u-channel, galvanized decking screws, post binding screws, and threaded 1/4 inch (6 mm)-20 x 4 inch (102 mm) round head zinc plated steel screws.

6. Vinyl Inserts and Main Directory Strips

a. Vinyl Inserts: Calendared matte/matte .010 mil thick vinyl die cut with a Patented punched keyhole for removal. Lettered with high performance vinyl.

b. Main Directory Strips: Routed 1/16 inch (1.6 mm) thick standard grade laminate or laser cut 1/16 inch (1.6 mm) thick back sprayed acrylic using Matthews’s polyurethane acrylic paints with surface applied high performance vinyl copy. Acrylic strips are laminated on the reverse side with 1 mil clear polyester over laminating film. Strips have 1/2 inch (12.5 mm) or 3/4 inch (102 mm) wide black magnetic tape applied to back for mounting.

7. Innerdot: 1/16 inch (1.6 mm) diameter clear acrylic raster placed in wholes drilled to 1/32 inch (.08 mm) deep in faceplate. Raised characters are 1/32 inch (.08 mm) styrene or 1/32 inch (.08 mm) thick. Sign Products molded plastic letters painted with Matthews polyurethane acrylic paints depending on color. Characters adhered to faceplate with IPS Weld-On #4.

8. Single Units: Processed photopolymer, .035 inch (.08 mm) thick on .024 inch (.04 mm) thick aluminum backer, hand routed to size. Surface is primed with PPG epoxy primer and painted with Matthews’s polyurethane acrylic paint. Raised areas of the painted photopolymer are screened with NazDar System 2 screen print ink. Finished single unit face is attached to 1/8 inch (3 mm) thick black styrene backplate of the same shape with 3M Isotec adhesive.

9. Exterior Grade Single Unit: Etched 1/8 inch magnesium, hand routed to size. Surface is primed with PPG epoxy primer and painted with
SECTION 10 14 03 – INTERIOR SIGNAGE

Matthews’s polyurethane acrylic paint. Raised areas of the painted photopolymer are screened with NazDar System 2 screen print ink.

D. Standard Mounting Systems:

1. Partition Clips u-shaped 1/8 inch (3 mm) thick clear acrylic cut and shaped to customers' specifications.

2. Magnetic Tape 1/2 inch (12.5 mm) or 3/4 inch (102 mm) thick black magnetic tape with adhesive backing cut to size.

3. Double Sided Foam Tape 1 inch (25 mm) wide black or white 3M double-sided foam tape.

4. Angle Stands 1/8 inch (3 mm) thick gloss black acrylic bent to a 65-degree angle. Base has four 3/8 inch (10 mm) diameter felt pads on the bottom.

5. Vandal Resistant Tape 3M white VHB double sided foam tape

6. Backplate Screws Routed 1/8 inch (3 mm) thick black styrene backplate with a counter sunk screw holes. Supplied with dry wall screws and anchors

7. Backplate Glass CNC routed 1/8 inch (3 mm) thick gloss black acrylic with 3M, 1 inch (25 mm) wide black double sided foam tape.

8. Stanchions: Telescoping sign holder with a 15 pound (6.8 kg) weighted base.

PART 3: EXECUTION

3.01 Examination

A. Do not begin installation until surfaces to receive signs have been finished and finishes are dry and correctly cured.

B. If substrate preparation is the responsibility of another installer, notify Architect Project Representative of unsatisfactory preparation before proceeding.

3.02 Preparation

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
SECTION 10 14 03 – INTERIOR SIGNAGE

3.03 Installation

A. Installation shall be by Innerface Sign Systems, or equal approved manufacturer, for new Capital Projects, as well as, Renovation Projects.

   1. Install in accordance with manufacturer's instructions.

B. Locate signs in accordance with approved shop drawings and ADA requirements.

3.04 Protection

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.
EXHIBIT 1

INCLUDES PAGES

10 14 03 – 15

THRU

10 14 03 – 23
SECTION 10 14 03 – INTERIOR SIGNAGE

Revised Jan-15

Interior Signage-10 14 03-15
SECTION 10 14 03 – INTERIOR SIGNAGE

Revised Jan-15

Interior Signage-10 14 03-16
SECTION 10 14 03 – INTERIOR SIGNAGE

ARCHITECTURAL SIGNAGE

INTERIOR

5849 Peachtree Road • Atlanta, Georgia 30341 • 770-921-5566 • Fax 770-279-1327

Elevator

Permanent Name

MODULE 7.0 Vertical [U-01 Directional]
- 11-3/4” x 7”
- Square No Perimeter

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SECTION 10 14 03 – INTERIOR SIGNAGE

ARCHITECTURAL SIGNAGE

5849 Peachtree Road • Atlanta, Georgia 30341 • 770-921-5566 • Fax 770-279-1327

G14
Elevator Equipment

3/4" Raised
3/4" Names are not raised

MODULE 7.0 Vertical [I-ID 1 Large Room ID]
- 11-1/2" x 7"
- Square No Perimeter

Perpendicular Frame
- Raised characters and grade 2 braille
  Translation in clear acrylic materials
  Dots are 1/20" or centers in each cell
  with 1/8" space between cells. Dots are
  raised 1/40" minimum above the
  background.

Permanent Names
- Custodial
- Elevator Equipment
- Electric Room
- Mechanical Room
- IDF/Data Room

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Revised Jan-15

Interior Signage-10 14 03-18
SECTION 10 14 03 – INTERIOR SIGNAGE

NOTE: Map is for drawing purposes only, Floorplans are required in order to reproduce Evacuation Maps. There will be a set-up charge.
SECTION 10 14 03 – INTERIOR SIGNAGE

ARCHITECTURAL SIGNAGE

5849 Peachtree Road • Atlanta, Georgia 30341 • 770-921-5566 • Fax 770-279-1327

1/16” Faceplate
1/16” Backplate Styrene
04 Double-Sided Tape

254

Message

Name Insert

Name Insert

Name Insert

Message

Name Insert

Name Insert

Name Insert

Message

MODULE 6.33 [1-42 Multi-Occupant]
- (7” x 8-3/4”)
- Square No Perimeter

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<th>RELEASE DATE:</th>
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Revised Jan-15

Interior Signage-10 14 03-20
SECTION 10 14 03 – INTERIOR SIGNAGE

ARCHITECTURAL SIGNAGE

5849 Peachtree Road • Atlanta, Georgia 30341 • 770-921-5566 • Fax 770-279-1327

CONSTRUCTION STANDARDS

DIVISION 10 - SPECIALTIES

Revised Jan-15

Interior Signage-10 14 03-21
SECTION 10 14 03 – INTERIOR SIGNAGE

ARCHITECTURAL SIGNAGE
INTERIOR

5849 Peachtree Road • Atlanta, Georgia 30341 • 770-921-5566 • Fax 770-279-1327

First Line

MODULE 6.0 [I-84 Regulatory]
- 8-3/8" x 8-3/8"
- Square No Perimeter

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>LOCATION</th>
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SCALE: 1 : 2

This drawing is intended for use in the preparation of an RME/CD drawing and is not to be used or reproduced without the express written consent of Interface Sign Systems.

Revised Jan-15

Interior Signage-10 14 03-22
CONSTRUCTION STANDARDS
DIVISION 10 - SPECIALTIES

SECTION 10 14 03 – INTERIOR SIGNAGE

ARCHITECTURAL SIGNAGE
INTERIOR

INNERFACE Architectural Signage

PROJECT: Texas State University
(Interior 06 - T)

LOCATION:

QTY:

RELEASE DATE: 04-20-06

REVISIONS:

SCALE: 1:2

DRAWN BY: YMC

This drawing is the sole property of INNERFACE Architectural Signage.

Interior Restroom Sign
- Double-sided signs
- 8-3/4” x 8-3/4”
- Sustain No Perimeter

Innerface Frame
- raised characters and grade 2 braille
- Translation in clear acrylic sign
- Data are 1/2” on centers in each cell
- 1/4” space between cells
- Data are raised 1/4” minimum above the background

X: Date:

Revised Jan-15

Interior Signage-10 14 03-23
SECTION 10 14 03 – INTERIOR SIGNAGE

END OF SECTION 10 14 03
PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Parking Garage Signage designed and configured for exterior installation.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases guidelines will govern the design and specifications for Texas State University. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Section Includes

A. Exterior signage of the following types:

1. Post and panel signs

2. Wall mounted signs.

B. Exterior signage illuminated.

C. Exterior signage non-illuminated.

1.03 Related Sections of Texas State University June 2013 Construction Standards

A. Interior Elevator Signs: 10 14 03, Page 1- 14 03 - 18

1.04 References


D. USATBCB - Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG), and Texas Accessibility Standards (TAS).

1.05 System Description

A. Design exterior signs to withstand positive and negative wind loads as calculated in accordance with applicable building code.

B. Frame and Enclosure:

1. Design, construct and install structural and non-structural support framing in conformance with applicable building code and with AISI Standards.

2. Design to provide for movement of components without damage, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

3. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.06 Submittals

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.
4. Provide proof of listing with UL or CSA.

B. Shop Drawings: Showing sign styles, lettering, locations and dimensions of each sign.

1. Indicate component details including, framing, anchorage, design loading, and location of fasteners, and accessories or items required of related work.

2. Submit calculations for loadings and stresses of all framing, under Professional Engineer's seal who are experienced in design of this work and licensed at the Project location.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: Two full size samples, representing type, style and colors including method of attachment.

1.07 Quality Assurance


PART 2: PRODUCTS

2.01 Manufacturers

A. Acceptable Manufacturer: Innerface Architectural Signage, Inc., Inc.; 5849 Peachtree Road, Atlanta, GA 30341 30047. ASD. Tel: Phone: (770) 921-5566, Toll Free: (800) 445-4796. Fax: (770) 279-1327. Email: Sales@innerfacesign.com. Local Contact: John Schindler III, 936-577-0878, JSCHINDLER@INNERFACESIGN.COM..

B. Substitutions: Only allowed if manufacturer can prove equal quality to Innerface, and matching Innerface colors, and approved by Texas State University’s Project Manager.

C. Requests for substitutions will be considered in accordance with provisions as located in Texas State Construction Standards 01 25 00.
2.02 Parking Garage Signs

A. Standard Products: The following parking garage sign systems shall be provided in locations indicated. Refer to example of sign types in Exhibit 1.

1. Font shall be Times New Roman, except for ADA & TAS required signs, which will be Helvetica Medium font.

D. Construction and Materials General:

1. ASTM B 221/221M: Extruded aluminum, 6063T5 alloy, anodizing quality.


3. Fasteners: Corrosion resistant stainless steel.


5. Assemble cabinets and frames with aluminum brackets secured by corrosion resistant concealed fasteners.

6. Provide gaskets between cabinet and face frame, to prevent water and dust from seeping into the interior.

PART 3: EXECUTION

3.01 Examination

A. Do not begin installation until surfaces to receive signs have been finished and finishes are dry and correctly cured.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify raceways and boxes are ready for installation.
D. Verify electrical and required data connections are available, in the proper locations and ready for use.

3.02 Preparation
A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 Installation
A. Install in accordance with manufacturer's instructions.
B. Locate signs in accordance with approved shop drawings, and ADA and TAS requirements.

3.04 Protection
A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

EXHIBIT 1: INCLUDES PAGES 10 14 04 – 10 THRU 10 14 04 – 32
## Table of Contents

### Vehicular

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Section</th>
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<td>ST-101</td>
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<td>ST-102</td>
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### Pedestrian

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### Mounting Options

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CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

5849 Peachtree Road • Atlanta, GA 30341 • 770-921-5566 • Fax 770-641-0362

NOTE:
Location: Sign to be mounted perpendicular to vehicular traffic in drive aisles.
Intent: Guide vehicular traffic within the parking garage to Parking, Exit(s).

Arrows: All arrows giving direction to straight ahead, left, up-left, & down-left shall be justified on the left side of the sign. All arrows giving direction to the right, up-right, & down-right shall be justified on the right side of the sign.

PRODUCT: VEHICULAR - 3 Directional

DATE: 01.02 / ST-101

DRAWN BY:
M.B.

This drawing should not be reproduced under the conditions set forth by the contractor. This drawing is subject to change without notice and without the written consent of the contractor. Actual dimensions or any other information may vary due to variations in the final design, manufacturing, or installation of the subject. Actual dimensions are not to be considered for design or installation purposes. Actual colors and materials may vary from those shown in this drawing.
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

Notes:
Location: Sign to be mounted perpendicular to vehicular traffic in drive aisles.
Intent: Guide vehicular traffic within the parking garage to Parking, Exit(s).

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Product: RELEASE DATE: APPROVALS:
01.03 / ST-102

VEHICULAR - 2 Directional

Revised Jan-15

Parking Garage Signage – 10 14 04-9
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

NOTES:

Location: Sign to be mounted perpendicular to vehicular traffic in drive aisles.

Intent: Guide vehicular traffic within the parking garage to Parking, Exit(s).

Arrows: All arrows giving direction to straight ahead, left, up-left, & down-left shall be justified on the left side of the sign. All arrows giving direction to the right, up-right, & down-right shall be justified on the right side of the sign.

PROJECT: TEXAS STATE
Parking Garage Sign Standards

DRAWN BY: Mil.B

01.04 / ST-103

VEHICULAR - 1 Directional

Revised Jan-15
Parking Garage Signage – 10 14 04-10
Vehicular Pedestrian Crossing Identification

Dimensions: Scale 1" = 1'-0"

NOTES:
Location: Sign to be mounted perpendicular to vehicular traffic in the drive aisles.
Intent: Identify pedestrian crossing (or other messages) to vehicular traffic.

TX STATE
Parking Garage Sign Standards

DRAWN BY: MI, B

This drawing and the specifications herein are intended for the use of the project. Any reproduction or use of any part thereof without the prior written consent of the owner is prohibited. Actual dimensions may vary due to the nature of the materials. Check with the architect or engineer for further information on the materials to be used in the project.
Each floor to have separate color per schedule below:

Level 1: SW 6907 “Yellow”
Level 2: SW 6867 “Red”
Level 3: SW 6922 “Green”
Level 4: SW 6891 “Orange”
Level 5: SW 6966 “Blue”
Level 6: SW 6979 “Violet”
Level 7: SW 6983 “Purple”

(All colors are Sherwin Williams)
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

5849 Peachtree Road - Atlanta, GA 30341 - 770-921-5566 - Fax 770-564-0362

NOTES:
Location: Sign to be mounted perpendicular to vehicular traffic at all vehicular entry points.

Intent: Identify the height clearance / areas of no entry of the parking garage to vehicular traffic.

VEHICULAR - Headache Bar

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Revised Jan-15

Parking Garage Signage – 10 14 04-13
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

1. Vehicular Regulatory - No Parking

2. Vehicular Regulatory - Accessible Parking

3. Vehicular Regulatory - Van Accessible Parking

NOTES:

Location: Sign to be mounted at each (van) accessible parking space or area of no parking.

Intent: Identify the accessible, van accessible, and no parking areas to vehicular and pedestrian traffic.

This drawing and all data expressed herein are the confidential property of Nelson A. This drawing and all data expressed herein are the confidential property of Nelson A. All dimensions shown are for indication purposes only and actual items can be measured by scale specification.
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

NOTES:

Location: Sign to be mounted perpendicular to pedestrian traffic.

Arrows: All arrows giving direction to straight ahead, left, up-left, & down-left shall be justified on the left side of the sign. All arrows giving direction to the right, up-right, & down-right shall be justified on the right side of the sign.

Pedestrian 3 Directional

Drawn By: M.B.

This drawing and the City seal represented under the authority of the City of Atlanta, this design and the City shall be responsible, unless in accordance with any other provision in effect without the express written consent of a contracting or as agent of MARTA Architectural Services. Inc. All dimensions are approximate. Actual dimensions may vary by 5/16” in physical relations. If dimension checks shown as the reference purpose, any actual error and or be eliminated by our specification.

Revised Jan-15

Parking Garage Signage – 10 14 04-15
Pedestrian 2 Directional

NOTES:

Location: Sign to be mounted perpendicular to pedestrian traffic.

Arrows: All arrows giving direction to straight ahead, left, up-left, & down-left shall be justified on the left side of the sign. All arrows giving direction to the right, up-right, & down-right shall be justified on the right side of the sign.

PROJECT: Pedestrian 2 Directional

REVISION: 02.03 / ST-202

DRAWN BY: MI.B

This drawing is the final approved concept for the project. The drawing and its data are the property of the Architectural Firm. Any reproduction or utilization of the drawing without the express written consent of the Architectural Firm is strictly prohibited. This drawing is not an actual representation of the project and is shown as the concept design. Actual measurements are subject to change as determined by the architectural specifications.
Pedestrian 1 Directional

Pedestrian 1 Directional - Alternate Layout

NOTES:

Location: Sign to be mounted perpendicular to pedestrian traffic.

Arrows: All arrows giving direction to straight ahead, left, up-left, & down-left shall be justified on the left side of the sign. All arrows giving direction to right, up-right, & down-right shall be justified on the right side of the sign.

PROJECT: REVISION DATE: APPROVALS: SHEET:

TEXT FOR A DIRECTIONAL SIGN:

Pedestrian 1 Directional

Pedestrian 1 Directional - Alternate Layout

NOTES:

Location: Sign to be mounted perpendicular to pedestrian traffic.

Arrows: All arrows giving direction to straight ahead, left, up-left, & down-left shall be justified on the left side of the sign. All arrows giving direction to right, up-right, & down-right shall be justified on the right side of the sign.

PROJECT: REVISION DATE: APPROVALS: SHEET:

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Pedestrian 1 Directional - Alternate Layout

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Pedestrian 1 Directional

Pedestrian 1 Directional - Alternate Layout

NOTES:

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Arrows: All arrows giving direction to straight ahead, left, up-left, & down-left shall be justified on the left side of the sign. All arrows giving direction to right, up-right, & down-right shall be justified on the right side of the sign.

PROJECT: REVISION DATE: APPROVALS: SHEET:

TEXT FOR A DIRECTIONAL SIGN:
Each floor to have separate color per schedule below:

Level 1: SW 8907 “Yellow”
Level 2: SW 0867 “Red”
Level 3: SW 0622 “Green”
Level 4: SW 1863 “Orange”
Level 5: SW 8868 “Blue”
Level 6: SW 8970 “Ivory”
Level 7: SW 6982 “Purple”

(Note: All colors above are Sherwin Williams)

Each floor sign to be mounted perpendicular / parallel to pedestrian traffic, depending on best suited location(s), in and around vertical cores.

NOTE: Identify the levels of the parking garage to pedestrian traffic.

Pedestrian Level Identification

NOTES:

Location: Sign to be mounted perpendicular / parallel to pedestrian traffic, depending on best suited location(s), in and around vertical cores.

楮: Identify the levels of the parking garage to pedestrian traffic.

PEDESTRIAN - Level Identification
Pedestrian Room Identification: Module 7.0

NOTES:
Location: Sign to be mounted on the latch side of the door, 24” from the door frame, 60” a/f to the centerline of the sign.
Intent: Identify the rooms within the parking garage.

PEDESTRIAN - Room Identification
Pedestrian Egress Sign: Module 9.1

NOTES:
Location: Sign to be mounted adjacent to the door or entry leading from the stairwell into the parking garage.
Intent: Identify stair name, level number, and indicate the upper and lower terminations of each stairwell within the parking garage.

This marking and all associated work is the responsibility of the contractor. Owner and architect are not to be held responsible, except in connection with their respective work. No contractor is authorized to alter this drawing or its dimensions without the express written consent of the architect. All dimensions shown are for architectural purposes only. Actual dimensions may vary.

DELIVERY INFORMATION:

TxDOT, City of Austin, State of Texas

CHECK: SCALE: 1:96 = 1'-0"

Pedestrian Egress Sign - Elevation

STAIR #1

ROOF ACCESS LEVELS 1 - 4
EXIT DISCHARGE ON 2nd

Thread New Roman Copy
Color #5 - Slate
#11 Ivory Text New Roman Material and Edge
Single Unit
Black Grade
Photopolymer
#11 Ivory Rule Line
Thread New Roman Copy
Grade 2 Black Copy

Pedestrian Egress Sign: Module 9.1

NOTES:
Location: Sign to be mounted adjacent to the door or entry leading from the stairwell into the parking garage.
Intent: Identify stair name, level number, and indicate the upper and lower terminations of each stairwell within the parking garage.

PROJECT: Release Date: Approvals: Sheet:

TEXAS STATE
Parking Garage Sign Standards

DRAWN BY: MI.B

PEDESTRIAN - Egress Sign

02.07 / ST-208

Revised Jan-15
Parking Garage Signage – 10 14 04-20
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

IN CASE OF FIRE, USE STAIRS.

1 Pedestrian Stair Sign (1): Module 8.0

2 Pedestrian Stair Sign (2): Module 8.0

3 Pedestrian Stair Sign (3): Module 8.0

NOTES:

Location: Signs to be mounted at points of exit, stairwells, and elevator banks.

Intent: Identify fire exits, stairwells, and the use of stairs during the occurrence of a fire.

Revised Jan-15

Parking Garage Signage – 10 14 04-21
Pedestrian Regulatory: Module 9.1

NOTES:
Location: Sign to be mounted perpendicular to pedestrian traffic at all vehicular only traffic exits.
Intent: Identify non-pedestrian exits and give information to locations of pedestrian exits.

SECTION 10 14 04 – PARKING GARAGE SIGNAGE

CONSTRUCTION STANDARDS

Revised Jan-15

Parking Garage Signage – 10 14 04-22
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

NOTES:

When to Use: This mounting type is to be used for all vehicular and pedestrian directional sign types and vehicular identification sign type when ceiling height of ten beams allows a minimum of 7'-2" clearance. All locations to be field verified prior to fabrication.

Beam Suspended

Revised Jan-15

Parking Garage Signage – 10 14 04-23
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

Revised Jan-15

Parking Garage Signage – 10 14 04-24
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

NOTE: Drawing not to scale.

When to Use: This mounting type is to be used for all vehicular headache bar sign types. All locations to be field verified prior to fabrication.

PRODUCT: [Details]

RELEASE DATE: [Details]

APPROVALS: [Details]

DATE: [Details]

SHEET: [Details]

NOTE: Drawing not to scale.

TEXAS★STATE
Parking Garage Sign Standards

DRAWN BY: [Details]

Ceiling Suspended

Revised Jan-15

Parking Garage Signage – 10 14 04-25
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

NOTES:

When to Use: This mounting type is to be used for all vehicular and pedestrian level identification sign types, and pedestrian regulatory sign types. All locations to be field verified prior to fabrication.

NOT: Drawing not to scale.

NOTE: Drawing not to scale.

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Revised Jan-15

Parking Garage Signage – 10 14 04-27
CONSTRUCTION STANDARDS
SIGNAGE

SECTION 10 14 04 – PARKING GARAGE

NOTES:
When to Use: This mounting type is to be used for all pedestrian door identification, egress, and stall-wall sign types. All locations to be field-verified prior to fabrication.

PROJECT: TEXAS STATE
Parking Garage Sign Standards

DRAWN BY: MLE

NOTE: Drawing not to scale.

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Revised Jan-15

PARKING GARAGE SIGNAGE – 10 14 04-28
SECTION 10 14 16 – BUILDING DEDICATION PLAQUE

PART 1 – GENERAL

1.01 Scope of Standard
   A. This standard provides general guidance concerning the specific preferences of Texas State University.
   B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. Guidelines will govern the design and specifications for Texas State University. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Summary
   A. Section Includes:
      1. Cast bronze building dedication plaque.

1.03 Action Submittals
   A. General: Submit the following in accordance with the Submittal Section.
   B. Owner will provide the correct names for the plaque.
   C. Submit four copies of a full size rubbing for approval prior to casting.
      1. Two copies of the approved rubbing will be returned to the Contractor.

1.04 Closeout Submittals
   A. Maintenance Data: For cast metal plaques to include in maintenance manuals.

1.05 Quality Assurance
   A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
SECTION 10 14 16 – BUILDING DEDICATION PLAQUE

1.06 Product Delivery, Storage and Handling

A. Deliver plaque, crated, to provide protection during transit and job storage.
B. Inspect plaque upon delivery for damage and correctness.
C. Store plaque inside building.

1.07 Job Conditions

A. The plaque will be attached to the wall with concealed mountings. The construction wall will have support blocking for the plaque.

PART 2 – PRODUCTS

2.01 Manufacturers

A. Acceptable Manufacturers: Subject to compliance with requirements, provide cast metal building plaque by one of the following:

1. A.R.K. Ramos
2. Gemini Incorporated
3. Matthews International Corporation; Bronze Division
5. The Southwell Company

B. Substitutions: Under provisions of Section 01 25 00.

2.02 Cast Bronze Plaques

A. Bronze Casting: ASTM B 584, allow UNS No. C83600 (No. 1 manganese bronze), (85-5-5-5 Standard U.S. bronze alloy). Casting shall be free of pits and gas holes and all letters shall be sharp and hand tooled.

B. Border and faces of raised letters shall be satin/brushed finish and background shall be leatherette finish. Plaque shall be chemically cleaned and etched and treated with Alodine and sprayed with two coats of Clear Acrylic Lacquer.

1. Size: 1’-6” x 2’-0”
2. Border Design: Raised, satin/brushed finish
SECTION 10 14 16 – BUILDING DEDICATION PLAQUE

3. Letter Style: Arial Narrow

4. Background: Leatherette finish, Oxidized-Dark Bronze.

C. Text: Refer to EXHIBIT 1. The Owner will provide correct names for the plaque.

2.03 Fabrication

A. General: Provide castings free from pits, scale, sand holes, and other defects. Comply with requirements specified for metal, border style, background texture, and finish, and in required thickness, size, shape, and copy.

2.04 Copper Alloy Finishes

A. Cast-Bronze Character Finishes: Manufacturer’s standard satin finish with exposed surfaces free from porosity, burrs, and rough spots; with returns finished with fine-grain air blast.

B. Cast-Bronze Plaque Finishes: Exposed surfaces free of porosity, burrs, and rough spots; with returns finished with fine-grain air blast.

1. Raised Areas: Hand-tool and buff borders and raised copy to produce manufacturer’s standard polished finish.

2. Background Finish: Dark Oxidized.

C. Clear Protective Coating: Coat exposed surfaces of copper alloys with manufacturer’s standard, clear organic coating specially designed for coating copper-alloy products.

PART 3 – EXECUTION

3.01 Inspection

A. Examine the area and conditions under which plaque is to be installed and notify Architect, in writing, of conditions detrimental to proper and timely completion of work.

B. Examine partitions and verify proper backing for attachment of plaque has been securely installed.
SECTION 10 14 16 – BUILDING DEDICATION PLAQUE

C. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 Installation

A. Cast-Metal Plaques: Mount plaques using standard fastening methods recommended in writing by manufacturer for type of wall surface indicated.

B. Install plaque plumb, level, and square, in proper planes with related surfaces, with concealed type fastening devices.

3.3 Clean-Up

A. After installation, clean soiled sign surfaces according to manufacturer’s written instructions. Protect signs from damage until acceptance by Owner.

B. Clean up all debris caused by the work of this section, keeping the premises clean and neat at all times.

END OF SECTION 10 14 16
SECTION 10 17 20– Telephones: Emergency Blue Light

PART 1: GENERAL

1.01 Scope of Standard
   A. This standard provides general guidance concerning the specific preferences of Texas State University.
   B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases guidelines will govern the design and specifications for Texas State University. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Summary
   A. Section Includes:
      1. Emergency Telephones
      2. CCTV
      3. Stranded power and control cable.
      4. Cable connecting hardware, patch panels, and cross-connects.
      5. Cable management system.
      7. Grounding
      8. Pathways
   B. Related Specifications:
      1. Communications Specification Standards – 27 00 00
   C. System Requirements:
      1. Install Emergency Blue Light Telephone and related hardware.
      2. Provide telephones, wide area broadcast equipment, power supplies, communication interfaces, and other related equipment.
      3. Provide all required software licenses for telephones and wide area broadcast system.
   D. Bidding Requirements:
SECTION 10 17 20– Telephones: Emergency Blue Light

1. Bidder shall submit complete detailed proposals with line item cost representation for components and associated installation labor. Lump sum bids will not be accepted.

2. Include as part of the bid response the following item:
   a. Installation schedule with proposed manpower assignments,
   b. Resumes for project manager and lead engineer for this project.

Review associated electrical, low voltage infrastructure drawings to verify necessary conduit and floor boxes will be provided by others. The Owner will provide no additional infrastructure to support the emergency telephones. Any discrepancies with the identified infrastructure to support these systems should be questioned in the form of a request for information (RFI) during the bidding process. Be responsible for any additional infrastructure requirements after receipt of contract for this project.

3. Unspecified Equipment and Material: Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide complete and functional emergency blue light telephone shall be provided in a level of quality consistent with other specified items.

1.03 References

A. The Codes and Regulations listed below from a part of this specification to the extent referenced. Work shall be performed in accordance with the applicable international, federal, state, and local codes or standards current at the commencement of installation. The following list summarizes applicable standards:
   1. UL 294, UL 1076, ULC
   2. CE
   3. FCC-Part 15, Part 68
   4. NFPA 70, NEC
   5. IEEE, RS 170 variable standard

B. Where more than one code or regulations is applicable, the more stringent shall apply.

C. Cable and equipment installation, identification and termination shall be performed in accordance to the applicable codes above.

1.04 System Description

A. Complete Engineering, installation, and maintenance emergency blue light telephones.
SECTIon 10 17 20– Telephones: Emergency Blue Light

B. Texas State University current telephone communications system standard are in Division 27 Construction Standards.

C. All additional accessories or supporting hardware shall be fully compatible with and able to integrate with existing campus systems.

D. All emergency blue phone installations shall provide adequate housings and environmental controls to insure proper operation of phone determined by environmental conditions and building usage. Provide protection from accidental and intentional damage or tampering.

1.05 Performance Requirements:

A. Provide as shown on drawing quantity of telephones, speakers, mounts, and controls.

B. All programming of all systems hardware is by the installation contractor. A one year full parts and labor warranty is specified. Note that the full one year parts and labor warranty is unconditional and covers all portions of this system form failure, except for acts of God or misuse by the owner. During this one-year period, the security contractor must meet the following performance requirements.

1. Respond Onsite Within Two to Four Hours

2. Advanced Loaners

3. Computerized Dispatch

4. Service technicians certified on Talk-A-Phone systems and products.

5. Available 7 days a week, 24 hours a day.

1.06 Submittals

A. Comply with requirements of Submittal Procedures by A/E specifications.

B. Informational Submittal: Submit a detailed bill-of materials listing all part numbers and quantities for this project.

C. Qualification data:

1. List all technical personnel

2. List of all technical personnel factory-certified Talk-A-Phone.

3. Resume of key project manager, and lead technician.
SECTION 10 17 20– Telephones: Emergency Blue Light

4. Three (3) references from entities using emergency call phone systems (prefer at least one reference from university or higher education entity).

D. Pre-Qualification Certificate as part of this proposal: Submit a letter of approval from the manufactures indication compliance with qualifications requirements. Training certificates for design, engineering and installation of the proposed products shall be submitted with the proposal.

E. Service Dispatch: Submit as part of this proposal an outline containing the type of service program used for dispatching and tracking service calls.

F. Shop Drawings: Required before work can begin. Shop drawings will clearly indicate how work will be performed.

G. Product Literature Sheets: Provide a manufacturer’s product cut sheet for each component of the system including each telephone, speaker, interface module, light unit, cabling, conversion device, power supply, mount, stanchion or other devices to be utilized.

H. Detail Drawings. Provide a detail drawing for each type of telephone and device installation. This should also include device location on floor plans, wiring diagrams and point-to-point charts, and riser diagram.

I. Project Directory. Provide a job directory of your company engineering and installation team including phone, fax, email or mail to each manager, engineer, sales rep, or installer involved in this project.

J. Block Diagrams. Submit block diagrams for emergency blue light telephone system indicating connections of equipment and indicating equipment types and model numbers.

K. Programming Sheets – Submit programming sheets in Excel format showing hardware components location, equipment type, model number, serial number, MAC address, and default IP address.

L. Manuals: Final copies of the manuals shall be delivered within fourteen (14) days after completing the installation test. Each manual’s contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following available from the manufacturing:
SECTION 10 17 20– Telephones: Emergency Blue Light

1. Hardware Manual: The manual shall describe all equipment furnished including:
   a. General description and specifications
   b. Installation and check out procedures
   c. Equipment layout and electrical schematics to the component level
   d. System layout drawings and schematics
   e. Alignment and calibration procedures
   f. Manufacturers repair parts list indicating sources of supply

2. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operations. The manual shall include:
   a. Definition of terms and functions
   b. System use and application software
   c. Initialization, startup, and shut down
   d. Reports generations
   e. Details on forms customization and field parameters

3. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

4. Manuals shall be delivered on CD/DVD in an organized fashion based on manufacturer and product.

M. As-Built Drawings: During system installation, maintain a separate hard copy of drawings, elementary diagrams, and wiring diagrams of the emergency blue light telephones to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the emergency blue light telephones system. The final as-built drawings shall be provided to the end user in DXF format.

1.07 Quality Assurance

A. Installing company must be on a pre-approved list furnished by the owner for installation services for this project.

B. Providers of manufactured components, installation, wiring and testing shall be the responsibility of a single contractor who is an authorized dealer for the product supplied and who has been continuously in business for a period of not less than five (5) years and is licensed as required by the jurisdictions where the work will occur to perform the work specified.
SECTION 10 17 20– Telephones: Emergency Blue Light

C. Service Support: Provide post-sales service support for all components in the system design that meets requirements:

1. Availability: 7 days a week, 24 hours a day.

2. Response Time: Two to four hours on-site.

3. Advance Replacement:
   a. Contractor shall provide advance replacements for any component whenever it is required.
   b. The contractor shall be able to provide advance loaners.

1.08 Contractor Performance Requirements

A. Working Hours Response: During normal working hours, all telephone calls placed to the contractor shall be answered by a live person, not an auto-attendant.

B. The contractor shall use a computerized service dispatch system that is a commercial off-the-shelf product used for dispatching service companies. At the end of every week, the contractor will be required to email Texas State University a list of all service calls and their status on an automatic basis. Excel spreadsheets are not acceptable for a service dispatch program.

C. The contractor shall have a dedicated position specifically for managing and dispatching service call for their clients. This position shall perform no other functions except service-related dispatch functions and service.

D. Engineering: The contractor must have field-trained engineers on staff are 100% conversant in AutoCAD and are able to provide the necessary electronic drawings and submittals required for a project of this size.

E. The Contractor must be a certified dealer of all products utilized in the CCTV system.

1.09 Substitutions and Quality:

A. Where products are specified by name, provide and install that product. Substitutions will not be accepted for the access control system or their sub-system.

1.10 Delivery, Storage, and Handling

A. Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating manufacturer and materials.
SECTION 10 17 20– Telephones: Emergency Blue Light

1.11 Project Conditions

A. Environmental Limitations: Do not deliver or install cables, equipment, and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 Coordination

A. Coordinate layout and installation of emergency blue light telephone systems equipment with Access Services.

1. Meet jointly with Access Services to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute them to other participants.

B. Coordinate layout and installation of the emergency blue light telephone systems cable pathways with telecommunications contractor.

1.13 Warranty

A. During the first year, provide a full service warranty program that guarantees a two to four hour on-site response, include all parts and labor, and provides advance replacements for any defective components. The installation contractor must qualify as the service organization and provide the on-site warranty service.

B. The system components shall be guaranteed against all defective materials, design and workmanship for a period of one-year from the date of acceptance by the client after final testing. New replacement parts shall be furnished promptly and defects in design and workmanship shall be corrected, without cost to the Owner, promptly upon receipt of notice from the Owner of failure of any part of the system during the guarantee period. This is a one year full parts and labor warranty and no alternative will be acceptable.

C. Any item failing before the one year guarantee period expires shall be replaced and the guarantee extended for that item for twelve months from the replacement date of the item.

D. The warranty period for any part which has a warranty by the manufacturer of longer than 12 months shall be for the longer period. Provide a copy of the manufacturer’s warranty period statement for all major emergency blue light telephone components.
PART 2: PRODUCTS

2.01 Wiring and Cabling

A. Data transmission cable.

1. All emergency blue light telephone system data wiring, cables, jumpers, and connectors will comply with requirements of Division 27 Construction Standards.

2. Each emergency blue light telephone installation shall be equipped with:

   a. Two (2) CAT 6 cables.
   b. One (1) 6 Strand 50 micron laser optimized fiber cable.
   c. All cabling shall be placed in rigid metal conduit, buried at least 24’ below finished grade.

3. All emergency blue light telephone system low voltage electrical wire shall be rated and adequate to supply the intended devices full functionality including but not limited to telephone, audio equipment, and lighting without exceeding seventy-five percent (75% of the wire’s rated capacity.

4. Sufficient cabling shall be provided to each installation to use all data, audio, dry contact input and output capabilities of the emergency blue light telephone system.

2.02 Electrical Power Needs

A. Emergency blue light telephone power supplies should be located in the device mount or Telecommunication/IDF closets.

B. Emergency blue light telephone system power cables shall not be installed to be within the public view. Any power cables within public view shall be placed in conduit to prevent damage or tampering.

C. Emergency blue light telephone system power supplies shall be connected to the building emergency power systems to insure service in the event of a power failure.

2.03 Mounting Equipment

A. All emergency blue light telephone system housings and mounts shall be installed to the manufacturer’s specifications using original parts.
SECTION 10 17 20– Telephones: Emergency Blue Light

2.04 Data Transmission Resources Needs

A. Contractors shall work closely with the Texas State University Office of Technology Resources via the Office of Facilities Planning design and Construction to insure adequate computer network and telephone communication resources are available for intended emergency blue light telephone systems.

B. Data cable runs shall be limited to no more than 290 ft. from the emergency blue light telephone installation and data switch. During design and installation close attention should be paid to the distance of cabling runs for emergency blue light telephone.

C. Installations requiring cable runs longer than 290 ft may use the following methods to transmit data to the telecommunications/IDF closet with prior approval by Access Services and Network Operations.

   1. 6 Strand 50 micron laser optimized fiber with required conversion devices. Data conversion devices must be approved by Network Operations (See Division 27 Construction Standards).

2.05 Products

A. Emergency Blue Light Telephone Stanchion/Tower (with wide area broadcast)

   1. Talk-A-Phone WEBS-MT-R-TSUSMR (custom part number)
      a. Includes:
         WEBS-MT-R tower – Tower factory color to be Sherwin Williams: SW 6258 “Tricorn Black”
         ETP-400RV emergency phone
         WEBS-CM-2 paging module
         LED Blue Light
         LED Panel Light
         Anchor Bolt Kit

   2. Stanchion/Tower shall be painted Sherwin Williams, color SW 6258, “Tricorn Black”, and semi-gloss finish.

B. Emergency Blue Light Telephone Surface Mount

   1. Talk-A-Phone ETP-SM surface mount housing.
   2. Talk-A-Phone ETP-400VR emergency call phone.

C. Emergency Blue Light Telephone Wall Mount (with wide area broadcast)

   1. Talk-A-Phone WEBS-WM wall mount housing
   2. Talk-A-Phone ETP-400VR emergency call phone
SECTION 10 17 20– Telephones: Emergency Blue Light

D. Talk-A-Phone Emergency Blue Light Telephone Stanchion Single Camera Arm
   1. Use OP-4 designation.

E. Talk-A-Phone Dual Camera Arm
   1. Use OP-4D designation

PART 3: EXECUTION:

3.01 Examination

A. The contract shall examine areas and conditions under which the equipment is to be installed and shall notify the general contractor in writing of conditions detrimental to proper and timely completion of work.

3.02 Records

A. A record is a collection of information about or related to a specific element of the emergency blue light telephones. Records must be maintained in a computer spreadsheet, or in a computer database. Paper records are encouraged, but are optional. A device and cable record is prepared for each device installation. The record will show the device name, and must describe the components from origin point and destination point. The device and cable record will record what services and/or connections are assigned to each installed location. An equipment record is prepared for services distributed from a certain piece of equipment, such as an telephone, controller, or a system.

3.03 Drawings

A. Drawings are used to illustrate different stages of emergency blue light system installation planning, installation, and administration.

B. Installation or Construction Drawings
   1. Installation or construction drawings are the plans that show the installer how the infrastructure and devices are to be installed. The quality of the installation can be directly impacted by the lever of detail in the installation drawings and written specifications. Installation drawings for Texas State projects shall, at a minimum, device installation, show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and wiring details including identifier assignments.

C. As-built Drawings
SECTION 10 17 20 – Telephones: Emergency Blue Light

1. The as-built drawings graphically document the installed video surveillance devices and infrastructure through floor plan, elevation, and details drawings. In many cases, these drawings will differ from the installation drawings because of changes made during construction and specific site conditions. In the as-built drawings, the identifiers for major infrastructure components must be recorded. The pathways, spaces, and wiring portions of the infrastructure each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings. As-built drawings are a vital component of the administration system, and must be kept current as adds, moves, and changes take place. Texas State requires the installer to provide a complete and accurate set of as-built drawings.

3.04 Labeling and Color Coding

   A. Use labeling and color coding found in Division 27 - Communications

END OF SECTION 28 23 00
PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preference of Texas State University for toilet compartments.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Mounting: All toilet compartments shall be ceiling/wall mounted.

   1. The structural steel support shall be capable of supporting the partitions without any movement, under normal use.

B. Compartment doors and division panels shall be 12” above floors to facilitate cleaning.

   1. Door thickness shall be minimum ¾” thick.
   2. Panel thickness shall be minimum ¾” thick.

C. Compartment material shall be:

   1. High pressure melamine made as integral part of a phenolic resin core that will not support rust, mold or mildew.
   2. Phenolic resin door & panels with standard manufacturer’s color throughout.
   3. On executive (high finish) restrooms, toilet partitions can have a custom finish on a core material that does not support rust, mold or mildew.

D. Provide all toilet and shower compartments with doors.

E. Showers shall have stainless steel rods with white, heavy duty, anti-bacterial, plastic curtains with built in weights at bottom hem similar to Staph Chek Brand.
SECTION 10 21 13.19 – PLASTIC TOILET COMPARTMENTS

F. Toilet compartment and shower doors shall be fitted with manufacturer’s standard mounting continuous brackets and hinges.

G. Solid fire treated wood blocking should be installed behind toilet partitions and urinal screens, 1 ½” thickness.

H. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB).

1.03 Related Standards

   1. Texas Accessibility Standards (TAS).

B. Refer Section 102813 – Toilet Accessories.

C. Federal Spec. RR-P-1352, Type I, Style A, B, or C as required.

PART 2: PRODUCTS

2.01 Acceptable Manufacturers

A. General: For the purpose of establishing the minimum functional, aesthetic and quality standards required for the work of this section, products of the following manufacturer are specified.
   1. AMPCO, or equal

PART 3: EXECUTION

3.01 Installation

A. Before starting the work of this section, verify the following and coordinate with:
   2. Site conditions to receive partition work.
SECTION 10 21 13.19 – PLASTIC TOILET COMPARTMENTS

3. Opening dimensions shown on approved shop drawing.

4. Locations of built-in framing, anchorage and bracing.

5. Locations of plumbing fixtures.

6. Required blockings.

B. Install partitions in accordance with approved shop drawings, manufacturer’s published recommendations and Contract Documents.

1. Panel Mounting Brackets: manufacturer’s standard continuous channel.

2. Space between Wall and Panels: Maximum ½”.

3. Space between Wall and End Pilasters: Maximum ½”.

4. The completed installation shall be secure, plumb and square.

5. Bottoms of doors shall be level when in closed position.

C. Equip each door with manufacturer’s standard continuous hinges, and one coat hook and bumper.

1. For Handicapped Stall: On inside of door install 1 coat hook and 1 door latch and 1 door pull for out swing doors; on outside of door install 1 door bumper and 1 door pull, each in compliance with Handicapped requirements.

2. Coat hooks/bumpers mounted on walls are not acceptable.

D. Install door strike keeper with door bumper on each pilaster in alignment with door latch.

E. Urinal Screens: Anchor to wall with fasteners appropriate for the type of wall construction.

1. Bracket Supported Screens: manufacturer’s standard continuous channel.

2. Provide in wall blocking for anchors.

END OF SECTION 10 21 13.19
SECTION 10 22 26 – OPERABLE PARTITIONS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for folding, sliding or coiling partitions and walls.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 Design Guidelines

A. It is the standard of Texas State University-San Marcos campus to discourage the use of these type systems.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 10 22 26
SECTION 10 26 13 – WALL & CORNER GUARDS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for protective devices such as corner guards and bumper rails of metal, plastic, rubber and other finish materials.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 Design Guidelines

A. There is currently no Texas State University-San Marcos campus standard for wall & corner guards. Each A/E will dictate the type of guard and its location. Use corner guards for walls and columns where equipment or furniture will be moved regularly.

1.03 General Requirements

A. Design team shall review potential locations for corner and wall protection with building occupants.

B. As a general rule protection of outside corners of gypsum board partitions in public corridors needs corner protection to wainscot height. Public spaces with moveable seating should also consider wall protection at chair rail height at gypsum board partitions.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 10 26 13
SECTION 10 28 13.13 – COMMERCIAL TOILET ACCESSORIES

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for toilet accessories.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification and prior approval by Texas State University, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines: (NOT USED)

1.03 Reference Standards


B. ASTM A153-Zinc Coating (Hot-Dip) on Iron and Steel Hardware.


D. ASTM A269-Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

E. ASTM A366-Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

F. ASTM A527-Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.

G. ASTM C1036-Flat Glass.

H. State of Texas Architectural Barrier Act published by the State of Texas Licensing & Regulation Commission & ADA/TAS Standards.

1.04 Quality Assurance

A. The work of this section shall be performed by a company which specializes in the type of toilet accessory work required for this project, with a minimum 5 years...
SECTION 10 28 13.13 – COMMERCIAL TOILET ACCESSORIES

of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

B. Manufacturer shall specialize in manufacturing the types of toilet accessories specified in this section, with a minimum of 10 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility and warranty.

C. Manufacturer’s identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.

1. Evidence of “patching” after removal of tags or marks is not acceptable.

1.05 Submittals

A. Submit the following according to Conditions of the Construction Contract and Division 1 Specification Sections.

B. Shop Drawings: Shall clearly indicate but not be limited to:

1. Locations, mounting heights and method of securing each type of toilet accessory, coordinating with tile layouts.

C. Product Data: Shall be clearly marked to indicate all technical information which specifies full compliance with requirements of this section and Contract Documents, including manufacturer’s published installation recommendations for the following:

1. Each type of toilet accessory scheduled on drawings.

D. Operations and Maintenance Data: Shall clearly indicate manufacturer’s printed instructions for operations and maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions and precautions against materials and methods which may be detrimental to finishes and performance.

E. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials, a “Material Safety Data Sheet” (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

F. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and
SECTION 10 28 13.13 – COMMERCIAL TOILET ACCESSORIES

materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB).

1.06 Warranty

A. Comply with General Conditions, agreeing to repair or replace specified materials or work that has failed within the warranty period. Failures include but are not limited to the following:

1. Rough, difficult or noisy operation.
2. Faulty installation.
3. Loose or missing parts.

B. Mirror Warranty: Comply with General Conditions, except extend warranty period on silver spoilage of mirrors to 15 years.

PART 2: PRODUCTS

2.01 Acceptable Manufacturers

A. General: For the purpose of establishing the minimum functional, aesthetic and quality standards required for work of this section, products of the following manufacturers are specified:


B. Substitutions: Approval required by Texas State University Project Manager and Director, Custodial Operations.

2.02 Toilet Accessories: General

A. Types and Mounting Locations: Refer to drawings.

B. Materials:

1. Sheet Steel: ASTM A366, cold-rolled stretcher leveled; G60 galvanized coating.
2. Stainless Steel Sheet: ASTM A167, Type 304, 22 gauge minimum.
SECTION 10 28 13.13 – COMMERCIAL TOILET ACCESSORIES


4. Galvanized Steel Sheet: ASTM A527, G60.


6. Adhesive: Epoxy type contact cement.

7. Fasteners, Screws, Bolts, Back-up Plates: Same material as accessory unit. Hot-Dip galvanized if fastener is concealed.

8. Expansion Shields: Fiber, lead or rubber of type recommended by accessory manufacturer.

9. Separator: Of type recommended by accessory manufacturer to prevent electrolysis between two dissimilar materials.

10. Mirror Glass: ASTM C1036, Type 1, Class 1, quality q2, with silvering, electro-plated copper coating and protective organic coating.

C. General Requirements:

1. Templates: Required for each type of toilet accessory.

2. Design, finish and keying of items shall be same; 2 keys for each lock.

3. Grab bars in handicap toilets shall be capable of supporting 250 pounds for 5 minutes.


5. Exposed Surfaces: Shall be free of distortion, scratches, dents and other imperfections.

D. Surface-Mounted Toilet Accessories:

1. Except where otherwise indicated, units shall be fabricated with tight seams and joints, exposed edges rolled.

2. Doors or Access Panels: Complete with continuous stainless steel piano hinge and stainless steel cable doorstop.

3. Anchorage: Concealed whenever possible.

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SECTION 10 28 13.13 – COMMERCIAL TOILET ACCESSORIES

E. Recessed Toilet Accessories:
   1. Except where otherwise indicated, fabricate units of all welded construction, without mitered corners.
   2. Doors or Access Panels: Complete with continuous stainless steel piano hinge.
   3. Anchorage: Concealed when unit is closed.

F. Finishes:
   1. Exposed Stainless Steel: No. 4 brushed finish.

2.03 Toilet Accessory: Products

A. Mirrors
   1. Plate-Glass Mirrors: As specified in Section 088313
   2. Mirrors Manufactured by Toilet Accessory Manufacturer: As scheduled on drawings.
      a. Fabricate frames to accommodate wood, felt, plastic, or other glass edge protection material.
      b. Provide galvanized steel mirror backing sheet not less than 22 gauge and full mirror size and non-absorptive filler and support system that will provide rigid, tamperproof glass installation and prevent moisture accumulation.
      c. Provide system for mounting mirror units that will provide rigid, tamper-proof installation with galvanized steel device with spring-action locking mechanism to hold mirror in position with no exposed screws or bolts or concealed locking devices requiring a special tool to remove.
      d. Approved products: Bobrick # B-290-2436 (24” x 36”), stainless steel # 4 finish frame, with plate glass mirror.
      e. Mount all mirrors in each restroom at height suitable to accommodate ADA code requirements, not just one mirror.
SECTION 10 28 13.13 – COMMERCIAL TOILET ACCESSORIES

B. Soap Dispenser

1. For all Buildings except Residence Life Buildings, Recreation Sports, Student Health Center, Round Rock Higher Education Center and LBJ Student Health Center: Provided and installed by Texas State University.

   a. The General Contractor shall supply and install.

C. Toilet Tissue Dispenser:

1. For all Buildings except Residence Life Buildings, Recreation Sports, Student Health Center, Round Rock Higher Education Center and LBJ Student Health Center: Provided and installed by Texas State University.

2. For Residence Life Buildings, Public and Community Restrooms: ABCO Paper Co., Tork #346090 T2-Twein mini jumbo roll, smoked grey plastic.
   a. The General Contractor shall supply & install.

3. For Residence Life Buildings, Private Room Restrooms: Grainger No. 3P895, stainless steel.
   a. The General Contractor shall supply & install.

D. Towel Dispenser

1. For all Buildings except Residence Life Buildings, Recreation Sports, Student Health Center, Round Rock Higher Education Center and LBJ Student Health Center: Provided and installed by Texas State University.

2. For Residence Life Building: ABCO Paper Co., Tork #309200 H1, Roll System, hand towel, smoked grey plastic.
   a. The General Contractor shall supply and install.

E. Waste Receptacle

1. Approved Product:
SECTION 10 28 13.13 – COMMERCIAL TOILET ACCESSORIES

2. Location: Locate one receptacle as close to exit door as possible and one as close to sinks as possible.

3. For Residence Hall Buildings: To be determined by Texas State University-San Marcos.

F. Sanitary Napkin Disposal Unit

1. Approved Product:
   a. Recessed: Bobrick Contura Series, #4353
   b. Surface Mounted: Bobrick Contura Series, #270
   c. Partition Mounted: Bobrick Contura # 4354

G. Grab Bars

1. Approved Product: Bobrick # B-6206 series

PART 3: EXECUTION

3.01 Installation

A. Preparation:

1. Deliver inserts and rough-in frames to Project site at appropriate time for installation.

2. Provide templates and rough-in measurements as required.

B. Install fixtures, accessories and items in accordance with approved shop drawings and manufacturer’s published instructions.

1. Fully recess units as indicated.

2. In case of any discrepancy in location, consult Architect.

C. Secure each item to prevent dislocation vandalism.

1. Attach each item plumb and level in the locations indicated with concealed attachment where possible.

2. If attachment devices are exposed, match finish to the specific item.
SECTION 10 28 13.13 – COMMERCIAL TOILET ACCESSORIES

D. Unless otherwise indicated, locations of accessories shall conform to tile coursing and heights from finished floor as shown on drawings.

1. Where locations are not indicated, locations of accessories shall be as indicated by Architect.

2. Care shall be exercised at all times to assure that tile surfaces are not cracked, chipped or damaged, and that finishes of toilet partitions are not abraded, scratched or damaged.

E. Installed accessories shall operate quietly and smoothly.

1. Doors and operating hardware shall function without binding or unnecessary friction.

2. Keys shall be turned over to Owner’s authorized agent, obtaining receipt for such delivery.

F. Install sealant between fixtures and adjacent tile or other wall finishes to achieve a tight, closed finished appearance at recessed accessories.

1. Sealant shall conform to requirements of Section 07900/ Joint Sealers.

G. Mirrors:

1. Coordinate toilet accessories with mirror installation specified in Section 08 83 13/ Mirrors.

3.02 Adjustments, Cleaning, Protection

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly.

1. Replace damaged or defective items.

B. Clean and polish all exposed surfaces after removing temporary labels; protect finished product.

C. Protect adjacent or adjoining finished surfaces and work from damage during work of this section.

END OF SECTION 10 28 13.13
SECTION 10 44 13 – FIRE EXTINGUISHERS & CABINETS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.

B. The designer and contractor’s attention is specifically directed, but not limited, to the following documents for additional requirements:


C. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product specified. Include construction details, materials descriptions, and dimensions of individual profiles, components and finishes for the fire protection cabinet.

- Fire protection Cabinets: Subject to compliance with requirement, provide recessed, brushed stainless steel, rolling catch, and clear acrylic glazing. Size cabinet to accommodate a minimum 5 lbs. capacity fire extinguisher.

B. Shop drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Sample for verification: For each type of exposed finish required, prepare a Sample 6” x 6” square.
SECTION 10 44 13 – FIRE EXTINGUISHERS & CABINETS

1.03 QUALITY ASSURANCE

A. Fire Rated, Fire Protection Cabinet: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

PART 2: PRODUCTS

2.01 RECESSED CABINETS

A. Basis of Design: J.L. Industries Cosmopolitan Fire-FX, C1037F10 SS3” RT FULL ACR (inside dimensions: 10 1/2” W x 24” H x 6” D), flat stainless steel #4 trim, clear acrylic glazing, rolling catch, fire extinguisher cabinet with flanged tub constructed of cold-rolled steel, or comparable products by one of the following:

- Architectural Series, fire extinguisher cabinet by Larsen’s Manufacturing Company.
- Modern Metal Products, Division of Technico Inc.

B. Letters: Die cut letters in white.

2.02 FIRE EXTINGUISHERS:

A. Basis of Design: J.L. Industries “COSMIC 5E, UL3-A-40BC, 5 pounds capacity, multipurpose dry chemical type consisting of heavy-duty steel cylinder, rugged metal valve and siphon tube, replaceable molded valve stem seal, pull pin and upright squeeze-grip operation, finish to be a factory-applied red epoxy, corrosion and impact resistant. Or comparable product by one of the following:

- Larsen Manufacturing Company.
- Potter Roemer LLC.
- Amerex Corporation
- Ansul Incorporated: Tyco International Ltd.
- Badger Fire Protection; a Kidde company.
SECTION 10 44 13 – FIRE EXTINGUISHERS & CABINETS

B. Accessories: Mounting Brackets: Manufacturers standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated.

2.03 CARBON DIOXIDE TYPE EXTINGUISHER:

A. Basis of Design: Sentinel 5 by J.L, Industries or approved equal. UL-rated 5-BC, 5 pound nominal capacity, with carbon dioxide in manufacturers’ standard enameled-metal container.

B. Locations: Electrical, Data Rooms and Major Mechanical Rooms. Our intent is to avoid installing an extinguisher when there is simply a couple of a breaker boxes or a single switch gear mounted on a rack for IT, etc.

PART 3: EXECUTION (NOT USED)

END OF SECTION 10 44 13
DIVISION 11: EQUIPMENT

11 12 00 Parking Control Equipment
SECTION 11 12 00 – PARKING CONTROL EQUIPMENT

PART 1:  GENERAL

1.01  Scope of Standard

   A.  This standard provides general guidance concerning the specific preferences of Texas State University for parking gates, bumpers and barriers, electronic access and survey controls, signaling devices, admissions/collections equipment, vehicle detectors, lane controllers, etc.

   B.  Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

PART 2:  PRODUCTS

2.01  Manufacturers

   A.  General

      1.  Parking Control Equipment - Amano Cincinnati Inc., an equal or better.

      2.  Parking Control Software - McGann Software Systems, an equal or better.

      3.  Access Cards - Cintac II compatible mag-stripe cards, an equal or better.

      4.  Access Cards – Amano Prox card PRX 120MD, an equal or better.

      5.  Access Cards – Amano Dual card 120MD, an equal or better.

2.02  Equipment/Components

   Note:  The equipment must function with Texas State University-San Marcos mag stripe ID card. And must also have the capability to import access data to data files and be capable of operating any Parking Garage compatible computer programs in use at the time of bid.

   A.  Amano Cincinnati items:
SECTION 11 12 00 – PARKING CONTROL EQUIPMENT

1. Gates - model AGP-1700 or AGP-1710:
   manufacturer’s standard white powder coat finish on base enclosure;
   General Contractor to paint white base with, Sherwin Williams,
   enamel, SW 6108, “Latte”, semi-gloss; color from Sherwin Williams,
   San Marcos, TX.

   Grey vinyl top to remain grey color from factory.

2. Detectors -
   Single detector - model ETP-134.
   Dual detector - model AGP-0234.

3. Ticket Dispensers – model ETP-12122 or ETP-22.

4. Gate Arms - model AL20 Folding Aluminum.

5. Pay Station - model AGP 7000.


9. Card Reader- model Mag1201-YL.

10. “Lot Full” Signs w/pole and hardware – model LFSYL.


13. Relays w/mounting bases (for gates)

14. Mag Stripe Tickets.

15. Mag Stripe Cards or Prox Cards.

16. L5 Amano Loops

17. Lag-time Exit Readers – model AGP-6000

18. Aiphone Intercom - complete system
SECTION 11 12 00 – PARKING CONTROL EQUIPMENT

B. McGann Software System Items:

1. Central Management System

2. Window Revenue Software - MPS1136W.


4. Window Access Control Software - MPS4002 - (with system code compatible to Cintac II cards currently in use at PGI).

5. Debit Card Module


7. IBM Compatible PC computer with printer, Pentium 4 Microprocessor, 1.4 GHz, 256MB SD RAM (133 MHz) 20 GB Hard Drive, 1 3.5 floppy drive, 1 CD/DVD combo drive, 2 USB ports (1 serial, 1 parallel), 56K modem, Windows 2000 RXP, PC Anywhere, 17” SVGA flat screen color monitor, IMSI PS/2 style mouse, keyboard, APC Power back-up, and plain paper color laser printer.

PART 3: EXECUTION (NOT USED)

END OF SECTION 11 12 00
DIVISION 12: FURNISHINGS

12 21 00   Window Blinds
12 46 19   Clocks
12 48 13   Building Entry Walk Off Mats
12 50 00   Furniture
12 93 00   Site Furnishings
SECTION 12 21 00 – WINDOW BLINDS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for aluminum window blinds for exterior applications.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Specify narrow slat (1” wide) Venetian blinds for all windows.

B. Typically use Venetian blinds with light colored anodized finish to reduce interior heat absorption.

C. The use of curtains or drapes is discouraged.

D. Where drapes or curtains are specifically required, use fire-retardant drapes or curtains.

E. For locations of black out shades in classrooms, refer to III Design Guidelines, 1.03 Classroom Design Standards with Enhanced Instructional Technologies.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 12 21 00
SECTION 12 46 19 – MESSAGE BOARDS/CLOCKS

PART 1:  GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for a Master Message Board/Clock System.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

C. A message board/clock is to be provided for each new classroom and seminar room (all teaching rooms). Texas State University’s communication department furnishes and installs these message boards/clocks.

PART 2:  PRODUCTS

2.01 Electrical Outlet:

A. Provide a single, recessed wall receptacle, mounted horizontally, 18” below finished ceiling, on the wall, opposite from the teaching lecture wall.

B. Outlet Manufacturer: Leviton #688, or equal.

PART 3:  EXECUTION (NOT USED)

END OF SECTION 12 46 19
SECTION 12 48 13 – BUILDING ENTRY WALK-OFF MATS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for walk-off mats for exterior and interior applications.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Recessed, metal abrasive strip walk-off mats are not allowed by Texas State University, at entry to Buildings.

B. Texas State University’s custodial department will supply and install walk-off entry mats to buildings.

1. The current walk-off mat manufacturer is: The Anderson Company, Waterhog ECO. Refer to attached photo for examples.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 12 48 13
SECTION 12 48 13 – BUILDING ENTRY WALK-OFF MATS
SECTION 12 50 00 – FURNITURE

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Furniture.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. FURNITURE LAYOUTS BY THE A/E OR DESIGN/BUILD TEAM

1. The A/E or Design/Build Team shall prepare Furniture Layouts to demonstrate that Programming requirements have been met.

a. Preliminary Furniture Layouts

(1) The A/E or Design/Build Team shall provide preliminary furniture layouts drawn to Architectural scale for the entire building during the Design Development stage to substantiate and verify that program space requirements are being met, and to confirm electrical, telecommunication, and audio/visual locations.

(2) While the A/E’s or Design/Build Team’s furniture layouts may be further refined during the design and Construction Document process, the A/E or Design/Build team’s preliminary furniture layouts shall be both well resolved and workable, and must conform to ADA standards.

(3) Layouts shall be based on Owner input via either the furniture committee, if one is in place during this phase, or from representation of the various User groups through the Ad Hoc building committee and the building program.

(4) Planning by the A/E must be provided for furniture items as they relate to doorways, circulation, windows, electrical outlets, communications system outlets, mechanical and plumbing coordination and ADA clearances.
SECTION 12 50 00 – FURNITURE

b. Final Furniture Layouts

(1) Requests for revisions to the Preliminary Furniture Layouts, which are specifically identified by the User groups or Facilities Planning Design and Construction (FPDC) during the Design Development review period, shall be incorporated into the layouts as part of the Design Development effort.

(2) The resulting Final Furniture Layouts developed by the A/E or Design/Build Team shall receive the approval and sign-off of the Owner.

(3) Construction documents shall include the final furniture layouts, drawn to Architectural scale.

(4) The A/E or Design/Build team shall convey its Final Furniture Layouts to all of its consultants so that all work is coordinated.

(5) When final revised layouts have been completed, a clean set of floor plans for both base bid and alternates that includes walls, windows, doors, room numbers, built-in cabinetry, and equipment shall be sent to the FPDC Project Representative and reviewed with users. Transmitted electronically and in hard copy, the A/E shall advise the designer of software type and version used prior to sending (dwg. format is preferred). This set of layouts shall include a site/project location map as well as electrical/data layers for each floor.

c. Revisions to Floor Plans During Construction

(1) The A/E or Design/Build team shall immediately notify the FPDC Project Representative of any revisions made to the floor plans during construction.

B. MOVEABLE AND NON-MOVEABLE FURNISHINGS & ACCESSORIES

1. Moveable Furnishings That Are Not the Responsibility of the A/E or Design/Build Team

a. The design specifications and procurement of Moveable Furnishings on a given project are typically not handled by the
SECTION 12 50 00 – FURNITURE

A/E or Design/Build Firm unless the services involved with this work is contracted through an Additional Services Agreement.

b. Instead, if the source of funding is identified as FPDC-Managed furnishings funds, the production and design work involved in the specification, procurement, and installation/inspection of Moveable Furnishings is through an outside Interior Design Services Professional Firm.

c. If the funding for Moveable Furnishings is identified to be Institutionally-Managed, the Component Institution then handles all the services related to this work.

d. Typically, furnishings and accessories are purchased from previously budgeted funds reserved for this purpose and are separate from “equipment funds.”

2. Fixed or Built-in Furnishings and Accessories That Are the Responsibility of the A/E or Design/Build Team

a. Items that are built-in or affixed to the structural, mechanical or plumbing members of a building fall under the design and specification responsibility of the A/E or Design/Build Team and are to be procured through the Construction Contract.

b. Those items include but are not limited to:

- Building directories, graphics, and way finding
- Built-in dishwashers, refrigerators, and icemakers
- Bulletin boards in public areas
- Carpet and carpet base
- Chalkboards and liquid writing boards in public areas
- Cubicle curtain and tracks
- Draperies on electrified tracks or that fit into wall or ceiling pockets
- Exterior and interior signage
- Parking Garage Signage
- Exterior benches and waste receptacles
- Fixed auditorium, lecture hall, and gymnasium seating
- Fixed classroom seating and tables
- Fixed laboratory casework and equipment
- Fixed lighting fixtures
- Floor to ceiling room dividers
- Food service equipment
SECTION 12 50 00 – FURNITURE

- High density files, shelving and floor tracks (motorized and manual)
- Laboratory Benches and Tables
- Lecterns tied-in to building’s A/V data and/or electrical systems
- Lockers
- Mailboxes and mail centers
- Projection screens
- Stage rigging and draperies
- Window blinds, drapery, shutters, and shades whether interior or exterior

C. ADHERENCE TO FURNITURE STANDARDS:

1. Maximizing Space and Following Requirements
   
   a. Space Planning shall reflect both FPDC’s and the Institution’s requirements. The A/E or Design/Build team shall be sensitive to FPDC’s need to maximize space and shall assist in that regard wherever possible.

2. Following Standards in Design
   
   a. Building design shall accommodate standard furniture dimensions, FPDC carpet standards, FPDC window coverings standards, all safety standards and ADA requirements.

   b. The following typical FPDC standards for furniture dimensions are outlined for the benefit and coordination of the A/E or Design/Build Team in space planning.

   c. Wherever an item under consideration is not covered by the minimum standards outlined below, the latest editions of the Texas Accessibility Standards (TAS), ADA, IBC, and Architectural Graphic Standards shall be used in setting forth minimum standards.

   (1) Minimum Standards for Fixed chairs with Tablet Arms (herein called T/A):

      (a) Minimum back-to-back spacing: 42” when the tablet arm is in a raised position
SECTION 12 50 00 – FURNITURE

(b) Minimum corridor side/wall aisle: 36” clear for four or less rows. Increase one (1) inch per row for each row over four rows, with at least one aisle per every 8 seats.

(c) Minimum clearance between top back of chair and rear wall: 6”

(d) Minimum window aisle: 24” clear, to increase one (1) inch per row for each row after first four rows.

(2) Minimum Standards for Fixed Pedestal Chairs without Tablet Arms:

(a) Spacing is the same as for T/A chairs, except back-to-back spacing minimum shall be 39”.

(3) Minimum Standards for Fixed Tables and Armless Chairs:

(a) Minimum lateral space per student is 30”. Side aisles are the same as for fixed T/A chairs. Where chairs with arms are required, use fixed tables with moveable chairs on casters; increase row clearance accordingly. “L” shaped table supports must be 60” apart to accommodate 2 chairs, located at extreme outside edges of tables.

(b) Minimum total (back to back) spacing for 18” deep tables is 54”; preferred spacing is 60”.

(c) Wheelchair clear floor space will comply with the Texas Accessibility Standards 4.2.4 and 4.32.

(4) Minimum Standards for Moveable Tables and Chairs in Classrooms:

Same requirements as for Fixed Tables and Armless Chairs (above) except that table depth shall be a minimum of 60 inches wide x 24 inches deep.

(5) Minimum Standards for Clear Space at Classroom Front (to Front Row):
SECTION 12 50 00 – FURNITURE

(a) Minimum space is 8’-0”. In places where a platform is provided, space shall be depth of platform plus 24” and shall account for wheelchair access.

(b) In auditoriums or large classrooms where demonstration tables are to be used, clear space shall be increased to 10’-0” minimum. In auditoriums with stage, 30 degree line of sight rule (30 degrees up from “eye level”, 3'-8” above floor) is to apply for spacing between front of stage and first row of seats.

(6) Minimum Standards for Computer Labs:

(a) Work surface for student shall be at least 36 inches wide x 30 inches deep. This depth may be accounted for by using a 30” deep work surface all at the same height or a 24” deep work surface with an attached keyboard (as approved by OFPC Interiors Group); 42 inches wide is preferable.

(b) Two students may share a 72”w table. Power may come from the wall, floor, or ceiling, and tables may be hard-wired as well, depending upon the room layout.

(c) Provide a minimum of 2 electrical receptacles per workstation. Also, provide one voice and data per person where applicable.

(d) Provide the appropriate number of circuits for each power entry, with a maximum of 3 computer stations sharing one circuit.

(e) In rooms where articulated keyboard trays are provided, at least 42 inches shall be provided between rows of tables.

(7) Minimum Standards for Auditorium Seating:

(a) Where tablet arms are used in auditorium seating, 10% shall be designed to be left-handed. Also, to meet ADA requirements, fold-away aisle chair arm
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rests shall accommodate the lateral transfer from a wheelchair at all designated wheelchair positions.

(b) In assembly areas having a seating capacity in excess of 25 feet, each wheelchair location shall accommodate 2 persons seated side by side in wheelchairs, as described in TAS 4.33.

(c) Wheelchair areas shall be an integral part of any fixed seating plan and shall be dispersed so as to provide people with disabilities a choice of lines of sight, comparable to other members of the audience. Refer to TAS 4.33.3.

(8) Standards for Built-In Cabinetry:

(a) Shall meet ADA accessibility requirements. Where knee spaces occur, it is suggested the counter height be further dropped to 30” (with a knee space height clearance of 27 inches) so that a standard task chair may also be used.

(9) Standards for Window Coverings:

(a) Mini-blinds or other window coverings are provided through the General Construction Contract.

D. RESPONSIBILITIES OF TEXAS STATE UNIVERSITY

1. The project’s Ad Hoc Building Committee shall provide the A/E or Design/Build Team with information regarding general room furniture requirements for inclusion in Design Development documents.

2. All furniture design and fabric colors have to be reviewed and approved by Texas State University’s President, before presentation to committee or stakeholders.

3. Texas State University Furniture Committee shall provide the FPDC Project Representative and the Interior Designer with specific detailed and refined information relating to the furnishing needs for each space in the project.

4. Texas State University Project Representative shall procure and arrange for the installation of all specialized audio-visual, office, lab, janitorial, laundry, medical, kitchen and gymnastic equipment as well as pianos and other musical instruments, computers and copier machines.
SECTION 12 50 00 – FURNITURE

5. Texas State University Project Representative shall arrange for the hard-wiring of any movable furnishings with electrical systems requiring connection to the building power source.

6. Texas State University shall arrange for a staff member to oversee building access on an as needed basis during the course of the installation, lock up the building if the contractor is no longer on the job site, and generally assist the Project Representative during this phase of the project.

E. RESPONSIBILITIES OF INTERIOR DESIGN CONSULTANT

1. Interiors Consultant Project Manager
   a. Management & Design:
      1.) The FPDC Interiors Project Manager will be responsible for the preparation of all Contract Documents for Moveable Furnishings and Accessories including change orders, all contract administration, furnishings installation, inspection and acceptance, as well as reviewing and approving furniture dealer’s application for payments.
   b. The furniture selections shall be available through the following purchase agencies:
      1.) TXMAS
      2.) GSA
      3.) Texas State Contracts
      4.) Buy Board
      5.) Any manufacture on CMBL
   c. Design and Documentation:
      1.) The interior design consultant shall be responsible for the selection, presentation, specification, bid documents, and on through the oversight of the furnishings installation and punch list.

      This work shall be guided by and overseen by the FPDC Project Representative.
SECTION 12 50 00 – FURNITURE

2.) Design Presentation and Approval:

a.) The furniture design shall coordinate with the Architect’s fixed and loose furniture layout plans, as well as, coordinate with the finish schemes of the building architecture and fixed furniture designs. The furniture design and installation must meet the building occupancy schedule.

b.) The furniture designer shall meet with the building users to determine the program requirements of furniture.

c.) At 50% furniture design completion, a presentation shall be made to the FPDC Project Representative, for approval by the President of the university. A furniture cost budget shall also be presented.

d.) At 95%, and final furniture design completion, a presentation shall be made to the users and FPDC Project Manager, with the cost budget, for final approval.

e.) The Interior Designer shall prepare complete furniture plans and specifications for bidding and furniture ordering. The furniture lists must be grouped in separate packages by manufacturer, so that separate purchase orders can be prepared to each manufacturer.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 12 50 00
SECTION 12 93 00 – SITE FURNISHINGS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for outdoor furniture products.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Quality Control

A. The Texas State University-San Marcos Project Manager shall review all proposed site furnishings.

PART 2: PRODUCTS

2.01 Benches

A. Victor Stanley: model RMFC-24, steelsites, 6’-0” long, electrostatically powder-coated black finish.

1. Provide bolted anchors, with stainless steel bolts, washers and nuts.

2.02 Non-Picnic Tables and Seating

A. Victor Stanley: model PRSCT-36R café table, with four (4) model PRSCC-8 café chairs, electrostatically powder-coated black finish.

2.03 Bike Racks

A. Bike Racks

  1. DERO Bike Rack Company, Hoop Rack, materials-1.5” scheduled 40 pipe (1.9” o.d.), galvanized steel, finished with electrostatically powder-coated black, with 6” wide surface mounted anchors. Use stainless steel anchor bolts.
SECTION 12 93 00 – SITE FURNISHINGS

a. When multiple Bike Racks are required, provide two parallel rails, galvanized steel powder-coated black finish, to bolt Hoop Racks. Use stainless steel anchor bolts.

B. Bike Racks inside Parking Garages.

2.04 Trash Receptacle for Campus Exteriors

A. Victor Stanley, model SD-42, with Side Opening Door, (36 gallons), steel powder-coated black finish.
   1. Provide Victor Stanley standard interior plastic Liner, black color.
   2. Provide Victor Stanley standard “Rain Bonnet Lid” with 11”-high uprights, black color.

2.05 Trash Receptacle for Inside Parking Garages:

A. Victor Stanley, model S-45 (45 gallons).
   1. Provide interior plastic liner, black color.
   2. Provide standard “Tapered Form Lid”.
   3. Provide standard rubber-tipped leveling feet.

2.06 Recycle Receptacle

A. Victor Stanley, model SD-42, with side-opening door (36 gallons), steel powder-coated black finish.
   1. Provide standard “Rain Bonnet Lid” (not special height), in green color.
   2. Provide interior plastic liner, black color.
   3. Provide rubber-tipped leveling feet.
   4. Provide recycling decals and TXST logo decal, as shown on attached photo.
SECTION 12 93 00 – SITE FURNISHINGS

2.07 Picnic Table and Benches

   A. Victor Stanley, model RND-363, 36” diameter, with powder-coated black color.

2.08 Exterior Site Bollard

   A. Landscapeforms, Annapolis, 6” embedded or 6” removable (where required), color: Grotto Black, gloss finish.

PART 3: EXECUTION (NOT USED)

END OF SECTION 12 93 00
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SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Electric Traction Elevators.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

C. When geared traction elevators are required the “machine-room-less” type is not acceptable.

1.02 Design Guidelines

A. Provide at least one passenger elevator for each new and renewed Texas State University building of more than a single story, except as otherwise approved by the Director of Facilities Planning, Design and Construction.

B. Elevators are required in all multi-story buildings to provide accessibility to the disabled.

1. Passenger Elevator: Minimum capacity is 3500 pounds, 350 FPM.

2. Service Elevator:
   a. Where service elevators are specifically required, provide elevators with minimum capacity of 5,000 pounds.
   b. Equip service elevators with horizontal-sliding, center-opening doors.
   c. Generally, passenger elevators equipped with pads and hooks will adequately serve as service elevators if their load capacity is at least 5,000 pounds.

1.03 Summary

A. Scope: Provide all required supervision, engineering, labor, materials, and tools necessary to install for geared traction elevators.
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

B. Related Sections: The following sections may contain requirements that relate to this section.

1. Section 07 14 00 – Fluid Applied Waterproofing: Waterproofing of elevator pits.

2. Section 26 00 00 – Electrical: Electrical service to main disconnect in elevator machine room, electrical power for elevator installation and testing, electrical disconnecting device to elevator equipment prior to activation of sprinkler system, electrical service for machine room, machine room and pit receptacles with ground-fault current protection, lighting in machine room and pit, wiring for telephone service to machine room.


4. Section 28 31 00 – Fire Alarm Systems: Fire and smoke detectors and interconnecting devices, fire alarm signal lines to contacts in the machine room.


1.04 References

A. Comply with all applicable current local, state, and federal building codes, elevator codes, laws, regulations, and ordinances at the project site, including but not limited to the following:


2. ADAAG – Americans with Disabilities Act Accessibility Guidelines.


SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

8. Model Building Codes.

9. All other applicable local, state, and federal codes, laws, regulations and ordinances.

1.05 Quality Assurance

A. Elevator contractor must be able to demonstrate that he has installed and maintained similar elevators to those specified, that he is able to show evidence of satisfactory past performance, that he maintains locally an adequate stock of parts for emergency purposes, that he has under his direct employment and supervision the necessary personnel specifically trained on the type and grade of equipment specified, and that he has been in business for a minimum of five (5) years.

B. Regulatory Requirements: Elevator system design and installation shall comply with the latest versions of all applicable local, state, and federal codes, laws, regulations, and ordinances.

1. TDLR Elevator Inspections: While it is the responsibility of the CMAR and their Subcontractor to call for elevator inspection, they should inform the A/E and FPDC of the inspection. FPDC representative should be present during these inspections.

C. Permits and Inspections: Provide licenses, permits and certificates of inspection for all elevator equipment, as required by local, state, and federal authorities. Perform required inspections and tests. The Owner shall select the QEI Inspector.

1.06 Submittals

A. Product Data: Submit three copies of manufacturer’s product data for each system to be used.

1. Cab design, dimensions and layout.

2. Fixtures (car stations, hall stations, hall lanterns, position indicators, etc.).

3. Electrical characteristics and requirements. The Elevator Contractor shall provide data concerning the size and location of the mainline switchgear, wiring, fuses and breakers.

SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

B. Shop Drawings: Submit three (3) copies of approval layout drawings.
   1. Clearances and travel of car.
   2. Clear inside hoistway dimensions.
   3. Clear inside pit dimensions.
   4. Car, guide rails, buffers, and other components in hoistway.
   5. Maximum spacing for rail brackets.
   6. Maximum loads imposed on guide rails requiring load transfer to building structure.
   7. Loads on hoisting beams.
   8. Location and sizes of access doors, hoistway entrances, and frames.
   9. Interior Cab Design.
  10. All Finishes.

C. Operational and Maintenance Manuals: Provide three (3) copies of manufacturer’s standard operational and maintenance manual for each system to be used.
   1. Straight line wiring diagrams of as-installed circuitry.
   2. Routine preventative maintenance manuals with operating instructions covering all systems used.
   3. Parts catalogs of all components.

D. Project Schedule
   1. Submit schedule of events with Bid Proposal.
      a. Material ship dates
      b. Project mobilization date
      c. Series of events through job completion
      d. Handover tests and inspections (QE1) date
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

2. Provide schedule as if one car and then the other will be modernized and a separate schedule if both units are to be modernized at the same time.

1.07 Warranty

A. Provide warranty to repair or replace parts or components that fail or do not operate properly due to engineering, design, or workmanship for a period of twelve (12) months from the date of final acceptance. The guarantee excludes ordinary wear and tear or improper use, vandalism, or neglect, or any other cause beyond the control of the elevator contractor.

1.08 Maintenance

A. Provide regular routine preventative maintenance service for a period of twelve (12) months after the date of final acceptance. Maintenance service shall consist of regular examinations of the elevator equipment by technicians specifically trained on the type and grade, and shall include 24-hour callback service. Response time for callback service shall be one (1) hour or less during the normal workday. Response time during after normal work hours shall be one and one half (1 ½) hours or less.

1.09 Addenda

A. Any and all changes, additions, clarifications, or interpretations will be in writing through Addenda prior to bid opening.

1.10 Acceptable Elevator Companies (Must be listed in alphabetical order):

A. Otis Elevator Co.
   11500 Metric Blvd. Suite 285
   Austin, TX 78758
   (512) 339-9731

B. Schindler Elevator Corporation
   8868 Research Blvd
   Austin, TX 78758
   (512) 451-3620

C. Tejas Elevator Co.
   4424-D Brandt Rd.
   Austin, TX 78744
   (512)454-7878
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

D. Thyssen/Krupp Elevator Co.
3615 Willow Springs Rd.
Austin, TX 78704
(512) 447-9511

Part 2: PRODUCTS

2.01 General Characteristics

A. Passenger Elevators

1. Quantity: Per architectural plans

2. Type: Geared traction

3. Capacity and Speed: 3500# @ 350 FPM

4. Stops: Per architectural plans

5. Openings: Per architectural plans

6. Floors served: Per architectural plans

7. Rise

8. Inside cab height

9. Cab inside, see EXHIBIT 1

10. Entrance type and size: One-speed center opening, 42” x 84” minimum.

11. Main Power Supply: 480 volts, +/- 5% of normal, 3 phases, with a separate equipment-grounding conductor.

   a. If existing Elevators are being remodeled, then field verify existing power voltage.

12. Lighting Power Supply: 120 volts, 1 phase, 15 amps, 60 Hz.

   a. If existing Elevators are being remodeled, then field verify existing power voltage.
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

2.02 Performance

A. Speed: +/- 2% under any loading condition.

B. Capacity: Safely lower, stop and hold up to 125% of rated load. Handle full load in both directions.

C. Leveling accuracy: +/- ¼” under any loading condition.

D. Door closing time: Thrust and Kinetic energy shall comply with ASME Code and ADA. Closing time shall be adjusted to the minimum allowable.

E. Door opening time: Doors shall open at 80% of closing time

F. Ride Quality: Acceleration, run, deceleration, leveling and stopping shall be adjusted for a smooth and comfortable ride.

2.03 Machine Room Equipment

A. Hoist machines

1. Hoist machines: Provide Hollister-Whitney geared hoist machines. The motor shall have a slip specification of 5% or less. No substitutions allowed.

2. Machines shall have isolation pads to prevent the transfer of noise and/or vibration.

B. Controls

1. Car Controls: Provide MCE 4000 Series controls. No substitutions allowed. Features required are as follows:

   a. On-board diagnostics
   b. Out of service timer
   c. Door operation timers
   d. Door pre-opening
   e. Nudging
   f. Car and hall call registration
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

- Fire Service Operation
- Independent Service operation
- Two way leveling
- 4000 Series landing system
- Controller test switch
- Relay panel inspection
- Un-cancelled call bypass
- Anti-nuisance
- On-site computer terminal for adjustment and diagnostics
- Emergency power

2. Dispatching System: Provide MCE 4000 Series dispatching system for groups of 3 or more. No substitutions allowed. Features required are as follows:

- Parking Operation
- Lobby Operation
- Time Activated Dispatching Configurations
- Traffic Identification Operation
- Lobby Up Peak
- Demand Up Peak
- Demand Down Peak
- Emergency Dispatch
- Emergency Power
- Out-of-Service
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

k. Loaded Car Dispatch

l. Display Terminal in Machine Room

m. Access Control for Elevators (ACE) Security

3. The controls shall NOT have any software embedded which shuts the elevator down when the elevator is operating normally that forces the Owner to contact the manufacturer for service or replacement of major components of the controller.

C. Speed Governor

1. Provide centrifugal-type speed governors. No substitutions allowed.

D. Provide means for two-way communication between the machine room and each elevator.

2.04 Hoistway Equipment

A. Hoistway Interlocks

1. Provide GAL hoistway interlocks. No substitutions allowed.

B. Hoistway Doors and Entrances

1. Hoistway door size 42” X 84”, one-speed center opening.

2. Unlocking devices shall be provided at all landings. Escutcheons shall be stainless steel. Escutcheons shall be mounted with a squeeze type locking collar.

3. All hoistway door panels shall have two gibs per panel.

C. Car Safeties

1. Provide flexible-guide clamp-type safeties. No substitutions allowed.

D. Car Roller Guides

1. Provide adjustable, floating-type roller guide assemblies.
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

E. Hoistway Wiring
   1. All machine room, hoistway, and all other wiring including travel cables shall be new.

2.05 Car Shell

A. Type: Car shell for all elevators shall be designed and constructed in full compliance with applicable code requirements.
   1. Floors: ¾” fire retardant plywood subfloor secured to 14 gauge steel plate braced and reinforced to prevent sagging.
   2. Walls: Steel braced and reinforced to prevent sagging when leaned against.
   3. Ceiling and Car Top: 12 gauge steel, braced and reinforced to support distributed weight of two men.
   4. Finish for All Steel Components: Shop-primed with rust-inhibitive primer complete with finish paint.

B. Car Shell Size: Shall accommodate clear inside dimensions indicated on drawings.

C. Car Shell shall be painted black.

2.06 Car Components

A. Stainless Steel Car Doors and Frames
   1. General: Doors and frames shall be designed and fabricated as part of car assemblies for car entrances.
   2. Doors: 42” x 84”, 1-3/8” thick, 16 gauge flush steel face sheets, hollow metal construction with reinforcing members spaced 9” apart filled with compressed cork or other sound-absorbing material complying with code requirements.
   3. Door Cladding Material: 16-gauge stainless steel clad to steel face sheets and exposed edges, free of oil-canning and exposed fasteners.
   4. Frame Material: Formed 14-gauge stainless steel with head and jamb in flush alignment corners welded and ground smooth, jamb width as

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detailed, free of oil-canning. Steel frames with stainless steel cladding are not acceptable.


6. Doors shall be center opening.

7. Door operator shall be GAL MOVFR operators. No substitutions refer to 2.06/I below for additional door operation.

8. Door opening protection light rays and safety shoes shall be infrared type. Refer to 2.06/J and 2.06/K below for additional specs.

B. Car Sides and Rear

1. Apply panels directly to car enclosure using concealed fasteners which allow panels to be removed from car side but which hold panels firmly and in true alignment.

2. Panels shall be theft-proof by provisions of a tamperproof fastener at top of panel.

3. HDF for plastic laminate panels shall be fire-retardant.

C. Fasteners:

1. Exposed fasteners will not be acceptable. Conceal all fasteners at car shell, doorframe and finish panels where exposed to view.

D. Lighting, Outlets and Emergency Lighting/Alarm Bell:

1. Lighting: Recessed incandescent low voltage downlight lighting fixtures as indicated on drawings.

2. Power Failure: Electric power failure or other interruption of normal electrical service shall automatically activate emergency lighting and bell function to operate with emergency generator.

3. Emergency Lighting: Shall be complete with emergency light circuitry, emergency bell, and integral battery powerpack and charger.

4. In Each Car: Not less than one car light fixture shall be connected to emergency lighting circuit and battery pack.
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

5. Battery Pack and Bell: Shall be located on top of car roof in an appropriate location.

6. Battery Type: 12-volt battery unit including solid state charger and testing means enclosed in common metal container rechargeable lead acid or nickel cadmium battery with 10-year minimum life expectancy.

7. Electric Power Outlet:
   a. One 20-amp duplex GFIC 110-volt power receptacle located on each car top enclosure, and inside service cabinet.

E. Ceiling Exhaust Fans:

1. Type: Concealed and capable of exhausting approximately 500 cubic feet of air per minute at top speed, 300 cfm at slow speed.
   a. Switch: Dual type located within recessed service panel in car operating front panel.

2. Vibration Isolation: Exhaust fan shall be installed with adequate vibration isolation material to prevent objectionable noise inside of car when fan is operating at top speed.

3. In case of power failure, exhaust fan shall be operated by the emergency electrical system immediately and automatically.

F. Car Finishes: See EXHIBIT 1

1. Flooring:
   a. Fritztile, Classic Flexible Marble Tile, CL 200 Series, 12” x 12” x 1/8” thick, with opaque binding.

2. Ceiling:
   a. Ceiling Suspension: As approved by Texas State University.
   b. Ceiling Panels: Refer to EXHIBIT 1, or if changes as approved by Texas State University.
   c. Emergency ceiling access panel joints shall be aligned with adjacent joints in ceiling.
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

3. Ceiling Lighting:
   a. Type: Refer to EXHIBIT 1: LED downlight fixtures as indicated on drawings, complete with emergency lighting; or if changes as approved by Texas State University.

4. Stainless Steel Doors and Frames:
   a. Type: AISI Type 302/304.

5. Stainless Steel Return Panels:
   a. Type: 1/8” thick AISI Type 302/304.

6. Plastic Laminate Wall Panels:
   a. Type, Plastic Laminate: Refer to EXHIBIT 1: Panels shall be marine-grade (moisture-resistant) plywood core with plastic laminate cladding on face and all edges; or if changes as approved by Texas State University.

7. Wall Base and Wall Panel Reveals: Plastic laminate adhered directly to steel cab walls.

8. Aluminum Sills/Thresholds:
   a. Type: Extruded, with grooves and concealed fasteners.
   b. Finish: Mill finish.

9. Car Handrails:
   a. Type: Refer to EXHIBIT 1: Stainless Steel Bar ½” x 2”, “Brushed” #4; or if changes as approved by Texas State University.
   b. Fasteners: Concealed type for all handrails.
G. Car Operating Front Panels

1. Type: Integral swing-type assembly manufactured of metal and finish to match entrance columns, complete with the following and as indicated on drawings:

   a. Hinges: Concealed piano hinges of metal and finish to match panels, of sufficient strength to prevent sagging of panels in open position.

   b. Locks: Two cam-operated locks concealed behind each operating panel, complete with tamperproof Allen type keyways with smallest possible access port.

   c. Sound Deadening: Required behind front panels.

   d. Cutouts: Required for protrusions of car buttons, switches, card readers, etc.

   e. Self-illuminating floor registration buttons.

   f. Markings for blind: As indicated on drawings.

      (1) Applied or stick-on markings not acceptable.

   g. Acid Etching: As indicated on drawings. Letter style as specified in this section.

   h. Emergency alarm and door control buttons.

   i. Car Telephone Compartments: Concealed behind door of type complying with applicable code and governing authorities, complete with permanent telephone complying with ADA requirements.

      (1) Door: Flush, 12 gauge metal of type and finish to match front return panels with hairline joint.

      (2) Door Hinges: Concealed heavy-duty metal of type to match door finish.

      (3) Lock: Bullet catch with flush key cylinder.
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

(4) Acid-etch each car number (PE-1 etc.) on panel inside telephone compartments.

(5) “Telephone” on door front in raised tactile letters.

(6) Contractor shall provide wiring from telephone to Telephone Room.

(7) Owner shall provide telephone line connection from Telephone Room to Campus Police Station.

(8) Contractor is to provide a Rath Microtech Model 2100-907 RAI phone inside the telephone compartment, so that the phone can be wired for CCTV images.

2.07 Hoistway: Frames/Doors

A. Door Openings:
   1. 7’-0” high, center opening.

B. Miscellaneous Items:
   1. Header: 3/16” steel formed to provide stiffening flanges.
   2. Fascia Plates: Concealed type, 14 gauge steel reinforced to ensure a flat even surface, secured to hanger housing and sill.
   3. Sill Support Angles: Required for all entrances.
   4. Struts and Closers: Continuous structural steel angels bolted to sill and building beams above, of size to accommodate door closers.
   5. Cover Plate: 14 gauge steel extended to full travel of door, easily removable from inside of car.
   6. Dustplates: Minimum 14 gauge steel centered on doorway extending 6” both sides of jamb.
   7. Sight Guards for Typical Floors: 16 gauge stainless steel.
   8. Toe Guards: 14 gauge steel centered on doorway, extending 6” each side of jamb, with finish paint.
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

9. Fascias: 14 gauge steel reinforced to ensure flat even surface, with finish paint.

10. Cutouts: Required for lights, signals, etc.

11. Finish for Miscellaneous Steel Items: Rust-inhibitive primer.

C. Steel Hoistway Doors and Frames

1. General: Doors and frames shall be UL Class “B” Label 1-1/2 hour rated assemblies designed and fabricated as part of door/frame assemblies for hoistway entrances of all elevator hoistways.

2. Doors: 42” x 84” 1-3/8” thick, 14 gauge flush steel face sheets, hollow metal construction with reinforcing members spaced 9” apart.

3. Frames: Formed 14 gauge steel with head and jamb in flush alignment, bolted, secured to sill and header.


D. Aluminum Sills/Thresholds:

1. Type: Extruded, with grooves and concealed fasteners.

2. Finish: Mill finished.

E. Floor Numbers:

1. Type: Tactile and Braille characters, in compliance with ANSI A17.1 and ADA.

2. Locations: Tactile and Braille on both jambs of all elevator hoistway entrances.

3. Material for Letters: Brushed stainless steel graphics on black painted plate as indicated on drawings.

4. Letter Style: Manufacturer’s standards.

F. Door Hangers/Tracks/Supports:

1. Door Hangers: Two-point support hangers designed to take the up thrust of doors equipped with rollers, tracks, hanger, hanger supports and cover plates.
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED

2. Rollers: Adjustable rubber-tired ball-bearing rollers designed to roll on metal tracks complete with heavy-duty sheaves not less than 3-1/4” diameter.

3. Tracks: Cold-drawn or cold-rolled polished steel.

4. Hanger Supports: Formed sections securely bolted to strut angles or closer support angles.

5. Hanger Cover Plates: Removable type, arranged to assure accessibility from inside of car.

G. For Emergency Access to Hoistways: Provide unlocking devices at all hoistway doors.

H. Hoistway Door Interlock:

1. Each elevator hoistway door shall be equipped with an interlock system.

I. Hoistway Door Operator:

1. Type: GAL MOVFR Heavy-duty, DC master door operator capable of opening doors at not less than 1-1/2 fps and accomplishing reversal in 2-1/2” maximum of door movement.

2. Arrange operator so doors can be opened by hand from inside car in case of power failure, if cars are within leveling zone.

J. Hoistway Door Re-Opening and Control Device:

1. Door Protective Devices: Infrared electronic detection or proximity devices for protection of passengers.

2. Door Open Timing Feature:

   a. Shall operate in conjunction with detection to provide adjustable, reduced, hold open time once rays are broken and re-established.

   b. When rays are broken beyond adjustable time, buzzer sounds and doors shall close at reduced speed, detection device effective to stop but not reverse doors.

   c. There shall be a difference in door hold-open times between car and hall calls.

2.08 Fixtures (Car stations, Hall Stations, Position Indicators, and Hall Lanterns)

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A. Car stations, position indicators, hall stations, and hall lanterns shall be Innovation Industries “Bruiser” Collection with Stainless Steel #4 brushed finish. No substitutions allowed.

B. The car station shall be Innovation Industries “Bruiser” Collection with Stainless Steel #4 brushed finish. The COP shall have round push buttons, digital position indicator and emergency light fixture integrated into the panel, built-in push-to-call emergency telephone, keyed stop switch, and a lockable service cabinet.

C. The in-car lanterns shall be Innovation Industries with Stainless Steel #4 brushed finish.

D. The hall stations shall be Innovation Industries “Bruiser” Collection with Stainless Steel #4 brushed finish. Hall stations shall be mounted flush with the wall panels. No extended panels allowed.

E. All lettering (such as Fire Service instructions) shall be engraved and filled. Silk-screened lettering or applied panels with lettering shall not be permitted.

2.09 Graphics

A. Type: Acid-etched and infilled with paint, and applied tactile graphics as indicated on drawings.
   1. Letter Style: Manufacturer’s standard.

B. Braille: Grade 2 Braille.

C. Tactile Letters:
   1. Type: Manufactured of metal and finish to match car operating front panel.

   2. Height: Raised a minimum of 1/32”.

   3. Letter Style: Manufacturer’s standard.


2.10 Car Protective Pads

A. Type: Cotton ticking on one side and reinforced vinyl over 1” thick cotton batting on opposite side, compatible with car enclosure design indicated on drawings.
SECTION 14 20 00 – ELECTRIC TRACTION ELEVATORS: GEARED


2. Quantity: 1 set.

2.11 Architectural Metal Finishes

A. Brushed Stainless Steel Finish No. 4:

1. Type: General purpose bright mechanically polished “Brushed Finish”, No. 4 obtained by finish with a 120-150 mesh abrasive, following initial grinding with coarser abrasive, complete with protective coating, in accordance with quality standards and methods established by NAAMM to match “control sample” approved by Architect.

2. Protective Coating: Temporary strippable type factory-applied coating for protection of exposed finish.

Part 3: Execution

3.01 Scope

A. Installation shall meet all standard and generally accepted requirements for elevator construction. All work required for a first-class and complete installation shall be the responsibility of the contractor.

B. All work shall be expedited. The elevator contractor shall provide OSHA compliant barricades and other protections necessary for public safety. All barricades and other protections shall be removed at the completion of the project.

C. All equipment shall be finish painted after the installation is complete. The Owner shall select paint colors.

D. Trash shall be removed daily from all areas.

E. Final acceptance for all elevator equipment shall have the same date, and will be after all inspections and tests are successfully completed, and the Owners representative is confident that the installation is complete.
CONSTRUCTION STANDARDS            DIVISION 14 – CONVEYING EQUIPMENT

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Exhibit #1

New standard Thyssen Krupp or equal plastic lam. wood pattern panels, 3/4" thick, formica amber maple, 7012.

Stainless Steel handrail (If existing elevator is being remodeled, reuse existing handrail.)

Side Elev.

1/2" = 1'-0"

Back Elev.

1/2" = 1'-0"

Reveals, top & base to be plastic lam., Wilson Art L6427, Alumia, glued directly to metal walls.

Ceiling Plan

1/2" = 1'-0"

Thyssen Krupp or equal standard ceiling style (E), with plastic lam. finish, formica amber maple 2012, with LED downlights.

Flooring finish:
12" x 12" x 1/8" Fritztile, Classic, flex. marble tile, CL 200 series, CL 234A "Persian Cream WM".

General Notes:
1. The finishes of wall, ceiling panels, and base/reveals can be changed by designer to coordinate with the color palette of each building interior.

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San Marcos, Texas 78666-4616
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Title: Standard Elevator Cab Details
File updated: 6/5/2013
File name: Standard_Elevator

Sheet No.:  1 of 1

Plot Date: 6/13/2013

END OF SECTION 14 20 00
SECTION 14 24 00 – HYDRAULIC ELEVATORS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Hydraulic Elevators.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Provide at least one passenger elevator for each new and renewed Texas State University building of more than a single story, except as otherwise approved by the Director of Facilities Planning, Design and Construction.

B. Elevators are required in all multi-story buildings to provide accessibility to the disabled.

1. Freight Elevator:

a. Where freight elevators are specifically required, provide elevators with minimum capacity of 5,000 pounds, 150 FPM.

b. Equip freight elevators with horizontal-sliding or center-opening doors.

2. Passenger Elevator:

a. Where hydraulic passenger elevators are required, provide with a minimum capacity of 3500 pounds, 150 FPM.

b. Passenger elevators with horizontal-sliding or center-opening doors.

c. Passenger hydraulic elevators which serve as Freight elevators will be design for 5,000 lb. capacity and shall have hooks at top to receive protective pads.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

1.03 References

A. Comply with all applicable current local, University, state, and federal standards, building codes, elevator codes, laws, regulations, and ordinances at the project site, including but not limited to, the following:


2. ADAAG – Americans with Disabilities Act Accessibility Guidelines.

3. TAS – Texas Accessibility Standards.


7. ANSI/UL 10B – Fire Tests of Door Assemblies.

8. Model Building Codes.

9. All other applicable local, state, and federal codes, laws, regulations and ordinances.

1.04 Quality Assurance

A. Elevator contractor must be able to demonstrate that he has installed and maintained similar elevators to those specified, that he is able to show evidence of satisfactory past performance, that he maintains locally an adequate stock of parts for emergency purposes, that he has under his direct employment and supervision the necessary personnel specifically trained on the type and grade of equipment specified, and that he has been in business for a minimum of five (5) years.

B. Regulatory Requirements: Elevator system design and installation shall comply with the latest versions of all applicable local, state, and federal codes, laws, regulations, and ordinances.

1. TDLR ELEVATOR INSPECTIONS: While it is the responsibility of the CMAR and their Subcontractor to call for elevator inspection, they should inform the A/E and FPDC of the inspection. FPDC representative should be present during these inspections.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

C. Permits and Inspections: Provide licenses, permits and certificates of inspection for all elevator equipment, as required by all authorities having jurisdiction. Perform required inspections and tests. The Owner shall select the QEI inspector.

1.05 Submittals

A. Product Data: Submit a minimum of three copies of manufacturer’s product data for each system to be used.

1. Car design, dimensions and layout.

2. Fixtures (car stations, hall stations, hall lanterns, position indicators, etc.).

3. Electrical characteristics and requirements. The Elevator Contractor shall provide data concerning the size and location of the mainline and car lighting switchgear, wiring, fuses and breakers.


B. Shop Drawings: Submit a minimum of three copies of approval layout drawings.

1. Clearances and travel of car.

2. Clear inside hoistway dimensions.

3. Clear inside pit dimensions.

4. Car, guide rails, buffer springs, and other components in hoistway.

5. Maximum spacing for rail brackets.

6. Maximum loads imposed on guide rails requiring load transfer to building structure.

7. Loads on hoisting beams.

8. Location and sizes of access doors, hoistway entrances, and frames.

9. Interior Cab Design

10. All finishes

C. Operational and Maintenance Manuals: Provide a minimum of three (3) copies of manufacturer’s standard operational and maintenance manuals for each system to be used.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

1. Straight line wiring diagrams of as-installed circuitry, one (1) set for the machine room and two (2) sets for the Owners file.

2. Routine preventive maintenance manuals.

3. Parts catalogs of all components.

D. Project Schedule

1. Submit schedule of events with Bid Proposal.
   a. Material ship dates
   b. Project mobilization date.
   c. Series of events (including sub-contractors schedule) through job completion.
   d. Handover tests and inspections (QEI) date.

1.06 Warranty

A. Provide warranty to repair or replace parts or components that fail or do not operate properly due to engineering, design, or workmanship for a period of twelve (12) months from the date of final acceptance. The guarantee excludes ordinary wear and tear or improper use, vandalism, or neglect, or any other cause beyond the control of the elevator contractor.

1.07 Maintenance

A. Provide regular routine preventative maintenance service for a period of three (3) months after the date of final acceptance. Maintenance service shall consist of regular examinations of the elevator equipment by technicians specifically trained on the type and grade, and shall include 24-hour callback service. Response time for callback service shall be one (1) hour or less during the normal workday. Response time during after normal work hours shall be one and one half (1 ½) hours or less.

1.08 Addenda

A. Any and all changes, additions, clarifications, or interpretations will be in writing through Addenda prior to bid opening.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

1.09 Acceptable Elevator Companies (Must be listed in alphabetical order):

B. Otis Elevator Co.
   11500 Metric Blvd. Suite 285
   Austin, TX 78758
   (512) 339-9731

C. Schindler Elevator Corporation
   8868 Research Blvd
   Austin, TX 78758
   (512) 451-3620

D. Tejas Elevator Co.
   4424-D Brandt Rd.
   Austin, TX 78744
   (512) 454-7878

E. Thyssen/Krupp Elevator Co.
   3615 Willow Springs Rd.
   Austin, TX 78704
   (512) 447-9511

PART 2: PRODUCTS

2.01 General Characteristics

A. Freight Elevator:

1. Quantity Per architectural plans
2. Type Freight
3. Capacity and Speed 5,000# @ 150 FPM
4. Stops Per architectural plans
5. Openings Per architectural plans
6. Rise FIELD VERIFY
7. Inside car height Indicate
SECTION 14 24 00 – HYDRAULIC ELEVATORS

8. Car inside: Indicate, see EXHIBIT 1

9. Entrance type and size: 2 speed, indicate opening type, opening, 4’0” x 7’0”

10. Main Power Supply: 480 volts, 5% of normal, 3 phase, with a separate equipment-grounding conductor.

11. Lighting Power Supply: 120 volts, 1 phase, 15 amps, 60 Hz.

B. Hydraulic Passenger Elevator:

1. Quantity: Per architectural plans

2. Type: Freight

3. Capacity and Speed: 3,500# @ 150 FPM

4. Stops: Per architectural plans

5. Openings: Per architectural plans

6. Rise: FIELD VERIFY

7. Inside car height: Indicate

8. Car inside: Indicate

9. Entrance type and size: 2 speed, indicate opening type, opening, 4’0” x 7’0”

10. Main Power Supply: 480 volts, +/- 5% of normal, 3 phase, with a separate equipment-grounding conductor.

   a. If existing Elevator remodel, field verify existing power voltage

11. Lighting Power Supply: 120 volts, 1 phase, 15 amps, 60 Hz.

   a. If existing Elevator remodel, field verify existing power voltage

2.02 Performance

A. Speed: +/- 5% under any loading condition.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

B. Capacity
   Safely lower, stop and hold up to 125% of rated load.

C. Leveling accuracy
   +/- 3/8” under any loading condition.

D. Door closing time
   Thrust and Kinetic energy shall comply with ASME Code and ADA and shall be the minimum allowable unless otherwise directed by the consultant.

E. Door opening time
   Opening time shall be 80% of closing time.

F. Ride Quality
   Acceleration, run, deceleration, leveling and stopping shall be adjusted for a smooth and comfortable ride.

2.03 Machine Room Equipment

A. Controls
   1. Provide new Motion Control Engineering, Inc., 2000 Series Controller. No substitutions allowed. Minimum required features are as follows:

      a. On-board diagnostics
      b. Out of service timer
      c. Door operation timers
      d. Door pre-opening
      e. Nudging
      f. Car and hall call registration
      g. Fire Service Operation
      h. Independent service operation
      i. Simplex selective collective operation
      j. Simplex home landing operation
      k. 2000 Series landing system
      l. Controller test switch
m. Relay panel inspection
n. Un-canceled call bypass
o. Anti-nuisance
p. Battery lowering device
q. Optional peripheral (capability to attach on-site or remote computer terminal)

2. Provide new solid-state type motor starter.

3. The controls shall not have any software embedded which shuts the elevator down when the elevator is operating normally that forces the Owner to contact the manufacturer for service or replacement of major components of the controller.

4. Controls shall be compatible with Integrated Building System (Section 13810), Control Sequence (Section 1320), and Integrated Fire Alarm/Life Safety (Section 13850), where applicable.

C. Pump and Motor Unit

1. Provide new submersible pump and motor unit. Leaks in the pump unit equipment or any other elevator equipment will not be tolerated.

2. Provide new Maxton brand Valve.

D. Provide new “to-from” oil line from the new pump unit to the jack head. The new oil line shall be connected with Victaulic couplings. Leaks in the oil line or any other elevator equipment will not be tolerated.

E. Provide a new shutoff valve in the new “to-from” oil line in the machine room. The new shutoff valve shall have a permanent handle.

F. If existing Elevator is being remodeled, then other wiring including travel cables shall be replaced.

2.04 Hoistway Equipment

A. Hoistway Interlocks

1. Provide new GAL hoistway interlocks.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

B. Hoistway Doors and Entrances

1. Stainless Steel hoistway doors and entrances.

2. Provide new aluminum hoistway sills.

3. Provide new unlocking devices at all landings.

4. Provide new stainless steel escutcheons. Escutcheons shall be attached to hoistway door with a clamp device. Spring keepers are not acceptable.

5. Provide two gibs per door panel on all hoistway doors.

C. Provide a new shutoff valve in the oil line in the pit. The new shutoff valve shall have a permanent handle.

D. Provide new top-of-car inspection station.

E. Provide new car floating, adjustable roller guide assemblies.

2.05 Car Enclosure and Car Doors

A. Freight Elevator interior car finishes:

1. New Elevators finish to be approved by Texas State University Project Manager.

2. If doing an existing elevator remodel, sand smooth and paint car ceiling, car walls, and car doors with industrial grade enamel paint. Texas State University personnel shall select paint color.

3. Provide new ¼” aluminum diamond boilerplate floor covering. The aluminum plate shall be bolted down from inside the car and shall be removable without disturbing car panels or car sill. There is to be no wood used in this elevator installation.

4. Provide new nickel silver car sill.

B. Hydraulic passenger Elevator Interior Car Finishes: see EXHIBIT 1

1. Flooring:

   a. Fritztile, Classic Flexible Marble Tile, CL 200 Series, 12” x 12” x 1/8” thick, with opaque binding.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

2. Ceiling:
   a. Ceiling Suspension: As approved by Texas State University.
   b. Ceiling Panels: Refer to EXHIBIT 1, or if changes as approved by Texas State University.
   c. Emergency ceiling access panel joints shall be aligned with adjacent joints in ceiling.

3. Ceiling Lighting:
   a. Type: Refer to EXHIBIT 1: LED downlight fixtures as indicated on drawings complete with emergency lighting, or if changed as approved by Texas State University.

4. Stainless Steel Doors and Frames:
   a. Type: AISI Type 302/304.

5. Stainless Steel Return Panels:
   a. Type: 1/8” thick AISI Type 302/304.

6. Plastic Laminate Wall Panels:
   a. Type, Plastic Laminate: Refer to EXHIBIT 1: Panels shall be marine-grade, moisture-resistant plywood core with plastic laminate cladding on one side and all edges, or if changed as approved by Texas State University.

7. Wall Base and Panel Reveals: Plastic laminate adhered directly to steel Cab walls.

8. Aluminum Sills/Thresholds:
   a. Type: Extruded, with grooves and concealed fasteners.
   b. Finish: Mill finish.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

9. Car Handrails:
   a. Type: Refer to EXHIBIT 1: Stainless Steel Bar ½” x 4” “Brushed” #4 or if changed as approved by Texas State University.
   b. Fasteners: Concealed type for all handrails.

10. Car Protection Pads:
   a. Type: Cotton ticking on one side and reinforced vinyl over 1” thick cotton batting on opposite side, compatible with car enclosure design indicated on drawings.

   (1) Hooks: Stainless steel type, removable.
   (2) Quantity: 1 set complete with hooks for each elevator.

C. Car Operating Front Panels

1. Type: Integral swing-type assembly manufactured of metal and finish to match entrance columns, complete with the following and as indicated on drawings:
   a. Hinges: Concealed piano hinges of metal and finish to match panels, of sufficient strength to prevent sagging of panels in open position.
   b. Locks: Two cam-operated locks concealed behind each operating panel, complete with tamperproof Allen type keyways with smallest possible access port.
   c. Sound Deadening: Required behind front panels.
   d. Cutouts: Required for protrusions of car buttons, switches, card readers, etc.
   e. Self-illuminating floor registration buttons.
   f. Markings for blind: As indicated on drawings.

   (1) Applied or stick-on markings not acceptable.
   g. Acid Etching: As indicated on drawings. Letter style as specified in this section.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

h. Emergency alarm and door control buttons.

i. Car Telephone Compartments: Concealed behind door of type complying with applicable code and governing authorities, complete with permanent telephone complying with ADA requirements.

1. Door: Flush, 12 gauge metal of type and finish to match front return panels with hairline joint.

2. Door Hinges: Concealed heavy-duty metal of type to match door finish.

3. Lock: Bullet catch with flush key cylinder.

4. Acid-etch each car number (PE-1 etc.) on panel inside telephone compartments.

5. “Telephone” on door front in raised tactile letters.

6. Contractor shall provide wiring from telephone to Telephone Room.

7. Owner shall provide telephone line connection from Telephone Room to Campus Police Station.

8. Contractor is to provide a Rath Microtech Model 2100-907 RAI phone inside the telephone compartment, so that the phone can be wired for CCTV images.

D. Provide emergency car lighting and alarm bell.

E. Provide new exhaust fan.

F. Provide GFCI convenience outlet in car station service cabinet.

2.06 Door Operator and Door Opening Protection

A. Provide new GAL MOVFR Door Operator.

B. Provide new infrared type door opening protection.

2.07 Fixtures (Car stations, Position Indicators, In-car Lantern, and Hall Stations)
SECTION 14 24 00 – HYDRAULIC ELEVATORS

A. Car station, position indicator, external lanterns, and hall stations shall be Innovation Industries “Bruiser” Collection with Stainless Steel AISI #4 satin finish. No substitutions allowed.

B. Provide new Innovation Industries “Bruiser” Collection car station (COP) with Stainless Steel AISI #4 satin finish. The COP shall have round push buttons, digital position indicator and emergency light fixture integrated into the panel, built-in push-to-call emergency telephone, keyed stop switch, and a lockable service cabinet.
   1. Switches behind the service cabinet door shall be toggled.
   2. Provide new GFCI convenience outlet in car station service cabinet.

C. Provide new Innovation Industries “Bruiser” Collection combination position indicator/hall lantern at all landings with Stainless Steel AISI #4 satin finish.

D. Provide new Innovation Industries “Bruiser” Collection hall stations with Stainless Steel AISI #4 satin finish. Hall stations shall be mounted flush with the wall panels.

E. All lettering (such as Fire Service instructions) shall be engraved and filled. Silk screened lettering or applied panels with lettering will not be accepted. Company logos or any other method of identifying a manufacturer shall not be permitted on any equipment viewed by the riding public.

PART 3: EXECUTION

3.01 Scope

A. Installation shall meet all standard and generally accepted requirements for elevator construction. All work required for a first-class and complete installation shall be the responsibility of the contractor.

B. All equipment shall be finish painted after the installation is complete. The Owner shall select paint colors.

C. Trash shall be removed daily from all areas.

D. Final acceptance for all elevator equipment shall have the same date and will be after all inspections and tests are complete, and the Owners representative is confident that the installation is complete.
SECTION 14 24 00 – HYDRAULIC ELEVATORS

Exhibit #1

Side Elev.
1/2" = 1'-0"

Ceiling Plan
1/2" = 1'-0"

New standard Thyssen Krupp or equal plastic lam. wood pattern panels, 3/4" thick, formica amber maple, 7012.

Stainless Steel handrail (if existing elevator is being remodeled, reuse existing handrail.)

Reveals, top & base to be plastic lam., Wilson Art L6427, Aluma, glued directly to metal walls.

Thyssen Krupp or equal standard ceiling style (E), with plastic lam. finish, formica amber maple 2012, with LED downlights.

Flooring finish:
12" x 12" x 1/8" Fritztil, Classic, flex. marble tile, CL 200 series, CL 234A "Persian Cream WM".

General Notes:
1. The finishes of wall, ceiling panels, and base/reveals can be changed by designer to coordinate with the color palette of each building interior.

Title: Standard Elevator Cab Details

File updated: 6/5/2013
Plot Date: 6/13/2013

File name: Standard_Elevator

END OF SECTION 14 24 00

Revised Jan-15

Hydraulic Elevators-14 24 00-
DIVISION 21: FIRE SUPPRESSION

21 10 00    Water Based Fire Suppression Systems
21 11 16    Fire Hydrants
------------ Fire Department Standpipe Valve Locations

Revised Jan-15
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for automatic fire sprinkler and standpipe systems.

B. The design guidelines contained herein include the requirements for systems, materials, fittings and valves utilized for fire protection systems at Texas State University-San Marcos. It is the intention of this document to provide a minimum standard for fire protection systems at Texas State University-San Marcos so as to provide the highest level of fire safety possible; it is not intended to be a guide specification.

1.02 Scope of Work

A. All new and renovated buildings at Texas State University-San Marcos shall have a fire sprinkler system.

B. Provide all design and materials required to provide a complete fire protection system to protect the specified building areas in accordance with design requirements. Antifreeze loops are not permitted. The preference of Texas State University-San Marcos is to provide automatic fire sprinkler systems that do not contain alarm valves, and if possible, do not require a fire pump.

C. Provide a complete automatic sprinkler system as defined by the National Fire Protection Association (NFPA) Standard 13. Wet pipe systems are the standard design at Texas State University-San Marcos Campus. Preaction systems may be a requirement for special occupancies such as special collections, computer rooms, etc. but such systems shall be authorized by the Owner prior to design.

D. Required standpipe systems shall be Class I in all cases regardless of minimum code requirements.

E. The work addressed in this section consists of a fire protection system, which may include, and at least will be coordinated with all of the following:

1. Fire Alarm Systems

2. Wet Chemical Extinguishing systems

3. HVAC and smoke control systems and fire, smoke, and combination fire/smoke dampers
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

4. Emergency power systems

5. Security Systems

6. Elevator installation. See the Texas State University-San Marcos Elevator Construction Standards 14 20 00 and 14 24 00.

7. Central control and monitoring system.


1.03 Related Work: References/Quality Assurance:

A. Industrial Risk Insurers (IRI) standards, the International Building Code, International Conference of Building Officials, and National Fire Codes as published by the National Fire Protection Agency (NFPA) and San Marcos, the State of Texas Fire Marshall’s requirements contain fire protection criteria and requirements for the design of all fire suppression systems. The contractor shall conform to the following:

1. Conform to a minimum of NFPA 13 for sprinkler systems. IRI or Owner requirements may require design in excess of NFPA 13.

2. Conform to minimum of NFPA 14 for standpipe systems. IRI or Owner requirements may require design in excess of NFPA 14.

3. All materials and performance shall meet the appropriate ANSI, ASME and ASTM Codes.

4. All design shall conform to requirements of Industrial Risk Insurers (IRI).

5. Welding Materials and Procedures shall conform to the ASME Code.

6. Only welders certified in accordance with ANSI/ASME Section 9 shall be employed.

B. Each item of equipment shall be capable of performing its function over an extended period of time with a minimum of attention and maintenance. All equipment shall be constructed using new materials designs and built in accordance with the best practices of the industry.

C. Each item of equipment shall be listed by Underwriters Laboratories (UL) or approved by Factory Mutual (FM). Each major item of equipment shall bear the manufacturer’s name or trademark; serial number, and UL or FM label.
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS


1.04 Submittals:

A. Texas State University-San Marcos Project Representative shall review and distribute all submittals for approval by IRI, the San Marcos, the State of Texas Fire Marshal, A&E Services, and others as appropriate.

B. The State of Texas Fire Marshall has final authority of approval of the Sprinkler System.

C. All product data shall be submitted under provisions of Division 00.

D. Manufacturer’s data sheets shall be provided for all materials and equipment for approval before purchase or installation. Data sheets shall describe the type of material, capacities, manufacturer, and part numbers of equipment and give information necessary for checking equipment approval.

E. The Contractor shall submit detailed and accurate shop drawings prepared in accordance with NFPA 13, NFPA 14, NFPA 20 and NFPA 24 for approval of all equipment to be constructed and installed. Shop drawings shall identify all materials and list all equipment to be used. Shop drawings shall include ceiling grid or reflective ceiling layout and have been coordinated with other trades prior to submittal.

F. Hydraulic calculations shall comply with NFPA 13 and shall include comprehensive hydraulic data sheets. Verification of the adequacy of water pressure and other pertinent water supply data shall be the responsibility of the design engineer. The design engineer shall immediately notify the State of Texas Fire Marshal and Architectural and Engineering Services (A&E Services) of the need for supplemental water supply or fire pump or the need for any special considerations required. The engineer shall provide the record data at the point of the new utility connection as follows:

1. Building Name and flange elevator (ft):
2. Test hydrants (hydrant number and location and hydrant elevation (ft)
3. Flow rate (gpm), static pressure (psi), and residual pressure (psi)

G. No work shall be performed until the shop drawings, calculations and data sheets have been approved by Architectural and Engineering Services. The contractor is solely liable for any work performed prior to this approval.
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

PART 2: PRODUCTS

2.01 Piping

A. All piping shall be a minimum schedule 40 steel pipe. All exposed pipe shall be painted (unless prohibited by code).
   Mechanical Grooved Couplings:
   Malleable iron housing clamps: ASTM A47; UL labeled; engage and lock, designed to permit some angular deflection, contraction, and expansion, galvanized couplings for galvanized pipe.

2. Steel bolts, nuts and washers: ASTM A183 heat-treated with a minimum tensile strength of 110,000 psi.
3. Connection shall be made to Texas State University-San Marcos Campus on-site water system unless the Owner agrees to an alternate arrangement. The connection between system piping and underground piping shall be made with a cast iron flanged piece, properly fastened.

B. Piping shall be concealed in areas with drop ceilings. Sprinklers shall generally be centered in ceiling tiles.

C. Piping shall be installed in a craftsman like manner and shall not interfere in the complete function of other systems such as cable trays, access panels, or pedestrian passageways. Installation of all piping shall be in coordination with duct, light fixture, and any other work that may obstruct sprinklers. The contractor shall coordinate with all trades having materials in above ceiling spaces prior to commencement of any work.

D. All piping installed outside or otherwise exposed to freezing weather, shall be externally galvanized. Antifreeze loops are not permitted. Piping shall be painted red, and the galvanized surface shall be properly prepped prior to painting to insure bonding.

2.02 Valves

A. Unless specified otherwise, all valves shall be UL listed or FM approved and be suitable for the anticipated pressures or a minimum of 175 psi working pressure, whichever is greater
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

B. All valves on connections to water supply to sprinklers shall be UL listed butterfly type indicating valves except for the following which shall be O.S.& Y:

1. All indicating valves on the supply side of the backflow preventer;
2. The indicating valve immediately adjacent to the backflow preventer on the system side.
3. All indicating valves on the suction side of a fire pump.
4. Where indicated on the contract drawings.

C. All butterfly valves shall have a built in tamper resistant switch for supervision of the open position. The switch shall be contained within a NEMA Type 1, general purpose indoor rated housing. Either unauthorized removal of the switch housing (when the valve is open) or closing the valve, shall cause the switch contacts to change position. The switch shall have four conductors to accommodate connections to Style 4 or Style 6 signaling line circuit devices.

D. Where OS&Y indicating valves are installed, the following shall apply:

1. Valves 2-1/2 inches and larger shall be iron body, except seats, discs, and stems which shall be brass. Valves 2 inches and smaller shall be brass body and brass stem seat.

E. A check valve shall be installed between each floor (isolation) control valve and the floor drain valve to permit draining of only the floor (area) affected. Check valves shall comply with the following:

1. Check valves 2-1/2 inches and larger shall be iron body swing check with cast brass hinge, rod, and brass faced discs.
2. Check valves 2 inches and smaller shall be UL listed brass body and all brass fitted.

F. Ball valves shall be constructed of forged brass with Teflon seats and shall be provided with a vinyl-covered handle.

G. Post Indicator Valve - Gate valve on incoming water service shall be operable by a UL listed post indicator valve.

H. All valves controlling water supply for sprinklers shall be readily accessible for use by emergency and maintenance personnel.
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

I. All accessible valves controlling water supply for sprinklers shall be supervised by the fire alarm system. All valves controlling water supply for sprinklers shall be red in color.

J. A valve shall be installed at the base of each riser.

2.03 Piping Accessories

A. All hanger components other than all thread shall be UL listed or FM approved. No sprinkler piping is to be supported from any mechanical or electrical devices and/or equipment (ducts, lights, etc.). Hanger assemblies installed outside, or otherwise exposed to weather, shall be externally galvanized.

B. Install iron pipe sleeves of ample diameter at all points where pipes penetrate beams, floors or walls. Size and install so that sprinkler pipes are not stressed.

C. Sleeves shall be installed prior to construction of walls or pouring of concrete. Install sleeves flush with all surfaces.

D. Sleeves for underground pipe shall have mechanical rubber seals and be watertight.

E. Floor, wall and ceiling plates shall be pressed steel or cast iron split plates, chromium plated.

F. Pressure gauges shall be UL listed or FM approved for fire service.

2.04 Sprinkler

A. Sprinklers shall be UL listed or FM approved. Any sprinkler that incurs damage, is painted, or is sprayed with any obstructive material shall be replaced at no cost to the Owner. Installation of sprinklers shall be coordinated with other work including duct and electric fixture installation to prevent sprinkler obstructions.

B. Sprinklers that may be subject to mechanical damage shall be provided with guards listed by UL and IRI approved for the model of sprinkler used.

C. Quick response sprinklers are required throughout all light hazard occupancies and encouraged throughout ordinary hazard occupancies.

2.05 Fire Department Connections

A. Each fire department connection shall be the flush type. Freestanding type fire department connections shall only be installed when approved by A&E Services
and the San Marcos, Texas Fire Marshal. Each fire department connection shall be two (2) 2-1/2 inches, equipped with UL listed screw caps with pin lugs and chains. The fire department connection shall be labeled “AUTOMATIC SPRINKLER” with raised letters at least one inch in size and cast on plate. The fire department connections shall be not less than two feet and not more than 3 feet 6 inches in elevation, measured from the ground level to the centerline of the inlets.

B. A bypass with a normally closed valve shall be installed around the check valve in the fire department connection piping, to permit flow testing of the backflow prevention assembly.

C. Locations of Hose Connections:
   1. Hose connections and hose stations shall be unobstructed and shall be located not less than 0.9 m (3 ft) or more than 1.5 m (5 ft) above the floor.
   2. Class I systems shall be provided with 65-mm (2½-in.) hose connections in the following locations:
      a. At each intermediate landing between floor levels in every required exit stairway.
      b. At the highest landing of stairways with stairway access to a roof and on the roof where stairways do not access the roof.


2.06 Identification Tags

Identification signs shall be porcelain enameled 18 gauge and shall be affixed securely by brass chain to all valves. The signs shall be red in color.

A. Provide an approved laminated valve chart in frame and plexiglass cover showing location and use of each valve. The chart shall be secured in a visible location acceptable to Texas State University-San Marcos near the system riser.

B. The main drain sign shall be labeled “MAIN DRAIN”. Riser drains shall be labeled “RISER DRAIN” or “DRAIN”.

C. Auxiliary drain signs shall be labeled “AUXILIARY DRAIN”.

D. Inspector’s Test signs shall be labeled “INSPECTOR’S TEST”.

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E. All water supply control valves shall have a standard sign identifying the portion of the system controlled, noting that the valve shall be kept open, and leaving a blank space for notification information.

F. All isolation valves shall be marked “normally open” (NO) or “normally closed” (NC).

2.07 Drains and Test Piping (including Dry Pipe Systems)

A. All risers, including the alarm check valve, shall be equipped with drains with sizes as specified in NFPA 13. The alarm checks valve drain (“main drain”) shall be piped to the sanitary sewer system.

B. Every waterflow switch shall have an inspector’s test connection piped in accordance with item 2.10C of this Standard.

C. All drains and test piping shall be piped to the sanitary sewer system.

2.08 Backflow Prevented

A. A double check backflow prevention assembly with AS&Y valves shall be installed in the water supply to each automatic fire protection system.

2.09 Dry Pipe System

A. Dry Pipe systems shall only be installed when adequate heat can not be provided to prevent sprinkler piping from freezing.

B. In areas subject to freezing that cannot be protected by dry sprinklers on a wet sprinkler system, a dry pipe system shall be installed. Antifreeze loops are not permitted.

C. All piping & fittings for Dry Pipe Systems shall be hot-dipped galvanized.

2.10 Fire Pump, Motor and Controller

A. A fire pump shall only be installed when the existing water supply is not adequate to meet the required sprinkler demand, or when the building height is greater than 75 feet as measured from the lowest level of the fire department access.

B. The pump furnished for fire protection service shall be supplied with a driver, controller and pump accessory items specified by the pump manufacturer.
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

C. The pump and controller shall be UL listed and approved for fire service, per NFPA 20.

D. The fire pump shall be capable of delivering not less than 10% excess capacity of the rated flow at not less than 100% of the rated head. The shut off (no flow) head shall not exceed 120% of rated head.

E. The fire pump shall be a horizontal split case, single stage, centrifugal pump specifically labeled for fire service. Limited service fire pump controllers will not be accepted unless specified by A&E services or the Fire Marshals Office.

F. The pump and motor shall be mounted on a common base plate of formed steel.

G. The pump casing shall be cast iron with 6 inch 125 pound rated suction and inch 250 pound rated discharge flanges machined to American National Standards Institute (ANSI) dimensions.

H. The pump shall be hydrostatically tested and run tested prior to shipment. The pump shall be hydrostatically tested at a pressure of not less than one and one-half times the no flow (shut off) head of the pump’s maximum diameter impeller plus the maximum allowable suction head, but in no case less than 250 psi.

I. Fittings
The pump manufacturer shall furnish piping accessory items for the pump installation which will adapt the pump connections to the fire protection system and test connection as follows: Fittings subjected to pump discharge pressure shall be ANSI 250 psi rated. Fittings subjected to suction pressure shall be 125 psi rated.

J. Flow Meter
An IRI approved flow meter shall be provided and installed in accordance with NFPA 20 to test the pump.

K. Fire Pump, Motor, and Controller

1. The main fire pump controller shall be a factory assembled, wired, and tested unit.

2. The controller shall be of the combined manual and automatic type designed for across-the-line type starting.

3. The minimum withstand rating of the controller shall not be less than 30,000 Amps RMS Symmetrical at 480 volts.
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

4. The controller shall include a motor rated combination disconnect switch/circuit breaker, mechanically interlocked and operated with a single externally mounted handle. When moving the handle from “OFF” to “ON” the interlocking mechanism shall sequence the isolating disconnect switch “ON” first and then the circuit breaker. When the handle is moved from “ON” to “OFF” the interlocking mechanism shall sequence the circuit breaker open first, and then the isolating disconnect switch.

5. The controller shall have externally mounted, individual, visible indicators for “Power Available”, “Phase Failure”, “Phase Reversal”, “Pump Running”, and “Run Time On”

6. The controller shall be wired so that the fire pump can only be shut down manually, per Fire Marshall Requirements.

7. Individual “Phase Failure”, “Phase Reversal” and “Pump Operating” alarm contacts shall be wired for connection to the Main Fire Alarm Control Panel, and the FCMS.

8. The manufacturer shall test the entire controller assembly prior to shipment. This test shall include each function the controller may be required to perform. The manufacturer shall test the circuit breaker at 300% full load, 600% load, and short circuit current settings. The manufacturer shall perform a high potential test on the controller power circuits at not less than two times the rated voltage plus 1000 Volts. Documentation of the above listed tests shall be submitted before the fire pump acceptance test.

L. Field Acceptance

1. Upon completion of the pump and sprinkler piping installation, a field acceptance test shall be conducted to 110% of the design capacity. All acceptance testing outlined in NFPA 20 shall be conducted by installing contractor in the presence of a representative of Texas State University-San Marcos Fire Marshal. Documentation of all factory and field tests shall be submitted at the conclusion of the field acceptance test. A&E will not approve any equipment prior to receipt and review of these test results.

2. Fire pump testing shall be of the recirculation type using a venturi.

3. The first flush must be filtered either by:
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

a. Directing the water to a large area of pervious cover capable of absorbing all of the discharge without causing erosion or damage to the existing landscape; or,

b. Directing the water to a cleaned area of impervious cover where the discharged water would enter a storm drain inlet protected by filtration (e.g. hay bales secured by sand bags).

4. If the total water volume is to exceed 1,000 gallons, the discharged water must be de-chlorinated before it enters the storm sewer system either by directing water into a small area where sodium metabisulfite (1 cup or 250 mgs per 5 gallons of chlorinated water) can be dripped in slowly to remove all chlorinate or, by directing the water through an obstacle course that is designed to remove the chlorine through aeration of the water. Contractors must use a chlorine test kit and test chlorine levels to ensure chlorine levels of discharged water are less than .1 mg/L residual chlorine before it enters other water bodies.

2.11 Pressure Maintenance Pump and Motor Controller

A. The contractor shall furnish and install a pressure maintenance pump with a rated capacity of 10 GPM, against a total head of 250 feet coupled to a motor rated for the required pump, not to exceed 5 HP (Maximum), 480 volts, 60 HZ, 3 phase.

B. The pressure maintenance pump shall be installed in accordance with NFPA 20.

C. The control valves to and from the pressure maintenance pump shall be supervised butterfly valves installed in accordance with item 2.02.A of this specification.

D. Pressure maintenance Pump Controller

1. The pressure maintenance pump controller shall be factory assembled, wired and tested, and specifically designed for this type of service.

2. The pressure maintenance pump controller shall be UL listed.

3. The pressure switch shall have a range of 0-300 psi and have independent high and low pressure settings. The pressure switch shall be mounted inside the controller. The piping connection for the pressure switch shall be installed as shown in NFPA 20Appendix A. The pressure switch set points shall be set as shown in NFPA 20 Appendix A.

4. The controller shall have a running period timer to be set to keep the motor in operation for at least one minute.
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

5. The controller manufacturer, prior to shipment, shall hook up and test the pressure maintenance pump controller as a completed assembly. This test shall include each function the controller may be required to perform. The manufacturer shall perform a high potential test of the controller power circuits are not less than two times the rated voltage plus 1000 volts. Documentation of the above listed tests shall submit prior to the pump acceptance test.

E. Field Acceptance Test

A field acceptance test of the pressure maintenance pump and controller shall be performed by the contractor at the same time as the main fire pump acceptance test. The acceptance test shall include each function the controller may be required to perform including manual start-stop, automatic start-stop, and minimum run timing.

2.12 Standpipe Systems

A. The Standpipe and hose cabinet shall be reviewed and approved by State of Texas Fire Marshall, as well as, the City of San Marcos Fire Marshall.

B. Wet standpipe systems shall be the manual-wet type and Class 1 as defined by NFPA 13.

C. Each standpipe shall be installed with a UL listed 2-1/2 inch NST fire department hose connection with screw caps on each floor in an accessible, protected; and readily visible location in accordance with NFPA 13.

D. Each standpipe shall have a drain sized and located in accordance with NFPA 13. Each drain shall be discharged to sanitary sewer.

E. All dry piping shall be installed so that the entire system may be drained. The number of auxiliary drains shall be kept to a minimum.

F. All dry piping, hangers and fittings shall be galvanized.

G. Each dry standpipe shall be provided with an air and vacuum valve installed at the top of each riser. The air and vacuum valve shall be a 1 inch APCO Series 140 air and vacuum valve, manufactured by Valve and Primer Corporation or approved equal.

H. One Standpipe Valve and Hose are to be located:

1. Inside each required exit stairwell, on the intermediate landing, (not at flooring landing), of the Building.
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

2. At the highest landing of stairway to roof access.

3. On roofs where stairway does not access roof.

Approved Product or equal: Larsen, FS0-3232, solid door, lettering black, horizontal, stainless steel, satin finish.

PART 3: EXECUTION

3.01 Guarantee

The Contractor shall guarantee and service all workmanship and materials to be as represented by him, and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of three (3) years after the date of final acceptance by the Engineer, ordinary wear and tear excepted. Contractor shall be responsible for, and pay for, any damages caused by, or resulting from defects in his work.

3.02 Qualifications

System design and installation shall be supervised by a licensed NICET Level III sprinkler system technician or fire protection engineer with not less than five (5) years experience with sprinkler systems. Shop drawings shall be prepared and engineered. Accurate As-Built drawings shall be required in the form of three hard copies and two copies on CD in the specified format. The signature of the RME or engineer constitutes an affidavit that the statements, representations, and information presented in the submittal constitute a complete operational system conforming to applicable state laws and recognized good engineering practices. All field installation work shall be continuously supervised by a NICET Level II or III sprinkler system technician.

3.03 Certification

A. Fire system is to be certified to the State Fire Marshall by the installing licensed fire alarm firms.

B. Copy of certification shall be included in fire alarm panel and owner’s manual.

C. Proof of transmitting certificate to State Fire Marshall shall be provided to owner and A/E. Contractor shall transmit via Certified Mail Return Receipt and shall include original copy of receipt to owner’s proof of submission as part of the Final Owners Operating and Maintenance Manuals.

END OF SECTION 21 10 00

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SECTION 21 11 16 – FIRE HYDRANTS

PART 1: GENERAL

1.01 Design Guidelines

A. Fire hydrants on the Texas State University campus will comply with the latest City of San Marcos fire hydrant specifications.

B. Fire hydrants on the university property will be painted with reflective red paint.

END OF SECTION 21 11 16
DIVISION 22: PLUMBING

22 00 00  Plumbing General System Designs
22 11 19  Domestic Water Piping Specialties
22 11 23  Domestic Water Pumps
22 13 19.26  Grease Removal Devices
22 42 00  Commercial Plumbing Fixtures
22 67 13.19  Deionized Water Piping for Laboratory Facilities
PART 1: GENERAL

1.01 Scope of Standards:


B. The design guidelines contained herein include the requirements for systems, materials, fittings and valves utilized for plumbing systems at Texas State University. It is the intention of this document to provide a standard for piping systems at Texas State University in order to provide the highest level of quality and standardization possible; it is not intended to be a guide specification.

1.02 Design Guidelines

A. General


2. All indirect drains shall be piped to a floor drain or floor sink. (A/C, Relief Valves, Pan Drains, etc.)

3. Building Drainage Systems – all venting to be properly sized and air admittance valves are strictly prohibited.

4. Building Drainage System – Horizontal Double Combination (any size) is strictly prohibited.

5. Seal all openings around piping.

6. Provide metal sleeves for piping passing through walls to provide fire protection equivalent to initial requirements.

7. In lavatories separately valve each riser pipe.

8. Always provide siphon breakers in pipe lines to hose bib-type faucets.

9. Use plugged tees rather than elbows to provide clean out points in plumbing piping.
SECTION 22 00 00 – PLUMBING GENERAL SYSTEM DESIGNS

10. Provide all take-offs from main water supply lines with cutoff valves and provide sufficient clearance for access to valves.

11. Provide enough valving so that plumbing systems can be closed down in sections.

12. Provide permanent “as-constructed” drawings which show locations of all piping systems, including those underground.

13. Use an identification system and a color coding system for plumbing and piping systems as described in mechanical section of these standards.

14. Provide keyed hose bibs within 20’ of main entrance and rear exit no more than 100’ apart around outside perimeter of a new building. Outdoor hose bib shall be non-freeze proof type.

15. All valves concealed within enclosing construction shall be made accessible via appropriate metal access doors. Their location and size shall be provided to the architect/engineer with a record document to be signed off on.

16. **When using PVC (in lieu of Cast Iron for building drainage systems) under slab or for slab on grade foundations, do not use test tees (see attached Photo)**
SECTION 22 00 00 – PLUMBING GENERAL SYSTEM DESIGNS

17. Mixing cast iron pipe and PVC pipe, under slab, is strictly prohibited on building drainage (sanitary) system. See attached photo

B. Plumbing Fixture Standardization: (only floor mount, floor outlet water closets)

1. Standardize plumbing fixtures for Texas State University as much as possible.

2. With each new construction project verify plumbing fixture selections with Project Manager prior to finalizing the specification of plumbing fixtures.

3. Specify plumbing fixtures which have been established as Texas State University standards.

4. Refer to plumbing section for standard plumbing products.

5. For energy conservation, where water saving devices have been developed and proven such as reduced flow shower heads they will be used.

C. Floor Drains

1. Provide floor drains, minimum 3”, in all restrooms and custodial closets.
   a. Do not provide drains in elevator pits, (only).

2. For drains in Restroom/Bathroom for Public use, provide minimum 3” pipe size. Large restrooms may require 2 or more floor drains.

3. Slope floor to drains, slope floor just around floor drain is not allowed.
SECTION 22 00 00 – PLUMBING GENERAL SYSTEM DESIGNS

4. Floor Drain Traps installed in inaccessible areas shall be brought to the attention of Texas State University for consideration of priming at that time. No drain seal use trap; primers on floor drains.

5. All pressure relief type trap primary devices shall be connected to a direct drop that supplies a single fixture.

6. All traps that are remote from a commonly used fixture shall have an electro mechanical trap primer for single or multiple primary connections and must be readily accessible.

D. Floor Sinks

1. Provide 16’ X 16” floor sinks in Mechanical Rooms.
   
a. Alternate: Trench Drains

E. Pipe Chases

1. Size pipe chases to be large enough to accommodate the piping to be housed in chases and to be accessible. Locate piping in chases to avoid the obstruction of entrances or openings to pipe chases.
   
a. Minimum pipe chase width is 42”.

F. Access to Plumbing

1. Provide minimum of 3’6” crawl space beneath new buildings. Provide easy access to crawl space.

2. Provide lights in crawl space which switch at access.

3. Equip access doors with locks keyed to campus master and grand master key.

4. Grade crawl space toward gravel-filled trenches provided with perforated drainage pipe.

5. Provide all spaces below grade with perimeter drain system.

6. Plan for clean outs at each corner and at high points of subsurface drainage system.

7. Provide adequate space for working on plumbing and piping. See Spec section Campus Standard 08-31-00 1.02 C 1 thru 4 – no exceptions.
SECTION 22 00 00 – PLUMBING GENERAL SYSTEM DESIGNS

8. Afford easy access to all working parts of all plumbing devices.

9. Do not permanently seal in masonry wall those items of plumbing requiring periodic maintenance or repair.

10. Pipes should not be run above electric panels, transformers, etc.

11. Provide adequate crawlspace ventilation.

12. Use forced air ventilation of crawlspace if crawlspace is below grade.

13. Design for crawlspace air charge as determined by soil test results.

G. Water Meters

1. Include a water meter in each new building and remodel of old buildings if needed.
   
a. Provide a Backflow Preventer at Meter
      1. Use Watts 909, 919 or 957 (depending on size of line)
      2. Watts 009 is strictly prohibited

   b. All Bypass systems shall have a Backflow Preventer

2. Water meter shall be positive-displacement turbo-compound type with readout featuring both odometer dial and electronic pulse output.

3. Water meter shall be preceded by an in-line strainer.

4. Badger compound with HRT register or Sensus SRH with Impulse Contractor register is acceptable meters.

5. Locate the meter inside a machine room, install meter horizontally no higher than 5” high and no lower than 12” AFF.

H. Pressure Gauge

1. Include a 1-200 psi pressure gauge, 4-inch or larger, on the domestic water header.

2. Also include an electronic pressure sensor on the header, suitable for connection to Owner’s FCMS system.
SECTION 22 00 00 – PLUMBING GENERAL SYSTEM DESIGNS

I. Pipe Size

1. Avoid 2-1/2, 3-1/2 and 5-inch pipe.

J. Solder

1. Must comply to Uniform Plumbing Code 316.1.3
2. Pro Press systems are acceptable.

K. Floor Sinks

1. There shall be one 16” X 16” floor sink with 4” outlet pipe size per air handler for fin water (condensate from cooling coils), and one 12”x12” floor sink per pump battery to facilitate multiple condensate lines, and to eliminate trip hazard of condensate lines routed over floors.

L. Fin Water

1. Fin water may be recovered in some buildings.

M. Water Softening

1. Provide water piping by pass on softener. Bypass will need to be protected by a backflow device.

2. Domestic water feed to heating hot water shall be softened using salt-ion exchange.

   a. Also provide Backflow Preventer on Softener.
      1. Use Watts 957 for 2-1/2” and larger
      2. Use Watts 919 for 2” and smaller
      3. Watts 009 is strictly prohibited

3. Water shall be tested for hardness and softening system shall be selected to reduce hardness to acceptable level and sized for building demand. Install test ports (hosebibb) for each unit for testing of hardness.

4. Brine storage tank shall be sized for no less than monthly service.

5. System shall consist of two ion exchange tanks each sized for seven (7) days of service.

   a. No rain bird products.
SECTION 22 00 00 – PLUMBING GENERAL SYSTEM DESIGNS

6. All air admittance valves (auto vents) are prohibited.

N. Vaults

1. Must meet manufacturer’s clearances for backflow preventer.

2. Access door/hatch opening shall be 36” to 42” or larger.

O. Water Mains and Distribution Water Lines

1. Water mains 4” and larger use Ductile Iron Pipe/fittings. 3” and Smaller shall be copper, type K with a 6 mil poly sleeve.

2. AWWA C-900, DR 14 water pipe is acceptable where there are no Steam Lines in the area.

   a. C-900 or Ductile Iron, Pipe to Pipe joints shall have joint restraints and all Ductile Iron fittings shall be mechanical joints with joint restraints (no exceptions)

3. All underground PVC (C-900) water distribution pipe must have 12 gauge Tracer Wire.

4. A) Refer to AWWA C605-5 for underground installation of PVC Pressure Pipe and fittings for water.
   b) Refer to AWWA C600-5 Installation of Ductile Iron water mains

5. Use Resilient Wedge Gate Valves on water distribution mains and provide a 4”x16”x4” concrete pad for proper support of the valve.

6. Use only stainless steel tapping sleeve. Basis of Design, Smith Blair #665-142512

Smith-Blair® Tapping Sleeves

Tapping Sleeve w/MJ Outlet Option Available on all SB Carbon Steel and Stainless, Steel Tapping Sleeves Use 665-142512MJ-200

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SECTION 22 00 00 – PLUMBING GENERAL SYSTEM DESIGNS

7. Fittings:
   a. Use EBAA iron pipe joint restraint (mega lugs) on all mechanical joints.
   b. Use mega lugs restraint harness for push-on pipe (pipe to pipe).
   c. Use polyethylene sleeve wrap on Ductile Iron Pipe and mechanical joint fittings.
   d. 90, 45, ells, tees, 22 ½, or turn of direction shall have a thrust block.

P. Domestic Utility Water Lines shall have a 4”x16” concrete pad under valves for proper support.

Q. Sewer Mains
   1. Sewer mains shall be a minimum of SDR 26, Heavy Wall, gasket sewer fittings, with 12 gauge tracer wire. Bell Ends must be installed upstream of flow.

O. Storm Drains
   1. Storm lines shall be a minimum of SDR 26 Heavy wall, gasket sewer fitting with 12 gauge tracing wire.

P. Roof Drains
   1. Drain inlets and outlets are to be 6” in diameter, minimum.
   2. Downspouts are to be 5” square, minimum, in Copper.

PART 2: PRODUCT (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 22 00 00
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

PART 1: GENERAL

1.01 Scope of Standards

A. This design guidelines contained herein includes the requirements for systems, materials, fittings and valves utilized for piping systems at Texas State University. It is the intention of this document to provide a standard for piping systems at Texas State University to provide the highest level of quality and standardization possible; it is not intended to be a guide specification.

B. Piping identification standard is ANSI A13.1 “Scheme for Identification of Piping Systems”.

1. All piping shall have flow arrows indicating direction of flow.

PART 2: PRODUCTS

2.01 Piping Specialties:

A. General: Texas State University Standards dictate factory-fabricated piping specialties recommended by manufacturer for use in service indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide with fittings coordinated to properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer’s option, after review with Texas State University Project Manager.

2.02 Pipe Escutcheons:

A. General: Provide pipe escutcheons with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish cast brass or sheet brass pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

2.03 Low Pressure Y-Type Pipeline Strainers at A/C Chill Water Lines:

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure, with Type 304, stainless steel screens, with 3/64” perforations @ 233 per sq. in.

2.04 Dielectric Unions:
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

2.05 Mechanical Sleeve Seals:

A. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.06 Instrumentation And Miscellaneous Piping Taps—Water Systems Below Ambient Temperature:

A. All taps shall be constructed of ¾” Schedule 80 Thread-o-Let, ¾” 304/316 stainless steel nipples, and ¾” bronze gate valve.

2.07 Basic Pipes and Pipe Fittings:

A. Standards for Basic Identification: Piping identification Standard at the University is ANSI A13.1 “Scheme for Identification of Piping Systems: All piping shall have flow arrows indicating direction on flow.

B. General: The following listing is to be used as the standard for domestic and laboratory water pipes and fittings:

C. Interior Laboratory and Interior Potable Water Piping:

1. Tube Size 2” and Smaller: Comply with Uniform Plumbing Code (U.P.C). Or, copper tube; Type L, with soldered connections

2. Pipe Sizes 2” and Larger: Use type L copper with soldered connections.

   1. Exception: ProPress Systems

3. Copper on potable water systems, no exceptions.

D. Exterior or Below Grade Potable Water Piping:

1. Tube Size ¾” and Smaller: Copper tube; Type K, soft-annealed temper; cast-copper flared tube fittings.
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

2. Tube Size 1” and larger Copper tube; Type K, soft-annealed temper; wrought-copper fittings, lead free jointing (Silvabrite).

3. All exterior or below grade potable water lines shall be sleeved

2.08 Basic Piping Specialties Standard:

A. General: Provide piping specialties in accordance with the following standard listing:

B. Y Strainers: Provide Y strainers with cast-iron body, 125-psi flanges, bolted type or yoke type cover. Furnish with removable, non-corrosive perforated strainer basket, with 1/8” perforations and lift-out handle.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering basket strainers which may be incorporated in the work include, but are not limited to, the following:

1. Nibco – Basis of Design
3. Metraflex Co.
4. Spirax Sarco

2.09 Basic Supports and Anchors:

A. General: Provide supports and anchors in accordance with the following listing:

1. Adjustable galvanized steel clevises and adjustable pipe saddle supports are Standard for horizontal piping hangers and supports.

2. Two-bolt riser galvanized clamps are Standard for vertical piping supports.

3. Concrete inserts, C-clasps, and steel brackets are Standard for building attachments.

4. Protection shields are Standard for insulated piping support in hangers.

2.10 Basic Valves:
A. General: The following valves are Standard in application at Texas State University. Valves applied to cold water and piping systems with fluids typically less than ambient temperature shall be constructed with all components exposed to atmosphere of stainless steel or brass. Steel components are not acceptable.

B. Type of valves specified in this article include the following:

Butterfly valves - for 2 ½” and larger
Gate Valves
Drain Valves
Ball Valves – Full Port
Plug Valves

C. The type valves to be used for each application are listed here. If not specifically listed for an intended use, check with Facilities Planning, Design and Construction.

Service: Hot Water
Rising Stem Gate Valve
Lug Mounted Butterfly Valve – 2 ½ inches and larger
Full Port Ball Valve – 2 inches and smaller
Plug Valve – Balancing only

Service: Domestic Hot and Cold Water
Ball Valve – Full Port
Gate Valve
Butterfly valves – for Hot and Cold, 2 ½ “and larger.

Service: Make-up Water - requires meter and backflow preventer.
Gate Valve
Plug Valve

D. Valve Identification: Provide valves with manufacturer’s name (or trademark) and pressure rating clearly marked on valve body.

E. Codes and Standards:

MSS Compliance: Mark valves in accordance with MSS-25 “Standard Marking System for Valves, Fittings, Flanges and Unions”.

ANSI Compliance: For face-to-face and end-to-end dimensions of flanged or welded-end bodies, comply with ANSI B16.10 “Face-To-Face and End-to-End Dimensions of Ferrous Valves”.

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SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

F. Submittal:

Product Data: Submit manufacturer’s technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing Manufacturer’s figure number, size, location, and valve features for each required valve.

Shop Drawings: Submit manufacturer’s assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in maintenance Manual; in accordance with requirements of Division I.

G. Products - Valves:

Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

Operators: Provide handwheel, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves, 5” and smaller, other than plug valves. Provide one wrench for every 10 plug valves. Provide gear operators for quarter-turn valves 8” and larger. Provide chain-operated sheaves and chains for overhead valves located 6’-6” or higher above the finished floor. The chain shall be of proper length so that the bottom of the chain “loop” is 5’-0” above finished floor.

1. Section Valves:
   a. 2” and Smaller: Gate valves or ball valves.
   b. 2 1/2” and Larger: Gate valves or butterfly valves

2. Shutoff Valves:
   a. 2” and Smaller: Gate valves or ball valves.( above ground only)
   b. 2 1/2 or Larger: Gate valves or butterfly valves

3. Drain Valves:
   a. 2” and Smaller: Gate valves or ball valves.
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

b. 2 ½ and larger: Gate valves.

c. Comply with the following standards: Water Heater Drain Valves: ASSE 1005

d. Manufacturers: Subject to compliance with requirements, provide drain valves of one of the following:
   Hammond Valve Corp.
   Lee Brothers; Div. Phelps Dodge Brass Co.
   Mansfield Plumbing Products
   Prier Brass Mfg. Co.
   Tanner Mfg. Co.

4. Check Valves:

   a. All Sizes: Swing check valves.
      1.) Brass to Brass is not allowed.
      2.) Use Teflon discs.

5. Plug Valves:

   a. For use on natural gas, use valves approved by Texas State University, AGA or ACA approved and complies with Uniform Plumbing Code.

   b. Manufacturers: Subject to compliance with requirements, provide drain valves of one of the following:
      Lunkenheimer Co.
      Power (Wm.) Co.
      Rockwell International; Flow Control Div.(Nordstrom)
      Walworth Co.

   c. 2” and Smaller: 150 psi, bronze body, straightway pattern, square head, threaded ends.
      Lunkenheimer: 454

   d. 2-1/2 and Larger: 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.
      Nordstrom: 143
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

Powell: 2201
Walworth: 1718F

6. Gate Valves:

a. Comply with the following standards:

   Cast Iron Valves: MSS SP-70
   Bronze Valves: MSS SP-80
   Steel Valves: ANSI B16.34

b. Manufacturers: Subject to compliance with requirements, provide gate valves of one of the following:

   Crane Co.     Lunkenheimer Co.
   Fairbanks Co.  Milwaukee Valve Co., Inc.
   ITT Grinnell Valve Co., Inc.  Powell (Wm.) Co.
   Jenkins Bros.  Stockham Valves and Fittings
   Walworth Co.

c. 2” and Smaller: Class 125, bronze, screw-in bonnet, rising stem, solid wedge.

<table>
<thead>
<tr>
<th></th>
<th>Threaded Ends</th>
<th>Solder Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>428</td>
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<td>0282</td>
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<tr>
<td>Grinnell</td>
<td>3010</td>
<td>3010-SJ</td>
</tr>
<tr>
<td>Jenkins</td>
<td>47</td>
<td>1242</td>
</tr>
<tr>
<td>Lunkengeimer</td>
<td>2127</td>
<td>2132</td>
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<tr>
<td>Milwaukee</td>
<td>148</td>
<td>1149</td>
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<tr>
<td>Powell</td>
<td>500-S</td>
<td>1821-S</td>
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<tr>
<td>Stockham</td>
<td>B-100</td>
<td>B-108</td>
</tr>
<tr>
<td>Walworth</td>
<td>55</td>
<td>55-SJ</td>
</tr>
</tbody>
</table>

d. 2” and Smaller: Class 125, bronze, screw-in bonnet, non-rising stem, solid wedge.

<table>
<thead>
<tr>
<th></th>
<th>Threaded Ends</th>
<th>Solder Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
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<tr>
<td>Fairbanks</td>
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<td>0280</td>
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<tr>
<td>Grinnell</td>
<td>3000</td>
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<tr>
<td>Jenkins</td>
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<td>Lunkengeimer</td>
<td>2129</td>
<td>2133</td>
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<tr>
<td>Milwaukee</td>
<td>105</td>
<td>1145</td>
</tr>
</tbody>
</table>
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

Powell  507  1822
Stockham  B-103  B-104
Walworth  55  4-SJ

e. 2-1/2” and Larger: Flanged ends, Class 125, iron body, bolted bonnet, solid wedge, bronze mounted.

<table>
<thead>
<tr>
<th>OSY</th>
<th>Non-Rising Stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>15B-9</td>
<td></td>
</tr>
<tr>
<td>Crane</td>
<td>465-1/2</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>0405</td>
</tr>
<tr>
<td>Grinnell</td>
<td>6020</td>
</tr>
<tr>
<td>Jenkins</td>
<td>651A</td>
</tr>
<tr>
<td>Lunkenheimer</td>
<td>1430</td>
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<tr>
<td>Milwaukee</td>
<td>F-2885</td>
</tr>
<tr>
<td>Powell</td>
<td>1793</td>
</tr>
<tr>
<td>Stockham</td>
<td>G-623</td>
</tr>
<tr>
<td>Walworth</td>
<td>8726-F</td>
</tr>
<tr>
<td>Mueller</td>
<td>Resilient Wedge Valves</td>
</tr>
</tbody>
</table>

f. Hose End; 2-1/2”: FM, 175 psi, bronze body, solid wedge, inside screw, non-rising stem.

Provide cap and chain.
Fairbanks:  0210
Jenkins:  707
Lunkenheimer:  366
Walworth:  115

g. Threaded End: 2” and Smaller: FM, UL-listed, 175 psi, bronze body, solid wedge, outside screw and yoke, rising system.

| Crane | 459 |
| Fairbanks: | 0412 |
| Jenkins: | 825-A |
| Stockham: | G-634 |
| Walworth: | 8713-F |

7. Ball Valves:

a. Comply with the following standards:

Cast Iron Valves: MSS Sp-72
Steel Valves: ANSI B16.34
b. Manufacturers: Subject to compliance with requirements, provide drain valves of one of the following:

Conbraco Industries, Inc.
Crane Co.
Fairbanks Co.
Hammond Valve Corp.
ITT Grinnel Valve Co., Inc.
Jamesbury Corp.
Jenkins Bros.
Metraflex Co.
Nibco, Inc.
Powell (Wm.) Co.
Stockham Valves and Fittings
Walworth Co.
Watts Regulator Co.

c. 1” and Smaller: 150 psi, bronze body, (Full port, bronze trim, 2-piece construction, TFE seats and seals.

<table>
<thead>
<tr>
<th>Product</th>
<th>Threaded Ends</th>
<th>Solder Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>2182</td>
<td>2182</td>
</tr>
<tr>
<td>Grinnell</td>
<td>3700</td>
<td>3700-SJ</td>
</tr>
<tr>
<td>Jamesbury</td>
<td>21-1100</td>
<td>----</td>
</tr>
<tr>
<td>Jenkins</td>
<td>900T</td>
<td>902T</td>
</tr>
<tr>
<td>Stockham</td>
<td>S-216BRRT</td>
<td>S-216BRRS</td>
</tr>
<tr>
<td>Watts</td>
<td>B-6000</td>
<td>B-6801</td>
</tr>
</tbody>
</table>

2.11 Bibbs and Faucets:

A. Hose Bibbs (must have vacuum Breaker and be fully recessed)

1. Threaded End: Bronze body, renewable composition disc, tee handle, ¾” NPT inlet, and ¾” hose outlet.

B. Sill Faucets: Bronze body, renewable composition disc, wheel handle, ¾” solder inlet, ¾” hose outlet.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering bibbs and faucets, which may be incorporated in the work, include, but are not limited to, the following:

1. Chicago
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

2. Hammond Valve Corp.
3. Lee Brothers; Div. Phelps Dodge Brass Co.
5. Nibco Inc.
8. Watts Regulator Co.

2.12 Hydrants:
   A. Recessed (no exceptions) Non-Freeze Wall Hydrants: Case-bronze casing, length to suit wall thickness, vacuum breaker, hinged locking cover, ¾” inlet, hose outlet.
   B. Project Non-Freeze Wall Hydrants: Cast-bronze hydrant, chrome plate face, tee handle key, bronze casing, length to suit wall thickness, vacuum breaker, ¾” inlet hose outlet.
   C. Projected Non-Freeze Wall Hydrants: Cast-bronze hydrant, chrome plated face, tee handle key, bronze casing, and length to suit wall thickness, vacuum breaker, and ¾” inlet hose outlet.
   D. Floor Level Non-Freeze Hydrants: Bronze hydrant, rough bronze box, tee handle key, bronze casing, length to suit depth of bury, drain hole, vacuum breaker, hinged locking cover, ¾” inlet, hose outlet.
   E. Lawn Non-Freeze Hydrants: Chicago No. 387. Install in 12” x 12” cast iron or concrete box.
   F. Non-Freeze Post Hydrants: Bronze hydrant, tee handle key, bronze casing with cast-iron casing guard, length to suit depth of bury, drain hole, vacuum breaker, ¾” inlet, hose outlet.

2.13 Thermometers:
   A. Provide Solar-Powered Digital Thermometers.
   B. Thermometers in pipe lines shall be installed in sockets fitted into piping by the use of tees, or elbows, or welded into pipe 3” or larger, to permit bulb socket to
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

enter into the pipe stream, and allowance shall be made in necks of thermometers for insulation where same is used.

C. Thermometers shall be provided in inlets and outlets to each water-cooled condenser, inlets and outlets to each chiller, inlets and outlets to each water coil, common cooling tower supply and return lines, common chilled water supply and return lines, in each zone supply duct at each air handling unit and at any other location indicated on the drawings.

D. Thermometers shall have a calibration adjustment and same be accurately calibrated.

2.14 Piping Systems:

A. General: Extend of pipe required by this article of the specifications is indicated on the drawings and/or specified hereinafter.

B. Type of pipe specified in this article include the following:

- Steel Pipe for A/C Shop & Steam Shop use
- Copper Tube for Potable Systems
- Cast-Iron Pressure Pipe on Ductile Iron
- Miscellaneous Piping Materials/Products

C. The type pipe to be used for each application is indicated on the drawings and/or specified hereinafter:

- Domestic Hot Water Pipe:
  - Above grade - Copper Type L, Hard
  - Below grade - pre-insulated steel/ductile iron pipe

- Domestic Cold Water Pipe:
  - Above grade - Copper Pipe Type L, Hard
  - Below grade - steel or ductile iron pipe

- Condensate Drain Piping for A/C:
  - Above grade - copper piping-Type L, Hard with Drainage Type-Copper Fitting

D. Available Manufacturers:


SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

3. Tyler Pipe; Sub. of Tyler Corp.


2.15 Backflow Preventers:

A. General: The standard back flow preventer is of the reduced pressure zone (RPZ) type, the assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventers shall include test cocks, and pressure-differential relief valve located between 2 positive seating check valves. Construct in accordance with ASSE Standard 1013. The exact model of the backflow preventor shall be coordinated with the Owner prior to incorporation into the design.

1. Must comply with Uniform Plumbing Code.(approved and listed by University of Southern California Foundation for Cross Connection Control and Hydraulic Research)

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering backflow preventers which may be incorporated in the work include, but are not limited to, the following:

1. Febco Sales, Inc.; Subs. of Charles M. Bailey Co., Inc.

2. ITT Lawler; Fluid Handling Div.

3. Watts Regulator Co.

2.16 Pressure Regulating Valves:

A. General: The standard pressure regulating valve is single seated, direct operated type, bronze body, integral strainer, complying with requirements of ASSE Standard 1003.

B. Available Manufacturers:


2. Cla-Val Co.

3. Spencer Engineering Co., Inc.

4. Watts Regulator Co.
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

2.17 Relief Valves:

A. General: The standard relief valves are to be manufactured in accordance with ASME Boiler and Pressure Vessel Code and are of the following configurations:

1. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI 221.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 o F (99 o C), and pressure relief at 150 psi.

B. Available Manufacturers:

2. Conbraco Industries, Inc.
3. Watts Regulator Co.

PART 3: EXECUTION

3.01 General:

A. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

1. Provide clean-out capability for domestic hot water return piping in recirculating loops. There may be a capped “tee” at each ninety-degree turn in the piped return system.

3.02 Installation of Valves:

A. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections.

B. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture.

C. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain potable water system.

D. Check Valves: Install on discharge side of each pump.

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Domestic Water Piping Specialties-22 11 19-13
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

E. Balance Cocks: Install in each hot water recirculating loop.

F. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.

G. Sill Faucets: Install on concealed piping where indicated with vacuum breaker.

H. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

I. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

J. Selection of Value Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or type of pipe/tube connections.

K. Tube Size 2” and Smaller: Soldered-joint valves.

L. Pipe Size 2-1/2” and Larger: Flanged valves.

M. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OSY valves.

N. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shut-off metal seated valves.

O. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

3.03 Installation of Backflow Preventers:

A. Install backflow preventers where required by Uniform Plumbing Code 603.0. Locate in same room as equipment being protected. Pipe relief outlet to nearest floor drain.

B. Backflow preventers shall be installed at any connection between potable and non-potable water systems.

3.04 Installation of Pressure Regulating Valves:
SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

A. Provide inlet and outlet shutoff valves, and throttling valve bypass. Provide pressure gage on valve outlet.

3.05 Equipment Connections:

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Uniform Plumbing Code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer’s installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.06 Adjusting and Cleaning:

A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

B. Cleaning: Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer’s touch-up paint.

END OF SECTION 22 11 19
SECTION 22 11 23 – DOMESTIC WATER PUMPS

PART 1: GENERAL

1.01 Purpose:

A. The design guidelines contained herein includes the requirements for pumps utilized for plumbing systems at Texas State University. It is the intention of this document to provide a standard for plumbing pump systems at Texas State University to provide the highest level of quality and consistency possible; it is not intended to be a guide specification.

B. Texas State University has standardized the use of end suction pumps in lieu of horizontal split-case pumps. Any deviation from this standard must be authorized in writing by Texas State University Project Manager at the beginning of concept design. Types of pumps referred to in this section include the following:

1. In-Line Re-circulation Pumps.
2. Water Pressure Booster Systems.
3. Duplex Pedestal Type Sump Pumps.

C. Power supply wiring from power source to power connection on pumps. The Mechanical Contractor shall include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

D. Interlock wiring between pumps; and between pumps and field-installed control devices shall be included as Division 23 HVAC.

1. Interlock wiring specified as factory-installed is work of Division 23 HVAC.

E. Control wiring between field-installed controls, indicating devices, and pump control panels is a part of Division 23 HVAC.

1.02 Quality Assurance:

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of plumbing pumps with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
SECTION 22 11 23 – DOMESTIC WATER PUMPS

1. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI “Hydraulic Institute Standards”.

2. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 “Motor Operated Water Pumps”.

3. UL and NEMA Compliance: Provide electric motors and components, which are listed and labeled by Underwriters Laboratories, and comply with NEMA standards.

4. SSPMA Compliance: Test and rate sump and sewage pumps in accordance with SUMP and Sewage Pump Manufacturers Association (SSPMA) and provide certified rating seal.

5. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI “Hydraulic Institute Standards”.

6. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 “Motor Operated Water Pumps”.

7. UL and NEMA Compliance: Provide electric motors and components, which are listed and labeled by Underwriters Laboratories, and comply with NEMA standards.

8. SSPMA Compliance: Test and rate sump and sewage pumps in accordance with SUMP and Sewage Pump Manufacturers Association (SSPMA) and provide certified rating seal.

1.03 Submittals:

A. Product Data: Submit manufacturer’s pump specifications, installation and startup instructions, and current accurate pump characteristic performance curves with selection points clearly indicated to Texas State University-San Marcos Project Manager for distribution to the appropriate parties.

B. Shop Drawings: Submit accurate and complete manufacturer’s assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit maintenance data and parts lists for each type of pump, control, and accessory; including “trouble-shooting” maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division I.
SECTION 22 11 23 – DOMESTIC WATER PUMPS
PART 2: PRODUCTS

2.01 Pumps:
   A. General: Provide pumps of same type by same manufacturer.

2.02 In-Line Re-Circulation Pumps:
   A. General: Provide in-line re-circulation pumps where indicated, and of capacities as scheduled.
   B. Type: Maintenance-free circulator designed for 125psi working pressure 225°F continuous water temperature and specifically designed for quiet operation.
   C. Body: Stainless steel fitted construction with iron body.
   D. Shaft: Steel, ground and polished, metal impregnated carbon thrust bearing.
   E. Motor: Non-overloading at any point on pump curve, open, drip proof, sleeve bearings, quiet operating, rubber mounted construction, built-in thermal overload protection.
   F. Coupling: Self-aligning, flexible coupling.
   G. Manufacturer: Subject to compliance with requirements, provide in-line re-circulation pumps as follows:
      1. Grundfos Pumps Corp.
      2. Engineer-approved equivalent

2.03 Water Pressure Booster System:
   A. General: Provide factory-fabricated and tested water pressure booster system consisting of diaphragm type water tank, centrifugal pumps, power and control panels, instrumentation, and operating controls. It is a Texas State University-San Marcos Standard to provide all booster pumps with a valve bypass to facilitate maintenance.
   B. Pumps: Provide 2 constant speed, single stage, end-suction design, cast-iron; bronze fitted centrifugal pumps with mechanical shafts seals. Mount pumps on
SECTION 22 11 23 – DOMESTIC WATER PUMPS

vibration insulators. Provide temperature probe and electric purge valve immediately upstream of each PRV. Provide drip-proof motors, with variable speed drives.

C. Water Tank: Provide factory pre charged diaphragm type water tank with replaceable flexible membrane. Construct in accordance with ASME Code and provide ASME stamp for 125-psi minimum.

D. System Controls: Maintain system pressure with pilot-operated diaphragm type combination pressure regulating and non-slam check valve on each pump discharge line.

1. Provide low system pressure switch located on discharge header to sense drop in system pressure, and to activate alarm and automatically start standby pump.

2. Provide adjustable vane type flow switch to sequence lag pump.

E. Control Panel: Provide UL-listed, NEMA 1, hinged door, lockable control panel containing the following:

F. For Each Pump:

1. Fused disconnect switch

2. Motor starter with 3-leg overload protection.

3. Running light.

4. Multiple position motor control switch.

5. Discharge pressure gage.

G. For System:

1. 115-V control transformer.

2. Control power switch.

3. Indicating lights.

4. Relays.

5. Visual alarm system.
SECTION 22 11 23 – DOMESTIC WATER PUMPS


H. Prefabrication: Factory-prefabricate booster system, mount all components on common structural stand, provide interconnecting piping, isolation valves on suction and discharge of each pump, suction and discharge piping manifolds, shutoff cocks for gages and pressure switches, and factory-wiring.

I. Factory-Test: Provide electrical and hydraulic test on assembled unit prior to shipment. Provide system operating flow test from 0 to 100% design flow rate at scheduled suction and discharge pressure conditions. This test shall be witnessed by personnel assigned by the Texas State University-San Marcos Project Manager.

J. Manufacturer: Subject to compliance with requirements, provide water pressure booster systems, but are not limited to the following:

1. Armstrong Pumps, Inc.
2. PSF; Div. Messco Inc.
3. SyncroFlo, Inc.

PART 3: EXECUTION

3.01 Installation Of Pumps:

A. General: Install plumbing pumps in accordance with manufacturer’s published installation instructions, complying with recognized industry practices to ensure that plumbing pumps comply with requirements and serve intended purposes. Provide valve bypasses around all booster pumps to facilitate maintenance.

B. Access: Provide access space around plumbing pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Support: Install base-mounted pumps on minimum of 4” high concrete base equal or greater than 3 times total weight of pump and motor, with anchor bolts poured in place. Set and level pump, grout under pump base with non-shrink grout.

1. Install in-line pumps, supported from piping system.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer’s wiring diagram submittal to Electrical Installer.
SECTION 22 11 23 – DOMESTIC WATER PUMPS

1. Verify that electrical wiring installation is in accordance with manufacturer’s submittal and installation requirements of Division-26 Electrical sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

E. Piping Connections: Refer to Division-22 plumbing piping sections. Provide piping, valves, accessories, gages, supports, and flexible connections as indicated.

END OF SECTION 22 11 23
SECTION 22 13 19.26 – GREASE REMOVAL DEVICES

PART 1: GENERAL

1.01

A. Grease Trap Sizing
Grease traps (interceptors) are required whenever there is the potential to discharge wastes containing fats, oils, greases, and/or settable solids into the sanitary sewer system.

B. Design Criteria
The trap shall have two compartments, with the primary having a seven-minute retention time and the secondary having a five-minute retention time. For cleaning and inspection purposes, traps shall be located in area accessible to appropriate grease recovery equipment. Manufactured traps that are properly sized may be used in lieu of on-site construction. When possible, the trap shall be installed outside the building. Note that all retention times shown are minimums.

C. Sizing Criteria
Traps will be sized according to the following criteria:

<table>
<thead>
<tr>
<th>Kind of Fixture</th>
<th>Trap and Trap Arm Size</th>
<th>Fixture Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 compartment sink</td>
<td>1-1/2”, 2”</td>
<td>3, 4</td>
</tr>
<tr>
<td>2 compartment sink</td>
<td>1-1/2”</td>
<td>2</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>2”</td>
<td>4</td>
</tr>
<tr>
<td>Garbage Grinder</td>
<td>2”</td>
<td>4</td>
</tr>
<tr>
<td>Wok Stove</td>
<td>2”</td>
<td>4</td>
</tr>
<tr>
<td>Floor Drains (2”, 3”, 4”)</td>
<td>2”, 3”, 4”</td>
<td>2, 3, 4</td>
</tr>
<tr>
<td>(1/2 credit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Floor sinks (3”, 4”)</td>
<td>3”, 4”</td>
<td>3, 4</td>
</tr>
</tbody>
</table>

Trap liquid holding capacity (gallons) = Total Fixture Count X Applicable retention time (minutes) X 3. As per City of San Marcos’s Industrial Waste Department requirements.

D. Fixtures receiving non-grease bearing wastes may be drained through a trap, but shall not be included for the grease trap sizing.
SECTION 22 13 19.26 – GREASE REMOVAL DEVICES

PART 2: PRODUCTS

2.01

A. All buried grease traps shall be constructed of concrete.

B. Where trap is exterior of building, all pipe and fittings shall be Sch 40 PVC. Normally traps will be installed 3-1/2” below grade, but in areas subject to vehicle traffic, shall be 8” below grade and equipped with traffic manhole frame and cover.

C. Traps inside building shall receive cast-iron pipe and fittings.

PART 3: EXECUTION (NOT USED)

END OF SECTION 22 13 19.26
SECTION 22 42 00 – COMMERCIAL PLUMBING FIXTURES

PART 1: GENERAL

A. This Section provides design standards for plumbing fixtures and trim. Certification of compliance with specified ANSI, UL, and ASHRAE Standards will be required, as appropriate, for all plumbing fixtures and appurtenant devices. Also, specific fixture selection and design shall incorporate all requirements and standards of the Americans with Disabilities Act (ADA) and all State Standards as may apply.

B. The design guidelines contained herein include the requirements for plumbing fixtures at Texas State University. It is the intention of this document to provide a standard for plumbing fixtures at Texas State University that requests the highest level of quality and standardization possible; it is not intended to be a guide specification.

PART 2: PRODUCTS

2.01 Acceptable Standard Manufacturers:

A. FIXTURES:

1. Wall Hung Lavatory:
   a. Lavatory 20” x 18” vitreous china lavatory, with 14-1/2” x 10-1/4” rectangular basin, splash lip, front overflow, fabricated for concealed arm supports, and having two soap depressions. Drill lavatories for 4” center faucets. Provide concealed arm carriers, trap, and supplies and stops as specified in the Articles below.
      1). American Standard; U. S. Plumbing Products.
      2). Crane Co.
      4). Kohler Co.
      5). Universal-Rundle Corp.
   b. Lavatory Intragal to Solid Polymen Counter Top Surfaces are approved.

2. Water Closets:
SECTION 22 42 00 – COMMERCIAL PLUMBING FIXTURES

a. Public Buildings: Low Consumption, vitreous china, floor outlet, floor mounted, water saving, siphon jet elongated closet bowl, with 1-1/2” top spud; quiet flushing action, with self-draining jets and large passageway. Provide carriers, seat, and flush valve as specified in the Articles below.

(1) Non ADA Approved manufacturer-Kohler Co., model #K-4350 Elongated, white color.

(2) ADA Approved manufacturer-Kohler Co., model #K-4368, white color.

b. Private Dormitory Rooms & Private Campus Owned Houses: Tank type toilet.

(1) Approved manufacturer-Kohler Co., model K3422 elongated, white color.

3. Urinals:

a. Approved manufacturer-Kohler, model #K5016 ET (ADA complaint), and white color.

b. Provide required number of ADA urinals and locate at ADA mounting height.

c. Provide clean-outs at each urinal, minimum of 6” above the flood-level rim of the fixture with cover to chromed plated (cover to be chromed plated).

B. FAUCETS:

1. Public Buildings – ADA complaint, Self – closing type, 4” center only, chrome plated cast brass, cold water only is standard. Hot water must be approved by Texas State University-San Marcos.

a. Approved cold water manufacturer – Chicago Faucet, model 857-665 PSHED.

b. Approved hot water manufacturer – Chicago Faucet, model 802-V665 cp.

2. Private Dormitory Rooms – ADA complaint, manual operated, 4” center only, chrome plated brass cast, 4” spout with constant flow aerator, single-
SECTION 22 42 00 – COMMERCIAL PLUMBING FIXTURES

wing handles indexed “HOT” and “COLD” and 1¼” chrome plated pop-up waste.

a. Approved manufacturer – Delta, model 525 MPLI

3. Shower Faucet: ADA Complaint

a. Provide built in shut off stops, washerless, mixer type shower and tub valve with metal blade handle.

b. Valve shall open to cold water first and then through warm with metal blade handle.

c. Valve shall open to cold water first and then through warm (mix) to hot.

d. Faucet shall have all operating parts separately replaceable from outside the wall, rotating cylinder type operating mechanisms, equipped with replaceable nonmetallic seats contained in stainless steel lined sockets.

e. Valve shall be equipped with pressure balance spool and sleeve device of Type 302 stainless steel which will maintain a preset high temperature limit; check stop (with an adjustable stop to prevent the possibility of the valve being turned to full hot water).

f. Provide with hand held shower head with swivel fitting, 60” flexible stainless steel hose, in-line vacuum breaker, and 24” chrome plated shower head slide guide set at 42” and 66” above the shower unit floor.

(1) Approved manufacturer – Delta 1343 WS

C. FLUSH VALVES:

1. Water Closet Flush Valve: ADA complaint, auto flush quiet, exposed closet flush valve, chrome plated.

   Approved Manufacturer:
   Technical Concept Auto Flush

2. Urinal Flush Valve: Auto Flush chrome plated, ¾” I.P.S. screw driver operated combination angle check and stop valve with protective cap, adjustable tailpiece, vacuum breaker flush connection and spud coupling for ¾” top spud flanges.
 SECTION 22 42 00 – COMMERCIAL PLUMBING FIXTURES


D. FIXTURE SUPPORTS:

1. Lavatory Supports (Hollow Tile or CMU Walls): adjustable cast iron, with thin concealed arms and sleeves, and complete with escutcheons and mounting fasteners.

2. Need to add a carrier for normal plumbing chase in walls.

E. FITTINGS, TRIM, AND ACCESSORIES:

1. Toilet Seats: elongated, solid white plastic closed back/open front, less cover, and having stainless steel check hinge and replaceable bumpers.
   b. Beneke Corp.
   c. Olsonite Corp.; Olsonite Seats.

2. P-Traps:
   a. Non ADA-cast brass, 1-1 ½” adjustable “P” trap, on all Lavatory and Electric Drinking Fountain, with cleanout and waste to wall, by Kohler, model K9000.
   b. ADA requirements – P-trap designed to provide knee clearance for wheelchairs, per ADA, by Kohler.


F. DRINKING FOUNTAIN:

1. Elkay, Model #EHFSA8L or #EZX8L, stainless steel housing.

PART 3: EXECUTION

3.01 Installation:

A. Install a stop valve in an accessible location in the water connection to each fixture.
SECTION 22 42 00 – COMMERCIAL PLUMBING FIXTURES

B. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

C. Seal fixtures to walls and floors using silicone sealant. Match sealant color to fixture color.

3.02 Field Quality Control:

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

END OF SECTION 22 42 00
CONSTRUCTION STANDARDS

DIVISION 22 - PLUMBING

SECTION 22 67 13.19 – DE-IONIZED WATER PIPING FOR LABORATORY FACILITIES

PART 1: GENERAL

1.01 Codes and Standards:

A. Plumbing Code Compliance: Comply with applicable portions of Uniform Plumbing Code (UPC) 2003 Edition pertaining to selection and installation of Plumbing materials and products. Laboratory water is that which is downstream of a backflow preventer.

B. The design guidelines contained herein include the requirements for systems, materials, fittings and valves utilized for piping systems at Texas State University. It is the intention of this document to provide a standard for piping systems at Texas State University in order to provide the highest level of quality and standardization possible; it is not intended to be a guide specification.

C. For buildings that need De-Ionized Water (DIW), locate a non-pressurized DIW tank high in the building. There is a stainless-steel orifice in the line (1/4” for buildings with large DIW demand, 1/8” for buildings with small demand) to limit the amount of makeup to the tank. A stainless-steel solenoid valve maintains the level in the DIW tank. A larger Polypropylene Pipe Schedule 80 line (often 2 inch) lets DIW flow by gravity from the tank to the building uses.

1. A pressurized DIW tank will be considered, submit for approval by Texas State University-San Marcos.

D. Avoid 2-1/2, 3-1/2 and 5-inch pipe in deionized-water systems.

E. An ultraviolet sterilizer shall be installed in the piping downstream of the DIW tank.

F. DIW tank supply piping shall have a meter system. DIW tank shall be provided with tank level sight glass. Sight glass shall be piped external to tank and be provided with isolation service valves at top and bottom of glass. Sight glass shall be equipped with high and low level switches. Switches shall be located within the section of sightglass isolated by service valves. Switches shall provide dry contacts for reporting conditions to system.

PART 2: PRODUCTS

2.01 Materials and Products:
SECTION 22 67 13.19 – DE-IONIZED WATER PIPING FOR LABORATORY FACILITIES

A. General: The following are materials and product standards to be followed in the design of domestic water systems.

PART 3: EXECUTION

Refer to Section 22 11 19.

END OF SECTION 22 67 13.19
DIVISION 23: HEATING, VENTILATING, & AIR CONDITIONING

23 00 00  Heating, Ventilating, and Air Conditioning (HVAC)
23 05 13  Common Motor Requirements for HVAC Equipment
23 05 93  Preparation for Testing, Adjusting, and Balancing for HVAC
23 05 93.01 Testing, Adjusting, and Balancing for HVAC
23 07 00  HVAC Insulation
23 09 33  Variable Frequency Drive
23 09 53  Pneumatic and Electric Control Systems for HVAC
23 21 13  Hydronic Piping in Buildings
23 21 14  Secondary Chilled-Water Piping Systems
23 22 13  Steam and Condensate Heating Piping
23 22 23  Steam Condensate Pumps
23 25 00  HVAC Water Treatment
23 31 00  HVAC Ducts and Casings
23 33 00  Air Duct Accessories
23 36 16  Variable Air Volume Units
23 73 00  Modular and Semi-Custom Air Handling Units (up to 20,000 CFM)
PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Heating, Ventilating, and Air Conditioning (HVAC).

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines:

A. The guidelines are intended to be typical in nature. Applications for specific projects shall be reviewed with Texas State University prior to proceeding with design. These guidelines are not intended to be guide specifications; rather, they are intended to be design standards for the purpose of aiding in appropriate design for building projects located at San Marcos Campus of Texas State University-San Marcos.

B. It is Texas State University preference for the HVAC Building System to be a 4 pipe (Chilled Water and Steam) with Air Systems that is Dual Duct VAV with DDC.

C. Mechanical Engineers are to prepare a life cycle cost analysis indicating the benefits of the deviation from the preferred construction standard of a dual duct system vs. single system for the project. This analysis is to include constructability advantages/disadvantages, floor to floor height changes/envelope cost and increased chase size, mechanical room size, etc. in regards to programmable space. This analysis should be performed no later than 30 days from the A/E being issued a Notice To Proceed.

D. Every effort shall be made during design to insure that the systems meet the following criteria:

1. The systems shall be safe;

2. The systems shall be flexible;

3. The systems shall be maintainable;

4. The systems shall be affordable;
5. The systems shall be energy efficient.

6. The systems shall be durable.

7. The systems shall be reliable.

E. Mechanical Rooms.

1. Size mechanical rooms to provide adequate housing for equipment and to provide ample clearance around piping and equipment for proper maintenance and repair.

2. All mechanical rooms over occupied space shall have a 100% waterproof membrane floor including all surfaces of equipment pads. Such membrane shall turn up walls 4 inches. A flood test is required. Provide water dam at doors or depressed mechanical room floor.

3. Do not plan mechanical rooms as return air plenums.

4. Provide locks for mechanical rooms to be keyed to campus mechanical master.

5. Make mechanical rooms accessible without necessity of passing through another assigned space.

6. Provide lifting eyes in mechanical room where the lifting or moving of heavy equipment might be anticipated.

7. Provide adequate fluorescent lighting for machine maintenance in mechanical rooms.

8. Position light fixtures to avoid blocking of light by piping or equipment. Use 4’-0” fluorescent fixtures with wire guards for lamp protection.

9. Do not light mechanical rooms with incandescent fixtures.

10. Provide hose bibb connection from domestic water system in each mechanical room for use in cleaning of coils and equipment.

11. Allow tube coil and shaft removal space for AHU’s boilers and refrigeration machines.

13. Provide accessibility to all sides of machine.


15. Provide at least one 110 Volt Duplex Receptacle per Mechanical Room for Maintenance Operations.

F. Air Terminal Units.

1. Air terminal shall have a maximum air flow of two thousand/cfm.

2. Units are to be equipped to function as either VAV or constant volume.

3. Box shall be designed to accomplish mixing of hot and cold deck before exit from box.

4. Discharge side of box shall have uniform air flow.

5. Air supply to the air terminal units shall be straight for three diameters preceding hard duct box.

6. Four feet maximum of flex duct to be allowed between medium pressure box and medium pressure duct.

7. Air terminal units are to be factory tested and independently certified for full range of operations.

8. Certification to be affixed to box.

9. Controls are to be fully accessible without removing ductwork.

10. Provide access doors as necessary.

G. Ventilation.

1. Ventilate storage spaces and serve with conditioned air by exhausting building air through storage spaces or by supplying conditioned air to storage spaces.

2. Provide storage spaces and restrooms with negative ventilation system.

3. Place controls for exhaust of equipment under control of building EMS.

4. Electrically interlock fume hoods in science laboratories with make-up air supply.
5. Separate ventilation for adjacent toilet rooms to prevent sound transmission.

6. Provide transformer vaults with separate ventilating fans connected to an emergency electrical power system.

7. Vent transformer vaults directly to outside in conformance to requirements of “National Electric Code”.

H. Filters.

1. Equip air units with disposable media filters **or pleated filters in standard sized rectangular frames.

2. Provide filter frames with integrated retainers **for filter media that are zinc electroplated after fabrication.

3. Use standard filter sizes: 24” x 24” x 2”, 24” x 12” x 2”, 20” x 20” x 2”, 20” x 25”x 2”, and 16” x 25”x 2”.

4. Other sizes may be used with Texas State University-San Marcos approval.

5. **Each separate closed water loop will be provided with a combination pot feeder/cartridge filter canister united filter model UFA-6-1-CS-150-2 or approved equal.

I. Controls.

1. Use Direct Digital Controls that are interfaced with the Campus Wide Control System.

2. Provide operator terminal at the building that is capable of reading and changing all data including setpoints.

3. Variable frequency drives will be used on all AHU’s, Pumps and Cooling Towers.

4. Provide gauges and Digital Thermometers at each AHU Discharge Air (Hot & Cold deck), at supply & return to each coil, and chiller and on the supply & return chilled water lines entering the building.

J. Valves.

1. Use Full Port Ball Valves on all piping 2 inches and smaller.
2. Use Lug Mounted Butterfly Valves or Rising Stem Gate Valves on 2 ½ inches and larger.

3. Install shut-off valves to be able to isolate each building, piece of equipment, floor of building and all other locations that seem reasonable to keep from having to shut down complete system for maintenance or repairs.

4. Locate valves in an easily accessible location or make provisions for easy access.

K. Air Handling Units.

1. All units will be floor level and housed in a suitable sized mechanical room for ease of service.

2. Units will be double wall with stainless steel drain pans.

3. Hinged access doors will be provided to allow access to blowers, motors, filters and coils without remounting panels.

4. Access door will be fully gasketed and large enough to allow entry for cleaning, maintenance and repair.

5. Fan coil units will not be used unless approved by University and then will not be allowed above ceilings where leakage can cause damage or accessibility problems.

L. Pumps.

1. Use end suction or horizontal split case centrifugal pumps only.

2. All pumps will have mechanical seals and replaceable bronze sleeves.

3. Aurora or Pacific pumps are preferred.

4. All pumps will have galvanized drip pans that are piped to the closest floor drain.

M. Regulators.

1. **Provide separate make-up regulators and water meters to all closed loops. Where make-up is required.

N. Drains.
1. Use floor drains in mechanical rooms which are accessible; do not locate floor drains beneath equipment.

2. Use floor drains in area for mechanical maintenance where spillage may be expected.

3. Insulate those floor drain lines, from drain to connection with main line, which have A/C condensate discharging into them.

4. Pipe insulated condensate drain lines to floor or hub drain in immediate area.

5. Do not extend drain piping across and aisle area.

6. Do not use a plumbing fixture as drain.

7. Grade pipe lines for drains with the low point in the direction of flow.

O. Ductwork and Registers.

1. All ductwork will be externally insulated metal duct.

2. No internally lined duct will be allowed.

3. No more than 7 feet of R-6 flex duct will be allowed to register drops.

4. Use 2x2 high volume louvered registers with removable cores.

P. Coils.

1. Use water coils of continuous copper tube with **aluminum fins.

2. Size cooling coils for maximum face velocity of 450 ft./min.

3. Size heating coils for maximum face velocity of 650 ft./min.

4. Where steam coils are used to temper outside air, use “non-freeze” type, so equipped and controlled that all condensate will be eliminated as soon as condensed.

Q. Outside Air Intake.

1. Design air conditioning system to maintain slight positive pressure within building and provide instrumentation to monitor and control.
2. Provide automatic outside air dampers and manual outside air dampers on all air handler units.

3. Employ a coordinated system of exhaust fan and fresh air intake.

4. Carefully plan locations of air intake ducts well away from emergency generators or loading docks or parking areas.

5. Avoid intakes in below grade pit situations.

6. Avoid horizontal grilles in direct weather.

7. Protect or cover intakes from gathering rain.

R. Duct and Pipe Supports.

1. Make certain that duct systems are properly supported throughout their lengths.

2. Provide floor openings for ducts passing through floors with 4” high concrete curbs.

3. Seal all vertical ducts, chases, conduit, and pipes at each floor of the building.

4. Provide sleeves for piping which passes through walls.

5. Use metal saddles to protect pipe supported by rollers.

6. Avoid damage to long runs of piping by using anti-friction pipe supports.

7. For future extensions of piping, provide valved and capped tees at strategic locations.

8. Require that all duct, piping and conduit be independently supported.

9. **Isolate all copper refrigeration tubing with rubber inserts to prevent rubbing at all supports.

S. Catch Pans.

1. Provide catch (or drip) pans to catch coolants, lubricants, condensate, process chemicals, and other fluids.

2. Make catch pans accessible for emptying and clearing.
3. Use corrosion-resistant catch pans.

4. Provide drip pans where leakage is likely to be a problem.

T. Condenser Water Treatment Controllers.
   1. Use ALLO 3D Trasar or approved equal controller.

U. Piping Identification.
   1. Identify all above-ground piping by means of color and labels.

V. Motors and Bearings: Refer to Section 23 05 13.

W. Texas State University-San Marcos preference for mounting of temperature control valves is for serviceability from floor without the use of ladder—maximum height 5’0” AFF. Where control valves are above serviceability height, locate over equipment in an accessible location such that top of equipment can be used for service platform. Other types of service valves shall be similarly located. Where service valves are mounted 8 feet above the floor (or other walkway) and not over service platform, provide with Rotohammer chain wheels and safety-trimmed chains.

1.03 Codes:

A. Whenever practical, systems shall conform to Uniform Mechanical and Plumbing Codes, NFPA standards of National Fire Code, NFPA 45 requirements for ventilation in buildings with laboratory operations:

B. Designs shall be in accordance with ASHRAE standards.

C. Mechanical Engineer’s design shall meet or exceed minimum standard requirements of State Energy Conservation Office (SECO) requirements. SECO adopted by reference the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE 90.1 – 2010). Refer to SECO for the latest updates to the SECO requirements.

1. Before beginning construction of a new state building or major renovation project, an institution of higher education must submit to SECO a copy of the certification by the design architect or engineer that verifies that the construction or renovation complies with the standards that are established under 34 TAC, Chapter 19.34, including engineering documentation.

1.04 Mechanical Systems Selection:
A. Airside – HVAC

1. It is Texas State University preference that the AHU systems shall be double duct systems with separate hot deck and cold deck fans where feasible with draw through coils.

2. Design HVAC systems with as few air handlers as feasible, preferably one air handling unit (AHU) system per floor.

3. Chilled water coils are to be two coils if greater than 4 rows, and with interstitial space between the coils for maintenance. Face velocity shall be 450 f.p.m. on cooling coils and 650 f.p.m. on steam coils.

4. Ventilation system to provide for 100% outside air for winter operation vent cycle.

5. Do not use reheat for temperature control.

6. Locate building air intakes as high as possible to ensure the cleanest possible air. Devote special attention to noxious fume exhaust systems to make certain that the exhaust contents escape boundary layer entrainment and subsequent contamination of the building or its neighbors. No less than U.M.C. requirements where practical, locate intakes directly adjacent to (near base of) exhaust stack where stacks penetrate above re-entrainment boundaries of building.

7. Use variable frequency drives (VFDs) for static pressure control; of air ducts. Variable inlet vanes are not acceptable.

8. Construct supply duct risers to withstand 4” w.c. of air pressure, construct horizontal ductwork to withstand 2” w.c. of air pressure, operate the system at 0.3” to 0.5” static pressure.

9. Laboratories or areas with high airflow rates require special design consideration for pollutant containment or control and for energy recovery or reduction.

10. Supply air ductwork shall be externally insulated and return air in unconditioned space in special applications where noise or other criteria is an overruling factor.

B. Waterside

1. Chilled Water
a. Use full reverse-return routing on all chilled water coil piping.

b. Control chilled water flow through units with 2-way valves.

c. Chilled water design supply water temperature should be 45°F, with a minimum return water temperature of 58°F to maximize the usable lifetime (optimize pipe size of existing piping) of water systems. This shall be accomplished without the use of blending stations.

d. Modulate chilled water pumps with variable frequency drives.

e. Chilled water pumps shall typically be end suction or horizontal split case type with mechanical seals and bronze fitted and connected to campus chilled water loop whenever practical.

f. Cleaning of Piping Systems.

(1) Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the system in service. Use whatever temporary connections are required for cleaning, purging and circulating. All cleaning shall be performed in the presence of the Texas State University-San Marcos Representative.

(2) Install temporary strainers in front of pumps, tanks, water still, solenoid valves, control valves, and other equipment where permanent strainers are not indicated. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blowoff valve.

(3) Circulate filtered steam and condensate piping systems to remove all scale, grease, oil and silt. For called water, circulate NAICEAN 8900. Circulate for 48 hours, flush system and replace with clean water. The chilled water system should then be treated with NALCO CW4751. Do not open to campus piping loop until Texas State University-San Marcos provides approval and after Contractor and Vendor certify piping systems are cleaned of any contaminants and comply with requirements of Texas State University-San Marcos Contract must provide an allowance amount for disposal if effluent is not accepted by City Waste Water System.
(4) Special Requirements, if any, are specified in the Section on each type of piping.

2. Heating shall be provided via steam coils wherever steam is available to building; otherwise, use hot water heating coil (central station) with closed loop water treatment typical for current University maintenance requirements.

C. Plumbing

1. Floor drain traps installed in inaccessible areas shall be brought to the attention of the Owner for consideration of priming at that time.

1.05 Other General Building Criteria:

A. General

1. Layout building structure and space utilization to preserve dedicated straight avenues for large duct runs at locations separate from electric runs and plumbing runs. On buildings, which may in the future be used for scientific research, provide organized space for future ductwork in the ceilings and chases.

2. Structural components shall in general be of uniform depth throughout a floor, allowing maximum space for routing of ducts, pipes, etc. above ceiling.

3. Frame in the building chase with a ring beam above, not below, the floor to minimize bottlenecking the air ducts and to minimize floor-to-floor spacing. Include open steel grating at each floor inside chases.

4. Paint bright stripe on the treads of machine-room steps, to benefit workers with limited sight. Add visually-contrasting nosings to steps, particularly steps made of exposed aggregate.

5. Protect stair treads during remodel projects, and repair or replace any damaged.

6. Coat floors of mechanical rooms. Coating selected shall remain pliant to span structural settling cracks and shall produce a seamless membrane resistant to puncture or damage. Floor coating shall extend up perimeter walls and floor penetrations a minimum of 12 inches. Exterior of tunnel walls and floors shall be sealed and drained in accordance with standard subsurface exterior structural building walls. Coating system shall consist of 2 coats with a non-slip abrasive applied between first and second coat.
1.06 Mechanical System Warranties

A. All mechanical systems, components and controls shall be provided with a minimum 2-year warranty. Specific mechanical components may have longer warranty periods. Warranty shall be unconditional and include material, labor and response within 24 hours of notification.

1.07 Equipment Serviceability and Access

A. Access

1. Design shall provide for service and maintenance access to all equipment. Service area shall comply with codes and shall be reasonably planned for human access. Project shall provide elevator access to all levels including basement and attic mechanical spaces. Elevators shall be sized and designed for equipment removal as noted in paragraph B.

B. Removal

1. Design shall include plan for removal of all equipment. Plan shall indicate sizes of major pieces of equipment and clearly marked paths of removal and egress for this equipment from point of installed equipment-to-equipment loading area exterior to building. Entire egress path shall be coordinated for removal of equipment. Preference is to remove all equipment through elevators to ground level. Egress paths of equipment through removable louvers or roof cupolas is acceptable provided louver or cupolas locations are crane accessible.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 23 00 00
SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1: GENERAL

1.01 This design guidelines contained herein includes the requirements electric motors utilized for electric motor driven systems at Texas State University. It is the intention of this document to provide a standard for electric motors at Texas State University to provide the highest level of quality and standardization possible; it is not intended to be a guide specification.

1.02 Motors

A. Fan motors and associated equipment shall be sized to operate at 110% of calculated loads and capacities.

B. Equipment shall be designed and installed to operate continuously under all actual site conditions and variations (i.e. typical voltages of 125/215 for 120/208 volt circuits).

C. Motor controls (i.e. starters) shall be properly identified, labeled and located in a sheltered and secure location (mechanical room when possible).

D. All motors 2 HP & larger will be 3 phase.

1.03 Motors and Bearings

A. In general do not use motor speeds in excess of 1800 RPM.

B. On air handling units requiring motors of 7-1/2 horsepower and larger, provide fan shaft and motor shaft with key way slot.

C. Use ball bearings in preference to sleeve bearings in motors and air units where noise limits permit.

D. Position air units to allow replacement of bearings without necessity for demolition to gain access.

E. Extend bearing lubrication points to central accessible points and provide alemite fittings for lubrication.

F. For energy conservation, energy efficient motors should be used where practical.

G. Use inverter rated motors on all motors that are controlled by VFD’s.
SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

1.04 Standards

A. Motors shall be designed, built, and tested in accordance with the latest revision of the following standard documents.

1. NEMA MG 1 - Motors and Generators.
2. ANSI/IEEE 112 - Test Procedures for Motors / Generators.
3. UL 1004 - Motors, Electric.
4. UL 674 - Motors, Generators, Electric, for Use in Hazardous Locations: Class I, Groups C and D; Class II, Groups E, F, and G.

1.05 Submittals

A. It will be required as a Standard to submit test results verifying guaranteed minimum efficiency and power factor at rated load and rated voltage for 3-phase motors larger than 1/2 hp. Report test results on Form A-1, IEEE Standard 112.

B. Submittal data on motors shall include, but not be limited to the following information:

1. Manufacturer;
2. Rated horsepower;
3. Rated voltage(s);
4. Number of phases;
5. Frequency in hertz;
6. Motor no-load current at rated voltage;
7. Full load amperes (FLA) at rated voltage;
8. Full load current at 110 percent voltage.
9. Starting current at rated voltage.
10. Locked rotor amperes (LRA) or code letter;
11. Safe stall time (motors 30 horsepower and larger);
12. Nominal speed at full load;
13. Motor Performance Characteristics:
   a. Guaranteed minimum efficiency at rated load at rated voltage.
   b. Guaranteed minimum power factor at rated load at rated voltage.
   c. Expected efficiency at ½, ¾, and full load at rated voltage.
   d. Expected power factor at ½, ¾, and full load at rated voltage.
   e. Provide certified factory test and test reports for identical motor tested in accordance with the Procedures for Polyphase Induction Motors and Generators No. 112A, NEMA MG 1-12.53a and IEEE Standard 112, Test Method B, to confirm that the motor full load efficiency and power factor meets the specified values. Motors not as specified will be rejected.
      (1) Measurements of no-load current and speed at normal voltage and frequency.
      (2) Measurement of locked rotor current at rated frequency.
      (3) Results of high-potential test.
      (4) Determination of efficiency and power factor at ½, ¾, full-load, and service factor load.
14. Maximum power factor correction capacitor “kvar” recommended by motor manufacturer and expected new motor-capacitor power factor at rated full load (motors 30 horsepower and larger);
15. Winding insulation system as defined by IEEE;
16. NEMA design letter;
17. Temperature rise (reference NEMA MG-1, 12.41 and 12.42);
18. Bearing type and duty, including bearing life calculations.

19. Motor outline dimensions, weight and frame number

20. 20 NEMA machine type classifications (ODP, TEFC, etc.).

21. Manufacturer’s descriptive information relative to specified features.

22. Vertical Motor Data:
   a. Thrust bearing life.
   b. Type of thrust bearing lubrication.
   c. Type of guide bearing lubrication.

23. Operation and Maintenance Manuals, including:
   a. Complete information for storage and installation.
   b. Complete operating and maintenance instructions.
   c. Bill of materials.

1.06 Warranties

A. Vendor shall provide the standard form of written guarantee and warranty covering defects in materials and workmanship for the equipment. Said guarantee and warranty shall be for a period of one year from the date of final acceptance of the equipment by Texas State University-San Marcos. Date of acceptance shall be defined as the date that Texas State University-San Marcos assumes operation of the unit.

PART 2: PRODUCTS

2.01 Acceptable Manufacturers

A. Allis Chalmers.

B. Century MagnaTek
SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

C. General Electric.

D. Gould

E. Reliance Electric

F. Siemens.

G. Toshiba

H. Westinghouse.

2.02 Motors Less Than ½ Hp

A. Unless otherwise specified, motors less than ½ hp shall be squirrel-cage, induction type, capacitor start with copper stator windings as the Standard low-horsepower motor.

B. Motors shall be continuously rated with 1.15-service factor for operation at 115 volts, single-phase, 60 Hz.

C. The driven load for constant speed applications shall not exceed the motor’s continuous nameplate rating, exclusive of any service factor, under any normal operating condition.

2.03 Motors Larger Than ½ Hp Through 250 Hp

A. Motors shall be 3-phase, continuously rated, squirrel-cage, random-wound copper, induction motors designed for 460 volt, 60 Hz operation. Provide motors rated for continuous operation with 1.15-service factor. Motors 7.5 HP and larger shall be 3-phase only.

B. Provide motors with Class F insulation and a Class B temperature rise based on 40 degrees C ambient. When ambient temperatures exceed 40 degrees C, temperature rise shall be adjusted according to MG 1-12. Locked Rotor Current: Provide motors with locked rotor starting currents not exceeding Code L under 3 hp, Code K for 3 and 5 hp, Code H for 7-1/2 and 10 hp, and Code G for 15 hp and above.
C. Provide motors meeting the energy efficiency and power factor requirements in paragraph 3.01 of this section, when tested in accordance with NEMA MG 1-12.53a and IEEE Standard 112, Test Method B.

D. Provide motors rated for continuous operation with 1.15-service factor. For constant speed motors, the driven load shall not exceed the motor’s brake horsepower nameplate rating, exclusive of any service factor, under any normal operating condition.

E. Provide all TEFC motors with anti-friction grease lubricated ball bearings, with a bearing AFBMA B-10 life of 100,000 hours, and sealed from the environment. Provide factory lubrication of all motors prior to shipment. Provide all grease-lubricated bearings with relief fittings.

F. Provide all ODP motors with sealed anti-friction grease lubricated ball bearings, with a bearing AFBMA B-10 life of 100,000 hours. Provide factory lubrication of all motors prior to shipment. Provide all grease-lubricated bearings with relief fittings.

G. Motors which are located outside or wherever specified shall be provided with space heaters sized to prevent moisture condensation, rated 120 volts, with a separate conduit box for heater leads only.

H. For motors 5 horsepower and larger, provide a snap action normally closed klixon embedded in the stator winding at the 12:00 position with tee leads wired out to the wiring compartment. The temperature of the klixon shall be set for 25% of the insulation temperature rating.

I. Provide motors with conduit boxes that are fully rotatable, diagonally split, including gasket between cover and box, and box and frame, with threaded hubs and a grounding lug located within the box for ground conductor connection.

J. Provide nameplates of stainless steel or other approved corrosion resistant material to provide a permanent legible marking, containing NEMA data plus guaranteed minimum efficiency. Attach nameplates and connection plates to the motor frame by rivets or screws.

K. Variable torque, inverter duty rated motors shall be provided for variable speed applications. Insulated bearings shall be used for motors driven by variable frequency drives.
2.04 Motor Types

A. The following Standard motor types shall conform to the following requirements:

1. Horizontal Dripproof: Provide horizontal motors with an enclosure that meets NEMA Standard MG 1 for open, dripproof construction. Provide screen over all air openings.

2. Horizontal Totally Enclosed Fan-Cooled: Provide totally enclosed fan-cooled (TEFC) motors with frame sizes 182 and larger with cast iron frames and end shields. Smaller frame sizes may be constructed of rolled steel with cast metal end shields. Provide motors with condensate drain holes. For frame size 286 and larger, provide automatic breather/drain device in drain hole.

3. Vertical Weather Protected Type I: Provide vertical motors with an enclosure that meets NEMA Standard MG 1 for weather protected Type I (WP-I) enclosure. Provide screens over all air openings.

4. Vertical Totally Enclosed Fan-Cooled: Provide vertical motor with an enclosure identical to the requirements for the horizontal TEFC motors.

5. Explosion proof: Provide all horizontal and vertical motors with TEFC explosion proof enclosures, UL listed for Class 1, Division 1, and Group D hazardous atmosphere. Provide motors manufactured by Reliance Electric.

6. Submersible: Submersible motors UL listed for explosion proof atmospheres in accordance with subsequent sections of this specification. In addition, provide submersible motors with two mechanical seals; the lower one outside the motor and protecting the upper one, which is in an oil filled chamber. Provide moisture detector probes in the oil filled seal chamber to indicate the presence of moisture in the seal chamber. Provide a temperature detector and switch rated 3 amperes, 120 volts minimum, set to operate when the internal motor temperature exceeds a preset limit. Provide any relays or solid-state controls for separate mounting.

7. Horizontal, Totally Enclosed, Fan-Cooled, Severe Duty: Provide horizontal (TEFC), severe duty motors suitable for contaminated environments, including gasketed conduit box, stainless steel drains, double-shielded bearings, and corrosion resistant paint. Provide motors
SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

manufactured by Reliance Electric SXT-XT-XE, Century Type SCE E-Plus.

8. Vertical, Totally Enclosed, Fan-Cooled, Severe Duty: Provide vertical (TEFC), severe duty motors with the requirements identical to horizontal (TEFC), severe duty motors, above.

2.05 Motors For Use With Variable Frequency Drives

A. Motor Application Considerations:

1. NEMA Standard MG1 definite purpose inverter duty rated motors shall used for all IGBT Pulse Width Modulated drive installations. Inverter duty motors shall be designed and manufactured to meet NEMA Standard MG1 for definite purpose inverter duty motors. The inverter duty motors shall be able to withstand voltages greater than 1600 volts peak and rise times of 0.1 microsecond.

2. Applications where the motor specification does not meet NEMA MG1 Part 31 (1600V peak and 0.1 microsecond rise time), and the cable length between the inverter and motor exceeds the drive manufacturer recommended maximum cable length; load sideline reactors shall be used. The load sideline reactor shall be design and constructed to operate with pulse width modulated IGBT inverter drives with switching frequencies up to 20 Khz. Line reactor insulation dielectric strength shall be greater than or equal to 4000 volts and shall carry a UL506 & UL508 approval.

3. Insulated or isolated bearings shall be used for the inverter duty rated motors.

4. The inverter duty motor shall be constructed with triple film wire, increased winding slot insulation, increased insulation between phases, and increased first turn insulation. The inverter duty motor shall use slot fillers as required to avoid loose windings.

5. The inverter duty motor insulation class shall be class F insulation and a class B temperature rise based on 40 degrees C.

6. The inverter duty motor nameplate shall indicate that the motor is an inverter duty motor.
### SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

#### PART 3: EXECUTION

#### 3.01 Minimum Efficiency

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Revised Jan-15

Common Motor Requirements for HVAC Equipment-23 05 13-9
## SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 4: INSTALLATION

4.01 Coordinate with electrical designs.

4.02 Motors and associated devices shall be installed as per NEC requirements.

END OF SECTION 23 05 13
PART 1: GENERAL

1.01 Summary

A. Testing, adjusting and balancing (TAB) of the air conditioning systems and related ancillary equipment will be performed by an impartial technically qualified TAB firm selected and employed by the Owner, separate and apart from the construction contract.

B. The Firm shall be capable of performing the services specified at the location of the facility described with the time specified, of preparing and submitting the detailed report of the actual field work performed, and following up the basic work as may be required.

1.02 Qualifications

A. The Firm shall be one which is organized to provide professional services of this specified type in the State of Texas and as a minimum shall have one (1) Professional Engineer licensed in the State of Texas, with current registration, to perform such professional services. This engineer shall be personally responsible for developing the job site data as required in the test procedures outlined in these Specifications.

B. The Firm shall have operated a minimum of five (5) years under its current Firm name, and shall be in good standing with the State of Texas, Franchise Tax Board. The Firm shall submit their full incorporated name, Charter Number and Taxpayer’s I.D. Number for proper verification of the firm’s status.

C. The Firm shall be capable of providing a performance bond, by a bonding company licensed to do business in the State of Texas, if determined by the Owner that such a bond is required. The amount of the bond which may be required shall be equal to the cost of the proposal submitted, or in the case of more than one proposal, the sum of all such proposals and any awarded work in progress.

D. The Firm shall maintain current insurance coverage in the minimum amounts shown below. If the firm normally carries such insurance coverage (minimum or higher) incident to its operation, additional insurance for the specific proposal or proposals is not required. The minimum insurance coverage required are:

1. Worker’s Compensation as required by law.
2. General Liability for not less than $2,000,000 aggregate.

3. Fire Damage, and Extended Coverage, Vandalism and Malicious Mischief, in the full amount of Contract. The above policies shall be carried with companies satisfactory to the Owner. Certificates of each of the above policies, together with a written statement by the issuing company, stating that said policy will not be canceled without ten (10) days prior written notice to the Board of Regents of the University of Texas system, shall be delivered to the Owner before any work is started.

E. All personnel used on the job site shall be either Professional Engineers or Engineering Technicians, who shall have been permanent, full time employees of the firm for a minimum of six (6) months prior to the start of work for this specific project.

F. The TAB firm shall submit biographical data on the individual proposed to directly supervise the TAB work, as well as other personnel scheduled to perform the technical work under the contract. It shall also submit a background record of at least five years of specialized experience in the field of air hydronic system balancing, and shall possess properly calibrated instrumentation. The supervisory personnel for the TAB firm shall be permanent, full time employees of the Firm.

1.03 References


1.04 Documents

A. The TAB firm shall, as a requirement of the TAB contract, arrange with the Architect to compile on set of mechanical specifications, all pertinent change orders, and the following:

1. One complete set of Drawings less the structural sheets.
2. One set of mechanical floor plans of the conditioned spaces. These Drawings shall be ozalid type (blue or black on light background) reproductions to facilitate marking.

B. Approved submittal data on equipment installed, and related changes as required to accomplish the test procedures outlined in Paragraphs 1.6 through 1.10 of this Specification will be available through the Owner.

1.05 Responsibilities of the TAB Firm

A. The TAB personnel shall check, adjust, and balance the components of the air conditioning system which will result in optimal noise, temperature, and airflow conditions in the conditioned spaces of the building while the equipment of the system is operating economically. This is intended to be accomplished after the system components are installed and operating as provided for in the Contract Documents. It is the responsibility of the Mechanical Contractor to place the equipment into service. Variable air volume systems shall be balanced in accordance with AABC 1989 Standard, Fifth Edition.

B. Liaison and Early Inspection:

1. The TAB firm personnel on the job shall act as liaison between the Owner, Architect and Contractor. The following reviews (observations) and tests shall be performed by the TAB Agency:

a. During the design stage, before the documents are finalized, review the mechanical drawings and specifications for balanceability and provide commentary.

b. During construction, review all HVAC submittals such as control diagrams, air handling devices, etc., that pertain to commissioning work and balanceability.

c. Allow for a fixed number of trips to the project site, over and above those required for testing and balancing for inspection of installation of the mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems during the construction stage. These inspections shall be made prior to and/or at the above ceiling inspections. Commentary will be provided to the Owner of each observation.
d. Test one (1) 8” single duct terminal box for performance capability and leakage as described in Section 23 36 16. The shipment of the box to the TAB Agency’s lab will be at the manufacturer’s cost and the test period will be for three (3) weeks from receipt of the box. Submittal data will not be approved until box testing passes. If the sample box is rejected for any reason the second test will be at the Contractor’s cost and the time allowed will restart when the box is received at the TAB Agency.

e. Test 10% of the single duct boxes for casing and damper leakage when the shipment arrives at the project site. All testing (except for the initial boxes) shall be performed on site. Boxes requiring re-testing will be charged to the Contractor at the unit price provided to the Owner.

2. During the balancing process, as abnormalities and malfunctions of equipment or components are discovered by the TAB personnel, the Owner shall be advised in writing so that the condition can be corrected by the Mechanical Contractor. The written document need not be formal, but must be understandable and legible. Data from malfunctioning equipment shall not be recorded in the final TAB report. The TAB firm shall not instruct or direct the Contractor in any of the work, but will make such reports as are necessary to the Owner.

1.06 Final Air Balance

A. General: When systems are complete and ready for operation, the TAB Consultant will perform a final air balance for all air systems and record the results. The outside, supply, exhaust and return air volume for each air handling unit, supply fan and exhaust fan and the supply, exhaust or return air volume for each distribution device shall be adjusted to within +/-5% of the value shown on the drawings. Air handling unit and fan volumes shall be adjusted by changing fan speed and adjusting volume dampers associated with the unit. Air distribution device volume shall be adjusted using the spin-in tap damper for flexible duct connected devices and the device OBD for duct connected devices. Air distribution devices shall be balanced with air patterns as specified. Duct volume dampers shall be adjusted to provide air volume to branch ducts where such dampers are shown. The general scope of balancing by the TAB Consultant will include, but is not limited to, the following:

1. Filters: check air filters and filter media and balance only system with essentially clean filters and filter media. The Division 15 Contractor shall install new filters and filter media prior to the final air balance.
2. Blower Speed: Measure RPM at each fan or blower to design requirements. Where a speed adjustment is required, the Division 15 Contractor shall make any required changes.

3. Ampere Readings: Measure and record full load amperes for motors.

4. Static Pressure: Static pressure gains or losses shall be measured across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter and exhaust fan. These readings shall be measured and recorded for this report at the furthest air device of terminal unit from the air handler supplying that device. Static pressure readings shall also be provided for systems which do not perform as designed.

5. Equipment Air Flow: Adjust and record exhaust, return, outside and supply air CFM(s) and temperatures, as applicable, at each fan, blower and coil.

6. Coil Temperature: Set controls for full cooling and for full heating loads. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil and HVAC terminal unit. At the time of reading record water flow and entering and leaving water temperatures. (In variable flow systems adjust the water flow to design for all the above readings)

7. Zone Air Flow: Adjust each zone of multizone units, each HVAC terminal unit and air handling unit for design CFM.

8. Outlet Air Flow: Adjust each exhaust inlet and supply diffuser, register and grille to within +/-5% of design air CFM. Include all terminal points of air supply and all points of exhaust. Note: For Labs and Rooms that are negative exhaust air flow shall be set to design +/-10% and supply to design – 5%. Positive areas will have opposite tolerances.

9. Pitot Tube Traverses: For use in future troubleshooting by maintenance personnel, all exhaust ducts, main supply ducts and return ducts shall have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations shall be described on the sheet containing the data.

10. Maximum and minimum air flow on terminal boxes.

**1.07 Final Chilled and Heating Hot Water Balance**
A. General: When systems are completed and ready for operation, the TAB Consultant will perform a final water balance for each chilled and hot water system. The general scope of balancing by the TAB Consultant will include, but not be limited to, the following:

1. Adjusted System Tests: Adjust balancing valves at each coil and heat exchanger for design flow, +/-5%. Adjust balancing valves air pumps to obtain design water flow. Record pressure rise across pumps and GPM flow from pump curve. Permanently mark the balance position for each valve (Note: If discharge valves on the pumps are used for balancing record the head being restricted by the valves).

2. Temperature Readings: Read and record entering and leaving water temperature at each water coil, converter and heat exchanger. Adjust as necessary to secure design and conditions. Provide final readings at all thermometer will locations.

3. Pressure Readings: Water pressure shall be recorded at all gauge connections. Pressure readings at coils and pumps shall be related to coil and pump curves in terms of GPM flow through flow measuring status, if provided and installed, at each air handler. The flow of water through all water coils shall be adjusted by manipulating valves until the rated pressure drops across each coil is obtained and total water flow is verified by flow measuring status. For coils equipped with 3 way valves, the rated pressure drop shall first be adjusted through the coils. The bypass valve shall then be adjusted on each coil until an equal pressure drop between supply and return connections is the same as with the flow through the coil.

4. ampere Readings: Reading and record full load amperes for each pump motor.

B. Sound: Read and record sound levels at up to 15 locations in the building designated by the Engineer. All measurements shall be made using an Octave Band analyzer. All tests shall be conducted when the building is quiet in the presence of the Engineer, if he so desires.

C. Vibration: Read and record vibration for all water circulating pumps, air handling units, and fans which have motors larger than 10 HP. Include equipment vibration, bearing housing vibration, foundation vibration, and other tests as directed by the Engineer. Readings will be made using portable IRD (or approved equal) equipment capable of filtering out various unwanted frequencies and standard reporting forms. Maximum vibration at any point listed above, or specified, shall not exceed 1 mil on fans an 1 mil on pumps unless otherwise specified. Equipment manufacturer’s shall rectify all systems exceeding vibration tolerances.
1.08 Testing of Temperature Control Systems

A. In the process of performing the TAB work, the TAB Agency shall:

1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of intended control performance.

2. Verify that all control devices are properly connected.

3. Verify that all dampers, valves and other controlled devices are operated by the intended controller.

4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).

5. Verify the integrity of valves and dampers in terms of tightness of close-off and full-open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.

6. Observe that all valves are properly installed in the piping system in relation to direction of flow and location.

7. Observe the calibration of all controllers.

8. Verify the proper application of all normally opened and normally closed valves.

9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.

10. Observe the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control Contractor will relocate as deemed necessary by the TAB Agency.

11. Verify that the sequence of operation for any control mode is in accordance with approval shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.

12. Verify that all controller setpoints meet the design intent.

13. Check all dampers for free travel.
14. Verify the operation of all interlock systems.

15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.

B. A systematic listing of the above testing and verification shall be included in the final TAB report.

1.09 Reports

A. The activities described in this section shall culminate in a report to be provided in quadruplicate (4) individually bound to the Owner. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of test instrument and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner’s operations personnel.

B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the reports must have been made onsite by the permanently employed technicians or engineers of the Firm.

C. At the option of the Owner, all data sheets tabulated each day by TAB personnel shall be submitted for initial by the Owner. Those work sheets so initialed, or copies thereof, shall be presented as a supplement to the final TAB report.

D. Submit reports on forms approved by the Owner and Engineer which will include the following information as a minimum:

1. Title Page
   a. Company Name
   b. Company Address
   c. Company Telephone Number
   d. Project Name
   e. Project Location
   f. Project Manager
g. Project Engineer
h. Project Contractor
i. Project Identification Number

2. Instrument List
   a. Instrument
   b. Manufacturer
   c. Model
   d. Serial Number
   e. Range
   f. Calibration date
   g. What test instrument was used for

3. Fan Data (Supply and Exhaust)
   a. Location
   b. Manufacturer
   c. Model
   d. Air flow, specified and actual
   e. Total static pressure (total external), specified and actual
   f. Inlet pressure
   g. Discharge pressure
   h. Fan RPM

4. Return Air/Outside Air Data (If fans are used, same data as for 3 above)
   a. Identification/location
b. Design return air flow

c. Actual return air flow

d. Design outside air flow

e. Return air temperature

f. Outside air temperature

g. Required mixed air temperature

h. Actual mixed air temperature

5. Electric Motors

a. Manufacturer

b. HP/BHP

c. Phase, voltage, amperage, nameplate, actual

d. RPM

e. Service factor

f. Starter size, heater elements, rating

6. V-Belt Drive

a. Identification/location

b. Required driven RPM

c. Driven sheave, diameter and RPM

d. Belt, size and quantity

e. Motor sheave, diameter and RPM

f. Center-to-center distance, maximum, minimum and actual

7. Duct Traverse

a. System zone/branch
b. Duct size
c. Area
d. Design velocity
e. Design air flow
f. Test air flow
g. Duct static pressure
h. Air temperature
i. Air correction factor

8. Air Monitoring Station Data
   a. Identification/location
   b. System
c. Size
d. Area
e. Design velocity
f. Design air flow
g. Test velocity
h. Test air flow

9. Air Distribution Test Sheet
   a. Air terminal number
   b. Room number/location
c. Terminal type
d. Terminal size
e. Area factor
f. Design velocity

g. Design air flow

h. Test (final) velocity

i. Test (final) air flow

10. Pump Data

  a. Identification/number
  b. Manufacturer
  c. Size/model
  d. Impeller
  e. Service
  f. design flow rate, pressure drop, BHP
  g. Actual flow rate, pressure drop, BHP
  h. discharge pressure
  i. Suction pressure
  j. Total operating head pressure
  k. Shut off, discharge and suction pressure
  l. Shut off, total head pressure
  m. Pressure differential settings

11. Cooling Coil Data

  a. Identification/number
  b. Location
  c. Service
  d. Manufacturer
e. Entering air DB temperature, design and actual
f. Entering air WB temperature, design and actual
g. Leaving air DB temperature, design and actual
h. Leaving air WB temperature, design and actual
i. Water pressure flow, design and actual
j. Water pressure drop, design and actual
k. Entering water temperature, design and actual
l. Leaving water temperature, design and actual
m. Air pressure drop, design and actual

12. Heating Coil Data
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Water flow, design and actual
   g. Water pressure drop, design and actual
   h. Entering water of steam temperature, design and actual
   i. Leaving water temperature, design and actual
   j. Entering air temperature, design and actual
   k. Leaving air temperature, design and actual

13. Sound Level Report
   a. Location (Location established by the design engineer)
b. NC curve for eight (8) bands – equipment off

c. NC curve for eight (8) bands – equipment on

14. Vibration Test on equipment having 10 HP motors or above

a. Location of points:
   (1) fan bearing, drive end
   (2) Fan bearing, opposite end
   (3) Motor bearing, center (if applicable)
   (4) Motor bearing, drive end
   (5) Motor bearing, opposite end
   (6) Casing (bottom or top)
   (7) Casing (side)
   (8) Duct after flexible connection (discharge)
   (9) Duct after flexible connection (suction)

b. Test readings:
   (1) Horizontal, velocity and displacement
   (2) Vertical, velocity and displacement
   (3) Axial, velocity and displacement

c. Normally acceptable readings, velocity and acceleration

d. Unusual conditions at time of test

e. Vibration source (if non-complying)

15. Control verification indicating date performed and any abnormalities identified.

a. Point Location/Description

b. EMS Readout (setpoint and Actual)
c. Actual Readout

d. Interlocks

e. Safeties
   (1) VSD Normal Operation
   (2) VSD Bypass Operation

f. Alarms

g. Sequences of Operation

END OF SECTION 23 05 93.01
SECTION 23 05 93 – PREPARATION FOR TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1: GENERAL

1.01 Summary

A. Perform all work required to prepare the building HVAC systems for testing, adjusting and balancing indicated by the Contract Documents as follows:

1. Responsibilities of Project Contractor.
2. Preparation for balancing of air systems.
3. Preparation for balancing of hydronic and steam systems.

B. The scope of the TAB work as defined in Section 230593.01 is indicated in order that the Contractor will be advised of the coordination, adjustment, and system modification which will be required under the project work in order to complete the Owner’s requirements for final TAB. The TAB firm will not have a contractual relationship with any Contractor referred to herein, but will be responsible to the Construction Inspector and the Owner for the satisfactory execution of the TAB work. The Contractor in his original bid shall allow for the costs required to cover all work which may be required in the TAB phases as defined herein and as may be necessary for the completion of the TAB work as defined by the TAB firm.

1.02 Related Sections

A. Section 230593.01 – System Testing, Adjusting & Balancing.

1.03 Scope of Work

A. Testing, adjusting and balancing (TAB) of the Air Conditioning systems and related ancillary equipment will be performed by an impartial technically qualified TAB firm selected and employed directly by the Owner, separate and apart from the Construction Contract. However, the preparation for and corrections necessary for the Testing, Adjusting and Balancing of these systems, as described herein, are the responsibility of the Contractor.

B. As a part of this project Construction Contract, the Contractor shall make any changes or replacements to the sheaves, belts, dampers, valves, etc. required for correct balance as advised by the TAB firm, at no additional cost to the Owner.
C. The Contactor shall provide and coordinate the services of qualified, responsible Subcontractors, suppliers, and personnel as required to correct, repair, and/or replace any and all deficient items or conditions found during the course of this project, including the testing, adjusting, and balancing period.

D. In order that all systems may be properly tested, balanced, and adjusted as required herein by these Specifications, the Contractor shall operate said systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB. This length of time shall be subject to the approval of the Construction Inspector.

E. Project Contract completion schedules shall allow for sufficient time to permit the completion of TAB services prior to Owner occupancy. The Contractor shall allow adequate time for the testing and balancing activities of the Owner provided services, during the construction period, and prior to Substantial Completion as defined in the Uniform General Conditions of this Construction Document.

F. The Drawings and Specifications indicate valves, dampers and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions, and it will be the responsibility of the Contractor to install these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the Contractor shall provide access as requested by the TAB firm. Also, any malfunction encountered by TAB personnel and reported to the Contractor or the Construction Inspector shall be corrected by the Contractor immediately so that the balancing work can proceed with the minimum of delays.

1.04 Responsibilities of the Project Contractor

A. The Contractor shall:

1. Have the building and air conditioning systems in complete operational readiness for TAB work to begin.

2. The Contractor shall allow sufficient time for the TAB firm to perform his contracted work within the construction schedule. The Contractor shall complete his work by systems or floors, whichever is the most efficient for scheduling. After awarding of the Contract and the Contractor has developed a construction schedule, a TAB coordination meeting shall be held at the Owner’s office with the TAB agency, the General Contractor and his primary subcontractors (i.e. mechanical, electrical, building automation, etc.) to develop a testing schedule for
SECTION 23 05 93 – PREPARATION FOR TESTING, ADJUSTING, AND BALANCING FOR HVAC

the project. The Contractor shall submit copies of the proposed schedule tow (2) weeks prior to this meeting to the Owner and TAB Agency.

a. The following are time requirements: The hot water and chilled waters must be 100% complete to balance. The air systems are pressure independent and can be balanced by systems, etc., but once the total system is complete, the total flows and system tracking will require finalization. Lab certification will be performed when the building is 100% operational and balanced.

3. Promptly correct deficiencies of materials and workmanship identified as delaying completion of TAB work.

4. Be responsible for any added costs to the Owner resulting from his failure to have the building and air conditioning systems ready for TAB when scheduled, or from his failure to correct deficiencies promptly.

B. Complete operational readiness of the building requires that construction status of the building shall permit the closing of doors, windows, ceilings installed, etc., to obtain simulated or projected operating conditions.

C. Complete operational readiness of the air conditioning systems also require that the following be accomplished:

1. Air Distribution Systems:

a. Verify installation for conformity to design. All supply, return, and exhaust ducts terminated and pressure tested for leakage as required by the Specification.

b. All volume, smoke and fire/smoke dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside, return and relief air shall provide tight closure and full opening, smooth and free operation.

c. All supply, return, exhaust and transfer grilles, registers, diffusers and terminal devices installed.

d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and/or sealed to eliminate excessive bypass or leakage of air.
e. All fans (supply, return and exhaust) operating and verified for freedom from vibration, proper fan rotation and belt tension; heater elements in motor starters to be of proper size and rating; record motor amperage and voltage on each phase at start-up and running, and verify they do not exceed nameplate ratings.

f. All single variable terminal units ("mixing boxes") shall be installed and functional (i.e. controls functioning).

2. Water Circulating Systems:
   a. Check and verify pump alignment and rotation.
   b. Open all valves to their full open position, close bypass stop valves. Set mixing valves to full-flow through systems components. After the system is flushed and checked for proper operation, remove and clean all strainers. The Contractor shall repeat the operation until circulating water is clean.
   c. Record each pump motor amperage on each phase and voltage after reaching rated speed. Readings shall not exceed nameplate rating.
   d. Verify that the electrical heater elements are of the proper size and rating.
   e. In preparation of TAB all water circulating systems shall be full and free of air, expansion tanks shall be set for proper water level, and all air vents shall be installed at high points of systems and operating freely. Systems shall be cleaned and flushed. Chemicals shall be added to closed systems to treat piping and inhibit corrosion.
   f. Check and set operating parameters of the heat exchangers and control devices to the design requirements.

3. Automatic Controls
   a. The Contractor shall schedule a meeting with the Engineer, Control Contractor, TAB firm and Owner’s Representative for a pre-submittal review to establish that his interpretations of the sequences of operation are correct.
b. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, dampers sequences, air and water resets, fire and freeze stats, high and low temperature thermostats, safeties, etc.

c. Verify that all controlling instruments are calibrated and set for design operating conditions with the exception of room thermostats or sensors, which shall be calibrated at the completion of TA service with cooperation between the TAB firm and Control Contractor.

d. The Automatic Temperature Control Contractor and/or Energy Management System Contractor shall thoroughly check all controls, sensors, operators, sequences, etc., before notifying the TAB agency that the Automatic Temperature Controls and Energy Management Systems are operational. The Automatic Temperature Control Contractor and/or Energy Management System Contractor shall provide technical support (technicians and necessary computers) to the TAB agency for a complete check of these systems.

4. Tabulated Data: The motor amperages, voltages shall be recorded showing “actual” and “nameplate” voltage and amperage and submitted and actual RPM. This applies to each piece of electrically driven air conditioning equipment in the system including supply and exhaust fans, fans of fractional horsepower, pumps, etc.

D. Notification of System Readiness:

1. After completion of the work in Paragraph 1.5.a through c above, the Contractor shall notify the Owner in writing, certifying that the work has been accomplished and that the building and the air conditioning systems are in operational readiness for testing, adjusting, and balancing. He shall include a copy of the tabulated data of Paragraph 1.5.c.4 above.

2. The Owner will, in turn, notify the TAB firm of the readiness for balancing and forward copies of the Contractor’s certification and the tabulated voltages and currents.

3. Should the TAB firm be notified as described above, and the TAB work commenced and the systems are found NOT to be in readiness if the systems, the Contractor shall request an inspection be made by duly
appointed representative of the Owner, Architect, TAB firm, and the Contractor. This inspection will establish to the satisfaction of the represented parties whether or not the system meets the basic requirements for TAB services. Should the inspection reveal the TAB services notification to have been premature, all cost of the inspection and wasted work accomplished by the TAB firm shall be reimbursed to the appropriated parties by the Project Contractor.

1.05 Responsibilities of the TAB Firm

A. Refer to Section 23 05 93.01 entitled “System Testing, Adjusting and Balancing.”

END OF SECTION 23 05 93
PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

B. This Section includes mechanical insulation for boiler breeching, duct, equipment, and pipe, including the following:

1. Insulation Materials:
   a. Flexible elastomeric.
   b. Mineral fiber.

2. Insulating cements.

3. Adhesives.


5. Sealants.

6. Factory-applied jackets.


8. Field-applied cloths.


10. Tapes.

11. Securements.

12. Corner angles.

1.03 DEFINITIONS

A. ASJ: All-service jacket.
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B. FSK: Foil, scrim, kraft paper.

C. FSP: Foil, scrim, polyethylene.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

3. Removable insulation at piping specialties, equipment connections, and access panels.

4. Application of field-applied jackets.

5. Field application for each equipment type.

C. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
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2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.08 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
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B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

   1. Products:
      a. Aeroflex USA Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

   1. Products:
      a. CertainTeed Corp.; Duct Wrap.
      b. Johns Manville; Microlite.
      c. Knauf Insulation; Duct Wrap.
      d. Manson Insulation Inc.; Alley Wrap.
      e. Owens Corning; All-Service Duct Wrap.

F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

   1. Products:
      a. CertainTeed Corp.; Commercial Board.
      b. Fibrex Insulations Inc.; FBX.
      c. Johns Manville; 800 Series Spin-Glas.
      d. Knauf Insulation; Insulation Board.
      e. Manson Insulation Inc.; AK Board.
      f. Owens Corning; Fiberglas 700 Series.
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G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:
   a. Fibrex Insulations Inc.; Coreplus 1200.
   b. Johns Manville; Micro-Lok.
   c. Knauf Insulation; 1000(Pipe Insulation.
   d. Manson Insulation Inc.; Alley-K.
   e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.03 INSULATING CEMENTS


1. Products:
   a. Insulco, Division of MFS, Inc.; Triple I.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products:

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products:
   a. Insulco, Division of MFS, Inc.; SmoothKote.
   c. Rock Wool Manufacturing Company; Delta One Shot.
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2.04 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Products:
      a. Aeroflex USA Inc.; Aeroseal.
      b. Armacell LCC; 520 Adhesive.
      c. Foster Products Corporation, H. B. Fuller Company; 85-75.
      d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products:
      a. Childers Products, Division of ITW; CP-82.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.

   1. Products:
      a. Childers Products, Division of ITW; CP-82.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.

E. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Products:
      a. Dow Chemical Company (The); 739, Dow Silicone.
SECTION 23 07 00 – HVAC INSULATION

e. Speedline Corporation; Speedline Vinyl Adhesive.

2.05 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Breather Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products:
   a. Childers Products, Division of ITW; CP-35.
   b. Foster Products Corporation, H. B. Fuller Company; 30-90.
   c. ITW TACC, Division of Illinois Tool Works; CB-50.
   d. Marathon Industries, Inc.; 590.
   e. Mon-Eco Industries, Inc.; 55-40.
   f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.


C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:
   a. Childers Products, Division of ITW; CP-10.
   b. Foster Products Corporation, H. B. Fuller Company; 35-00.
   c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
   e. Mon-Eco Industries, Inc.; 55-50.
   f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.


2.06 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products:
   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, and PVC Jacket Flashing Sealants:

1. Products:
   a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

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2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

3. Vinyl Jacket: UL-rated white vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.08 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

1. Products:
   a. Vimasco Corporation; Elastafab 894.


1. Products:
   a. Childers Products, Division of ITW; Chil-Glas No. 5.

C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.

1. Products:
   b. Vimasco Corporation; Elastafab 894.
SECTION 23 07 00 – HVAC INSULATION

2.09 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd...

1. Products:


2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products:

   a. Johns Manville; Zeston.
   c. Proto PVC Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.


4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.
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D. Metal Jacket:

1. Products:
   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
   c. RPR Products, Inc.; Insul-Mate.

   a. Sheet and roll stock ready for shop or field sizing.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
   d. Factory-Fabricated Fitting Covers:
      1. Same material, finish, and thickness as jacket.
      2. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3. Tee covers.
      4. Flange and union covers.
      5. End caps.
      7. Valve covers.
      8. Field fabricated fitting covers only if factory-fabricated fitting covers are not available.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
   b. Compac Corp.; 104 and 105.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
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2. Width: 3 inches.

3. Thickness: 11.5 mils.


5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Products:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   b. Compac Corp.; 110 and 111.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
   d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.

3. Thickness: 6.5 mils.


5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
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b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.

2. Width: 2 inches.

3. Thickness: 6 mils


5. Elongation: 500 percent.

6. Tensile Strength: 18 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Products:
   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.

3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.


B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   a. Products:
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1. AGM Industries, Inc.; CWP-1.
2. GEMCO; CD.
3. Midwest Fasteners, Inc.; CD.
4. Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, and length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   a. Products:

   1. AGM Industries, Inc.; CWP-1.
   2. GEMCO; Cupped Head Weld Pin.
   3. Midwest Fasteners, Inc.; Cupped Head.
   4. Nelson Stud Welding; CHP.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products:

   1. AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
   2. GEMCO; Press and Peel.

   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   d. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Products:

   1. AGM Industries, Inc.; RC-150.
   2. GEMCO; R-150.
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   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.
   1. Manufacturers:
      a. ACS Industries, Inc.
      b. C & F Wire.
      c. Childers Products.
      d. PABCO Metals Corporation.
      e. RPR Products, Inc.

2.13 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
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3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
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P. For above ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.

3.04 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Duct: Install insulation continuously through floor penetrations.

3.05 DUCT INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct surfaces.
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2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

3.06 EQUIPMENT INSULATION INSTALLATION

A. Insulation Installation on Pumps:
   1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
   2. Fabricate boxes from galvanized steel, at least 0.040 inch thick.
   3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.07 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, sensors, switches, and transmitters on insulated pipes, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
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3.08 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Impale insulation over pins and attach speed washers.
   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
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a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
SECTION 23 07 00 – HVAC INSULATION

3.10 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
3.11 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Owner. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum jackets.

3.12 INDOOR DUCT INSULATION SCHEDULE

A. Concealed, round, supply-air duct insulation shall be:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

B. Concealed, rectangular, supply-air duct insulation shall be:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

C. Concealed, rectangular, return-air duct insulation shall be:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

D. Concealed, rectangular, outdoor-air duct insulation shall be:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

E. Exposed, rectangular, supply-air duct insulation shall be:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

F. Exposed, rectangular, return-air duct insulation shall be:
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1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

G. Exposed, rectangular, outdoor-air duct insulation shall be:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

3.13 ABOVEGROUND, OUTDOOR DUCT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Exposed, rectangular, exhaust air and outside-air duct insulation shall be:
   1. Mineral-Fiber Board: 3 inches thick and 3-lb/cu. ft. nominal density.

3.14 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor equipment in paragraphs below that is not factory insulated.

C. Chilled-water pump insulation shall be:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

D. Dual-service heating and cooling pump insulation shall be:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

E. Heating-hot-water pump insulation shall be:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

3.15 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
SECTION 23 07 00 – HVAC INSULATION

3.16 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:
   1. All Pipe Sizes: Insulation shall be Flexible Elastomeric, 3/4 inch thick.

B. Chilled Water:
   1. Insulation shall be Mineral-Fiber, Preformed Pipe, Type I, 1-1/2 inches thick.

C. Heating-Hot-Water Supply and Return:
   1. Insulation shall be Mineral-Fiber, Preformed Pipe, Type I, 2 inches thick.

D. Dual-Service Heating and Cooling:
   1. Insulation shall be Mineral-Fiber, Preformed Pipe, Type I, 1½ inches thick.

3.17 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts, Exposed: Aluminum, Smooth, 0.020 inch thick.

END OF SECTION 23 07 00
CONSTRUCTION STANDARDS DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

SECTION 23 09 33 – VARIABLE FREQUENCY DRIVES

PART 1-GENERAL

1.01 DESCRIPTION

A. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.

B. The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. VFD’s that are manufactured by a third party and “brand labeled” shall not be acceptable.

1.02 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronic Engineers (IEEE)
   2. Underwriters Laboratories
      a) UL508C
   3. National Electrical Manufacturer’s Association (NEMA)
      a) ICS 7.0, AC Adjustable Speed Drives
   4. IEC 16800 Parts 1 and 2

B. Qualifications:
   1. VFDs and options shall be UL listed as a complete assembly. VFD’s that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. VFDs requiring additional branch circuit protection are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fuses.
   2. CE Mark – The VFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level.
   3. Acceptable Manufactures
      Base Bid Standalone VFD
      a) Yaskawa Z1000 Series

      Alternate VFD
      b) ABB ACH550 VFD
      c) VFDs that are manufactured by a third party and “brand labeled” shall not be acceptable.
SECTION 23 09 33 – VARIABLE FREQUENCY DRIVES

1.03 SUBMITTALS

A. Submittals shall include the following information:
   1. Outline dimensions, conduit entry locations, and weight.
   2. Customer connection and power wiring diagrams.
   3. Complete technical product description include a complete list of options provided. **Any portions of the specifications not complied with must be clearly indicated or the supplier and contractor shall be liable to provide all components required to meet the specification.**
   4. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).

PART 2 – PRODUCTS

2.01 VARIABLE FREQUENCY DRIVES

A. The VFD package as specified herein shall be enclosed in a UL Listed Type enclosure, (NEMA rated enclosures are not acceptable) completely assembled and tested by the manufacturer in an ISO9001 facility.

   1. Environmental operating conditions: 0-40C continuous. Altitude 0 to 3300 feet above sea level, up to 95% humidity, non-condensing.
   2. Enclosure shall be rated UL type 12 and shall be UL listed as a plenum rated VFD. VFD’s without these ratings are not acceptable.

B. All VFDs shall have following features:

   1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
   2. The keypad shall include Hand-Off-Auto selections and manual speed control. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
   3. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control
SECTION 23 09 33 – VARIABLE FREQUENCY DRIVES

start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings. Capacitor backup is not acceptable.

4. The VFD shall be capable of both displaying on the VFD panel and communicating to the BMS the KWhrs used, MWhrs, Run Time, and Input KWHrs. Additionally, the VFD shall accept the dollars per KWHr for the facility ($/KWHrs) and use this to display and communicate the Dollars saved from running below full load.

5. The VFD shall be capable of displaying and communicating with BMS the tons of CO2 saved by not running at full load.

6. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

7. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.

8. The VFD shall have 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD’s with only one DC reactor shall add AC line reactors.

9. The VFD shall provide a programmable proof of flow Form-C relay outputs (broken belt / broken coupling). The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

C. All VFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.

2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an
independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (i.e. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network.

3. Two (2) programmable analog inputs shall accept current or voltage signals.

4. Two (2) programmable analog outputs (0-20 ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.

5. Six (6) programmable digital inputs.

6. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.

7. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.

8. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.

9. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

10. The VFD shall have an energy optimization routine that automatically adjusts the energy provided to the motor; continually matching to the specific load and speed of the attached mechanical system. VFDs that only provide generalized Linear or Squared Volts / Hz operation shall not be allowed.

11. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.

12. The VFD shall include password protection against parameter changes.
E. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (LED and alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words.

F. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

- Output Frequency
- Motor Speed (RPM, %, or Engineering units)
- Motor Current
- Drive Temperature
- DC Bus Voltage
- Output Voltage

G. The VFD shall include a fireman’s override input. Upon receipt of a contact closure from the fireman’s control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed or operate in a specific fireman’s override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlock, and force the motor to run in one of the two modes above. “Override Mode” shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.

H. Serial Communications

1. The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, BACnet, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be “certified” by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.

2. The BACnet connection shall be an RS485, MSTP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall
support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:

a. Data Sharing – Read Property – B.
b. Data Sharing – Write Property – B.
e. Device Management – Communication Control – B.

3. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. “Pass thru I/O” All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.

I. EMI / RFI filters. All VFD’s shall include EMI/RFI filters. The VFD shall comply with standard EN 61800-3 for the First Environment, restricted level with up to 100’ of motor cables. No Exceptions. Certified test lab test reports shall be provided with the submittals.

J. All VFD’s through 60HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not be damaged by this condition.

K. OPTIONAL FEATURES – Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. The bypass enclosure door and VFD enclosure must be interlocked such that input power is turned off before either enclosure can be opened. The VFD and Bypass as a package shall have a UL listed short circuit rating of 100,000 amps and shall be indicated on the data label.

1. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor, service (isolation) switch and VFD input fuses are required. Bypass designs, which have no
SECTION 23 09 33 – VARIABLE FREQUENCY DRIVES

VFD only fuses, or that incorporate fuses common to both the VFD and the Bypass will not be accepted.

2. Door interlocked, padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.

L. BYPASS CONTROLLER

The following operators shall be provided:
   a. Bypass Hand-Off-Auto
   b. Drive mode selector and light
   c. Bypass mode selector and light
   d. Bypass fault reset
   e. Bypass LDC display, 2 lines, for programming and status / fault / warning indications

1. Motor protection from single phase power conditions - The Bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in bypass mode are not acceptable.

2. The system (VFD and Bypass) tolerated voltage window shall allow the system to operate from a line of +30%, -35% nominal voltages as a minimum. The system shall incorporate circuitry that will allow the drive or bypass contactor to remain “sealed in” over this voltage tolerance at a minimum.

3. The Bypass system shall NOT depend on the VFD for bypass operation. The Bypass shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the enclosure for repair / replacement.

4. Serial communications – the Bypass and VFD shall be capable of being monitored and / or controlled via serial communications. Provide communications protocols for Modbus; Johnson Controls N2; Siemens Building Technologies FLN (P1) and BACnet.

5. BACnet Serial communication bypass capabilities shall include, but not be limited to; bypass run-stop control; the ability to force the unit to bypass; and the ability to lock and unlock the keypad. The Bypass shall have the capability of allowing the DDC to monitor feedback such as, bypass current (in amps), bypass kilowatt hours (resettable), bypass operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relay’s output status, and all digital input status. “Pass thru I/O” All Bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional bypass status indications and settings shall be
transmitted over the serial communications bus – keypad “Hand” or “Auto” selected, and bypass selected. The DDC system shall also be able to monitor if the motor is running under load in both VFD and Bypass (proof of flow) in the VFD mode over serial communications or Form C relay output. A minimum of 40 field parameters shall be capable of being monitored in the bypass mode.

6. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications), the VFD and bypass shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD system input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.

7. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor operation shall be indicated on the Bypass LCD Display as well as over the serial communications protocol.

8. The bypass control shall include a programmable time delay for bypass start and keypad indication that this time delay is in process. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.

9. The bypass control shall be programmable for manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will generate an automatic transfer to bypass and which faults require a manual transfer to bypass.

10. There shall be an adjustable motor current sensing circuit for the Bypass and VFD mode to provide proof of flow indication. The condition shall be indicated on the keypad display, transmitted over the building automation protocol and on a relay output contact closure.

11. The Bypass Controller shall have six programmable digital inputs, and five programmable form C relay outputs.

12. The relay outputs from the Bypass shall be programmable for any of the following indications.
   a. System started
   b. System running
   c. Bypass override enabled
SECTION 23 09 33 – VARIABLE FREQUENCY DRIVES

d. Drive fault
e. Bypass fault
f. Bypass H-O-A position
g. Motor proof of flow (broken belt)
h. Overload
i. Bypass selected
j. Bypass run
k. System started (damper opening)
l. Bypass alarm
m. Over temperature

13. The digital inputs for the system shall accept 24VAC or 24VDC. The Bypass shall incorporate internally sourced power supply and not require an external control power source. The Bypass power board shall supply 250 ma of 24 VDC for use by others to power external devices.

14. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and Bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.

15. The user shall be able to select the text to be displayed on the keypad when the safety opens. Example text display indications include “Firestat”, “Freezstat”, “Over pressure” and “Low pressure”. The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.

16. Class 10, 20, or 30 (selectable) electronic motor overload protections shall be included.

PART 3 – EXECUTION

12.01 INSTALLATION

A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the requirements of the VFD manufacturer’s installation manual.

12.02 START-UP

A. Certified factory start-up shall be provided for each drive by a factory certified service center. A certified start-up form shall be filled out for
SECTION 23 09 33 – VARIABLE FREQUENCY DRIVES

each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

12.03 PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line shall be available.

B. A computer based training CD or 8-hour professionally generated video (DVD format) shall be provided to the owner at the time of project closeout. The training shall include installation, programming and operation of the VFD, bypass and serial communication.

12.04 WARRANTY

A. Warranty shall be 36 months from the date of certified start-up, not to exceed 42 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION
SECTION 23 09 53 – PNEUMATIC AND ELECTRIC CONTROL SYSTEMS FOR HVAC

PART 1: GENERAL

1.01 System of Overview

A. The Building Automation System (BAS) shall include a hybrid HVAC temperature control system consisting of digital and pneumatic control components. Equipment controlled digitally shall include primary and secondary HVAC equipment including fans; chilled water coils, heating coils, pumps, humidification equipment, and VAV boxes.

B. Texas State University-San Marcos standard VAV boxes serving conditioned zone space shall be controlled digitally using electric actuators and temperature sensors.

C. Major HVAC component valve and damper actuators including air handler mixing dampers, smoke management system dampers, and air handler valves shall be electronic.

D. Texas State University-San Marcos standard building monitoring points shall be incorporated into the design.

E. Texas State University-San Marcos maintains standard HVAC control sequences which shall be incorporated into the project design. Control sequences are based on Texas State University-San Marcos standard HVAC equipment configurations. Deviations from standard equipment configurations shall require modifications to standard control sequences.

1.02 Compatibility – Digital

A. Due to the need for compatibility with existing BAS equipment, the automation contractor shall be approved by Texas State University-San Marcos Physical Plant prior to acceptance of the contractor’s proposal.

B. To ensure compatibility, design and procurement of the automation system shall include Texas State University-San Marcos Standard documents as follows:

1. Contractor technical proposal requirements
   a. BAS Cost Summary—completed by the proposed contractor.
b. BAS Scope Checklist—completed by the proposed contractor.

c. Equipment technical information.

d. Contractor personnel information.

2. Specifications

a. Control drawings and schematics

b. Point schedules

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION

3.01 Design Requirements

A. The 50% Schematic Document review submission shall include automation system plans and specifications and shall include a list of deviations from standards.

B. Statement of deviations from standards approved by Physical Plant.

C. Incorporate Physical Plant standard HVAC control documents and details into project Contract Documents.

D. Show BAS enclosure locations on mechanical plans. Coordinate locations with other divisions—architectural, electrical, telecommunications, etc. Ensure adequate mounting space and floor area including service access. Enclosure preferred location is adjacent to and within the same room as equipment served.

E. Show automation system communication requirements on telecommunication plans.

F. Two electrical circuits sourced from one panel location for automation system power and routed to each BAS enclosure. Power sourced from an emergency system.
3.02 Coordination

A. Fire alarm and smoke management system. Independent of BAS HVAC control system.
   1. Fire alarm system smoke detector shutdown and start/stop control of fans.
   2. Smoke management system control of dampers and fans.
   3. Interface with BAS for control of HVAC components.

B. Motor controls
   2. Variable speed drives: provisions to operate with 4-20ma, 0-10VDC or 3-15psi pneumatic control signal. Components for communication with BAS. 4-20 ma analog output signal from drive that varies in direct proportion to drive speed. Minimum 2 programmable analog outputs. Minimum two form C dry contacts for run mode and fault mode indication. Texas State University-San Marcos standard drive mounting configuration including disconnects and external bypass mounted on rack.

C. Electrical
   1. Power source: electrical contractor provides circuits and breakers at a central location. BAS contractor provides wire and conduit from this location to automation equipment.
   2. Source of all power for BAS including network hardware shall be emergency/backup power.

D. Telecommunications and Network
   1. Coordinate BAS network and telecommunications requirements with telecommunications design.
   2. BAS network requirements include one data outlet in each main mechanical room and at least one data outlet on each floor. Location of data outlet to be coordinated with location of BAS equipment enclosures. All circuits shall be routed back to centrally located BAS network switch.
Network switch shall be provided with UPS, which shall be powered from 30amp 120 VAC emergency power circuit. 30-amp circuit provided with NEMA L5-30 receptacle located adjacent to UPS location.

3. BAS telecommunication requirements include voice outlet in each main mechanical and electrical room with phone set.

E. Utility metering

1. Chilled water flow meter and temperature sensors. Steam or condensate meters and temperature sensors.

2. Other miscellaneous utility meters as required by project.

F. Safety Annunciator

1. Texas State University-San Marcos standard fan and motor safety annunciator and components shall be used.

END OF SECTION 23 09 5
1.01 Quality Assurance:

A. Installer’s qualifications: To be considered for this work, firms must have at least 3 years of successful installation experience on projects with hydronic piping work similar to that required for project. In addition, all welders performing installation of piping described in this Standard must be Certified Welders, and each weld must be stamped with the stamp of the welder performing the work.

B. This design guidelines contained herein includes the requirements for systems, materials, fittings and valves utilized for hydronic piping systems at Texas State University. It is the intention of this document to provide a standard for piping systems at Texas State University to provide the highest level of quality and standardization possible; it is not intended to be a guide specification.

C. Testing of the quality of the welds (x-ray or other testing method) may be required, and if so, shall be at the discretion and expense of the Owner.

1.02 Chilled Water System Design

A. Use full reverse-return routing on all chilled water coil piping.

B. Control chilled water flow through units with 2-way valves.

C. Chilled water design supply water temperature should be 45F, with a minimum return water temperature of 58F to maximize the usable lifetime (optimize pipe size of existing piping) of water systems. This shall be accomplished without the use of blending stations.

D. Modulate building chilled water pumps with variable frequency drives for pumps above 5 horsepower.

E. Codes and Standards:

1. ASME Compliance: Fabricate and install hydronic piping in accordance with ASME B31.9 “Building Services Piping”.
SECTION 23 21 13 – HYDRONIC PIPING IN BUILDINGS
PART 2: PRODUCTS

2.01 Basic Identification:

2.02 Basic Pipe and Pipe Fittings:
   A. Hydronic Piping:
   B. Pipe Size ½” (connections to fan coil units): Type “L” copper w/ wrought copper fittings.
   C. Pipe Size 2” and Smaller: Black steel pipe; Schedule 40; Class 125 cast-iron fittings with threaded joints.
   D. Pipe Size 2-1/2” and Larger: Black steel pipe; Schedule 40; wrought-steel butt welding fittings with welded joints.
   E. Pipe Size 2-1/2” and Larger: Black steel pipe with grooved joints; Schedule 40; Mechanical/grooved fittings and couplings. (Can be used at contractor’s option).
   F. Avoid use of 3-1/2 and 5-inch pipe.
   G. Drains and vents on chilled water distribution piping shall consist of Schedule 80 thread-o-lets, stainless steel pipe nipples and bronze gate valves.
   H. Section valves and shut off valves on chilled water distribution. Provide with extended stem to facilitate insulation installation.
      1. 2” and smaller: Full Port Ball Valves.
      2. 2 ½” and Larger: Rising Stem Gate Valves or Lug Mounted Butterfly Valves.
      3. Plug Valves: Balancing only.

PART 3: EXECUTION

3.01 Installation of Hydronic Piping:
   A. Install piping level with no pitch, and plumb and square whenever possible.
B. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.02 Installation of Valves:

A. Sectional Valves: Required on each branch and riser, close to main, where branch or riser serves 2 or more hydronic terminals or equipment connections, and elsewhere as indicated on the drawings.

B. Drain Valves: Required on each mechanical equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain hydronic-piping system.

C. Check Valves: Required on discharge side of each pump, and elsewhere as indicated.

3.03 Standard Equipment Connections:

A. General: Valve and union is required on supply and return, drain valve on drain connection.

B. Hydronic Terminals: Install hydronic terminals with hydronic terminal outlet valve and union on outlet; union, shutoff valve on inlet. Install manual air vent valve on element in accordance with manufacturer’s instruction. Where indicated, install automatic temperature control valve with unions between shut-off valve and element on supply line.

END OF SECTION 23 21 13
SECTION 23 21 14 – SECONDARY CHILLED-WATER PIPING SYSTEMS

PART 1: GENERAL

1.01 General:

A. Avoid 3-1/2 and 5-inch pipe in chilled-water systems; except that 5” chilled water meters are OK.

B. Schedule 80 nipples and Class 200 Bronze Gate Valves with rising stem. Full Port Ball valves are acceptable: 2” or smaller. Plug Valves: balancing only.

C. Use only gate valves with rising stem, 200 psi rated, in lines 2 ½” or larger, or use lug mounted butterfly valves of 200 psi or greater rating with stainless trim and rubber seat (bubble tight shut off).

1.02 Chilled Water Systems Serving Secondary Loads:

A. Chilled water systems serving secondary loads shall be independently circuited from the primary chilled water system within the building and serve mechanical systems such as standalone computer HVAC, refrigeration equipment, etc.

B. Each loop shall be provided with independent circulating pump. Pump shall be located in easily accessible areas for service and not above ceiling.

C. System shall be independently controlled by equipment served.

D. System shall be provided with check valves to prevent unregulated flow from supply and return.

E. System shall be provided with appropriate alarm and monitoring points for remote annunciation through FCMS.

F. As to extent practical all secondary loads shall be consolidated into a minimum number of separate chilled water circulating loops. Aggregation of equipment on such loops shall be approved in advance by Texas State University.
SECTION 23 21 14 – SECONDARY CHILLED-WATER PIPING SYSTEMS

1.03 Cleaning Chill Water System Piping:

   A. See Section 23 25 00

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 23 21 14
SECTION 23 22 13 – STEAM & CONDENSATE HEATING PIPING

PART 1 – GENERAL

1.01

A. High-pressure steam and condensate gaskets shall be asbestos-free spiral-wound gasket.

B. Low pressure steam shall be provided by a two-stage steam pressure-reducing station (60 psi reduced to 15 psi), and 25% / 75% PRV’s.

C. Steam pressure-reducing valves shall be Spence ED (with SECO-Weld seats) with stainless steel trim or Leslie GPS-1EP with stainless steel trim. Contractor shall provide Owner with manufacturer’s recommended repair kit for each steam pressure-reducing valve.

D. Steam PRV’s over 2” shall be flanged. 2” or smaller shall be threaded.

E. Campus high-pressure steam is 60 psig, 308° F., with design conditions for 135 psig. (400° F).

F. Avoid 2-1/2, 3-1/2 and 5-inch pipe in steam and condensate systems.

G. Pipe and fittings through the high-pressure PRV’s, up to and including the first downstream block valves shall be schedule 80/300 pound.

H. Include certain spare parts in project, deliverable to Owner. These include one spare of every size high-pressure steam trap and high-pressure steam pressure-reducing valve installed.

1.02 Cleaning Steam & Condensate Heating Piping:

A. Steam lines shall be cleaned via a steam blow to atmosphere for a period of 3-5 minutes each five times. Condensate lines can be cleaned by placing in service and wasting condensate to drain until clear/clean.

B. When condensate is placed to drain add cooling medium to the condensate to meet the city temperature requirements.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 23 22 13

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Steam & Condensate Heating Piping-23 22 13-1
SECTION 23 22 23 – STEAM CONDENSATE PUMPS

PART 1: GENERAL

1.01

A. Condensate pumping units shall be Aurora Series 220 condensate pumping units; bronze fitted centrifugal pumps with stainless-steel shafts and Viton mechanical seals with 1750-rpm motors and cast-iron receivers. Units shall come pre-wired with mechanical alternator. Receiver shall have thermometer and sight glass. Receiver shall have a drain line to floor drain.

B. Arrange the inlet piping to the condensate receiver so Owner can dump condensate to floor drain before it ever enters the receiver.

C. Avoid the use of plug valves in condensate systems.

D. Avoid 2-1/2, 3-1/2 and 5-inch pipe in steam and condensate systems.

E. Use 316 SS tubing with Swagelok fittings between the discharge of all condensate pumps and the connection at the utility tunnel.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 23 22 23
SECTION 23 25 00 – HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions, Division 01 Specifications, Component Special Conditions, and addenda.

1.2 SUMMARY

A. Pre-Operational Cleaning, Passivation, Flushing and Discharge requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. An alkaline detergent, containing emulsifier, dispersant and polyphosphate mixture, is acceptable.
B. Product must be non-nitrite and non-acidic.
C. Products must be approved by a representative from Texas State University Environmental Health Safety and Risk Management (EHS&RM) office and the City of San Marcos (City). The product must clean the pipe without acid etching or causing a surface conversion or displacement of iron from the pipe.

PART 3 –EXECUTION

3.1 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, valves, etc.

3.2 CHILLED WATER PIPE PRE-OPERATIONAL CLEAN & FLUSH

A. Chemical Treatment Vendor

1. Chemical treatment will be provided by a Vendor approved by Texas State University. Vendor will provide the following:
   a. Responsibility for piping passivation.
   b. Personnel to take samples of water during passivation
   c. Water testing reports from an approved testing laboratory.
   d. Recommendation to EHS&RM, when water is acceptable for final testing by EHS&RM.
e. Written documentation of all cleaning and flushing procedures and results.
f. Calculate (based on volume of piping added) and provide to Texas State University Central Plant post-cleaning and final operational chemicals.

2. Cleaning and flushing process is summarized briefly as follows:
   a. Inject cleaning chemicals after Contractor has rinsed and re-filled piping system with approved water.
   b. Circulate water throughout piping system for minimum 48 hours; take water samples every 4 to 6 hours; test samples for iron. Circulate water until analytical testing has confirmed that iron removal has reached its “plateau”, but a minimum of 48 hours.
   c. EHS&RM will perform final water chemistry test to determine if the water is safe to discharge to sanitary sewer or into storage tank to hold for off-site disposal.
      1. For discharge to sanitary sewer, see Section 3.02 Discharge below.
   d. Final operational chemicals will be injected by Texas State University.

B. Contractor

1. Coordinate with representatives of Texas State University, A/E, and Consultants regarding circulation piping installation, operation, and water quality testing.
   a. Attend meeting(s) with representatives of Texas State University to plan and coordinate cleaning, passivation, flushing, discharge and chemical treatment activities.
2. Contractor will provide the following:
   a. Submittals for chemicals and equipment.
   b. Circulating pump and power for same.
   c. All materials necessary to connect circulating pump to new chilled water system piping.
   d. Tank for storage and proper disposal if water is unacceptable to discharge to sanitary sewer.
   e. Cleaning will be performed in all new sections of metal piping that are 100 gallon capacity or greater. All cleaning will be performed in the presence of the Texas State University qualified representative.
   f. Cleaning the metal piping must be performed prior to connecting the lines into a Texas State University system loop. The purpose of the cleaning is to remove any dirt or debris that was introduced during construction as well as oils and coatings on the piping left from the manufacturing process. This cleaning standard also applies to metal pipe for hot water and metal pipe for chill water system. Fill system with clean
water, approved by Texas State University, and rinse pipe for 4 hours to remove dirt and construction debris.
g. Discharge the rinse water directly to the sanitary sewer, per City of San Marcos requirements. Do not re-use rinse water.
h. Re-fill pipe with approved water; coordinate with Chemical Treatment Vendor for injection of cleaning chemicals. The cleaning process will follow the product manufacturer’s procedures in terms of dosing, monitoring and pH control and these procedures must be provided to FPDC. The chemical representative will be responsible for dosing the chemical at the recommended dosage rate.
i. Once the solution has circulated in the lines for 48 hours, a sample will be collected by an EHS&RM representative and sent to a laboratory for analysis of the industrial wastewater permit discharge parameters. Next day analysis will be requested. The water in the piping will continue to circulate during the analysis period. If testing confirms that the water is safe to discharge, then discharge as described in Section 3.3 Discharge. Do not re-use treated water.
j. Immediately fill pipe with approved water and circulate the water for 2 hours, then discharge as described in Section 3.3 Discharge. Do not re-use water.
k. If discharge to sanitary sewer is not allowed by test results or by the City of San Marcos, discharge to the storage tank and properly dispose of water off-site.
l. Re-fill system with approved water and coordinate with Texas State University for injection of final operational chemicals.
m. Install piping and valves, per contract drawings and specifications, in such a manner as to facilitate installation of chemicals. Use whatever temporary connections are required for cleaning, purging and circulating through each new run of pipe
n. Install, delay installation of, or temporarily remove flanges, valves, fittings, etc. as required to facilitate cleaning and flushing connections and activities. Use flanged connections to allow for connections. Re-install flanges, valves, piping, etc. to close system and prepare for service after chemical treatment is complete.
o. A piped source of city water, at local city water pressure, with shutoff valve, in convenient location to allow filling of piping system.
p. Traffic control and safety fencing if/as required for circulating pump.

3.3 DISCHARGE

1. There will be no discharge to the sanitary sewer or storm sewer without prior approval by Texas State University and the City of San Marcos.
2. ESH&RM (liaison with the City) will notify the City in writing of the volume of cleaning water (provided by contractor), date of cleaning and chemical in use. EHS&RM will notify the City of the sample results and receive approval or denial to discharge to the sanitary sewer.

3. If the discharge is approved by the City, the Director of Utilities Operations and EHS&RM, Contractor can discharge to the sanitary sewer at a rate specified by the approval. Only discharge during normal operating business hours. No overnight discharging will be allowed. Flush the lines by circulating with clean water and discharge to the sanitary sewer until the water has clarified as witnessed by the FPDC representative. Coordinate with the FPDC representative for gradual filling of the lines and preparation to tie into the campus piping loop.

4. If the City denies the discharge to the sanitary sewer, offsite disposal of this volume plus two rinse volumes will be required at the expense of the Contractor. Contractor is responsible to include an Allowance in the construction cost for disposal of the rinse volume plus two clean water rinses. If Allowance is not used or required, the Allowance returns to the Owner (Allowance to be indicated as a separate line item on the Schedule of Values). The EHS&RM representative must approve the offsite disposal method and location and receive documentation of the shipment.

END OF SECTION SS 232500
CONSTRUCTION STANDARDS                          DIVISION 23 – HEATING, VENTILATING
AND AIR CONDITIONING

SECTION 23 31 00 – HVAC DUCTS AND CASINGS

PART 1: GENERAL

1.01 Work Included

A. This section provides for furnishing and installing low velocity and high velocity
ductwork and includes duct construction and accessories.

1.02 Applicable Provisions

A. Refer to Section 23 00 00, Heating, Ventilating and Air Conditioning (HVAC).

1.03 Guarantee

A. Guarantee all ductwork for one year from the date of final acceptance. The
guarantee will cover workmanship, noise, chatter, whistling, or vibration.
Ductwork must be free from pulsation under all conditions of operation. Correct
any and all defects that appear after the system is put in operation. Submit
corrective measures to Architect for review prior to implementation.

1.04 Submittals

A. Submit ductwork shop drawings, including ¼ inch per foot floor plans and
equipment room plans. Refer to Section 23 00 00 for requirements.

B. Submit oval duct reinforcing methods; submit casing and plenum shop drawings.

1.05 Contractor Coordination

A. Erect all ducts in the general locations shown, but conform to all structural and
finish conditions of the building. Before fabricating any ductwork, check the
physical conditions at the job site and make all necessary changes in cross
sections, offsets, and similar items, whether they are specifically indicated or not.

B. Refer to Section 23 00 00 for coordination requirements between ductwork and
other trades. Especially careful coordination prior to commencement of any work
will be required.

1.06 Standards and Codes

A. Except as otherwise indicated, sheet metal ductwork material and installation
shall comply with the latest edition of SMACNA HVAC Duct Construction

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SECTION 23 31 00 – HVAC DUCTS AND CASINGS

Standards (SMACNA) for the appropriate pressure classification. All air distribution devices (such as dampers) included in this specification shall comply with latest edition SMACNA and NFPA 90A.

PART 2: PRODUCTS

2.01 Duct Material

A. Except for the special ducts specified elsewhere, use prime galvanized steel sheets or coils up to 60 inches wide. Stencil each sheet with proper gage and manufacturer’s name. Stencil coils of sheet steel throughout on 10-foot centers with gage and manufacturer’s name. Contractor is cautioned that Engineer may random check duct and strap gauges with a micrometer to verify compliance with the specifications.

2.02 Sealing of Seams and Joints

A. The entire duct system shall be sealed. Do not use oil solvent based sealants except where specifically allowed herein. Seal the seams and joints of ductwork and fittings by applying one layer of sealant, then immediately spanning the joint with a single layer of 3 inch wide open weave glass fiber tape, then apply sufficient additional sealant to completely embed the cloth. Thoroughly clean the duct areas to be sealed prior to application of tape and sealant.

2.03 Low Pressure Ductwork (Less Than 3 Inches Static Pressure)

A. Ductwork downstream of terminal units and exhaust ductwork downstream of fans is defined as low pressure ductwork.

B. Rectangular. Furnish rectangular low pressure ducts constructed of sheet metal with metal gages meeting or exceeding that required in latest edition SMACNA, heavy enough to withstand the physical abuse of installation, or in the following minimum gages:

<table>
<thead>
<tr>
<th>Largest Dimension</th>
<th>U.S. Gage</th>
</tr>
</thead>
<tbody>
<tr>
<td>12” and less</td>
<td>No. 26</td>
</tr>
<tr>
<td>13” to 30”</td>
<td>No. 24</td>
</tr>
<tr>
<td>31” to 54”</td>
<td>No. 22</td>
</tr>
<tr>
<td>55” to 84”</td>
<td>No. 20</td>
</tr>
<tr>
<td>85” and above</td>
<td>No. 18</td>
</tr>
</tbody>
</table>

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SECTION 23 31 00 – HVAC DUCTS AND CASINGS

C. Round. Furnish round, low-pressure ducts which are spiral wound, such as manufactured by United McGill. Use the following gages for shop fabricated ducts:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>U.S. Gage</th>
</tr>
</thead>
</table>

D. Low Pressure Insulated Flexible Duct

1. Furnish factory-fabricated, flexible duct for connections between low velocity trunk ducts and supply air diffusers.

2. Furnish flexible duct with an airtight inner liner, insulation and outer jacket. Construct the inner liner of coated steel helix and fabric substantially bonded together to prevent the duct from collapsing or kinking in short radius bends.

3. Furnish fiberglass insulation at least 1-inch thick (R-6) and ¾ pound minimum density around the inner liner. Sheath the entire assembly with heavy, outer vapor-barrier jacket or reinforced aluminum foil kraft.

4. Maximum length of flexible duct is 7 feet.

5. Use a supply duct rated at a minimum positive working pressure of 1-1/2 inches of water. Exhaust ducts must withstand a negative pressure of 1.5 inches of water.

6. Furnish duct listed by UL at flame spread rate of not over 25 and smoke developed rate of not over 50, and complying with NFPA Standard 90A, paragraph 113a.

2.04 Medium Pressure Ductwork (3 Inches Through 6 Inches Static Pressure)

A. Ductwork downstream of all air handlers, up to and including terminal units, plus all return ductwork and all exhaust ductwork upstream of fans is defined as medium pressure.

B. Rectangular. Furnish rectangular, medium-pressure duct construction, gages and reinforcing in accordance with table 1.8 of the latest SMACNA HVAC Duct Construction Standards Manual.

C. Round. Use spiral-wound ducts up to 48 inches in diameter, equivalent to those of United McGill. Also furnish fittings equal to those of United McGill.
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Largest Dimension  U.S. Gage
18” and less        No. 24
19” through 48”     No. 22
49” through 72”     No. 20
73” and over        No. 18

D. Oval. Furnish oval, medium-pressure ducts that are spiral-wound, flat oval, or welded flat oval equivalent to those of United McGill with gages and reinforcing as recommended by the manufacturer for medium-pressure. Use fittings equal to those of the United McGill. The ducts may be shop fabricated of completely welded construction of the following gage:

Major Axis Dimension  U.S. Gage
20” and less          No. 24
21” through 30”       No. 22
31” through 46”       No. 20
47” through 50”       No. 18
51” and over          No. 16

E. Use longitudinal seam, rolled, welded, and provided in standard lengths of 4 and 5 ft. for oval ducts greater than 24” x 72”. Factory weld or field connect with flanges or slip couplings, all transverse joints. Fabricate such ducts from galvanized steel meeting ASTM A527 and in accordance with the following table:

Major Axis Dimension  U.S. Gage
36” and less          No. 20
36” through 60”       No. 18
61” through 144”      No. 16

2.05 Fire and Smoke Dampers

A. Quality Standards. Furnish and install fire and smoke dampers according to NFPA Standards and SMACNA Duct Manual. Dampers must bear UL label. Use blade dampers when blade width exceeds 12 inches.

B. Furnish access doors in attached ductwork for inspection. Stencil each door “FIRE DAMPER ACCESS” or similar notation as appropriate for the type of damper to be accessed.

C. Fire Dampers. Furnish Ruskin DIBD2 or equivalent, Style B for rectangular ducts, Style CR for round ducts, 95% minimum free area, UL Dynamic rating, constructed and tested in accordance with latest edition of UL Standard 555, for vertical or horizontal mounting, 1-1/2 hour fire rated under UL Standard 555,

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SECTION 23 31 00 – HVAC DUCTS AND CASINGS

165°F fusible link, galvanized steel sleeve as required to meet applicable codes, retaining angles, and picture frame mounting angles.

D. Combination Smoke and Fire Dampers. Furnish Ruskin FSD-60 dampers, or equivalent, with minimum 16 gage galvanize steel hat channels shape frame; stainless steel sleeve bearings; airfoil shaped double skin 14 inch galvanized steel blades; silicone rubber / galvanized steel mechanically locked in blade edge seals that withstand 450°F; stainless steel flexible metal compression type jamb seals; 1-1/2 hour fire rated under UL Standard 555; UL classified as a Leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same; damper manufacturer shall have tested and qualified with UL a complete range of damper sizes covering all dampers required by this specification; leadage class I; demonstrated capacity to open and close under HVAC system operating conditions, with pressures of at least 4 in. w.g. in the closed position, and 500 fpm air velocity in the open position; 120 volt actuator motor; 20 inch long, caulked factory sleeve, gage as required to meet code; and TS150 Firestat 165°F option.

2.06 Duct Mounted Wall Detectors

A. Wherever required by applicable codes and not shown on the Electrical drawings, furnish and install duct-mounted smoke detectors and coordinate with electrical to provide shutdown of air units as applicable. This includes but is not limited to the supply and return of all air units with a scheduled air quantity of 2,000 cfm or more.

2.07 Wall Louvers

A. Louvers are furnished under other sections of these specifications.

2.08 Acceptable Manufacturers

A. Round and flat oval ductwork and fittings. Spiral Pipe of Texas, United McGill, or accepted substitution.

B. Proprietary duct joining systems. Ductmate, Ward Industries, no substitutions. May be used in lieu of flat oval ductwork at Contractor option.

C. Low and medium pressure ductwork sealant. “MP” Hardcast Iron Grip 601; United Duct Seal water base, latex, or acrylic sealant; or accepted substitution.

SECTION 23 31 00 – HVAC DUCTS AND CASINGS

E. Flexible duct. Thermaflex, Porter, Wiremold, or accepted substitution.

F. Fire and smoke dampers. Nailor, Prefco, Rusko, or accepted substitution.

PART 3: EXECUTION

3.01 Installation

A. Construction Standards. Construct and erect ductwork in a “first class” workmanlike manner. Use construction methods which follow the requirements outlined in the latest Edition of SMACNA HVAC Duct Construction Standards, as well as SMACNA Balancing and Adjusting publications, unless otherwise indicated in these specifications or accompanying drawings.

B. Reinforcement. Reinforce ducts having one side equal to 25 inches or more in accordance with recommended construction practice of SMACNA.

C. Plenum Construction. Construct Plenum chambers of not less than No. 20 U.S. gage metal reinforced with galvanized structural angles.

D. Cross Breaking or Beading: Cross break or bead sheet metal for rigidity, except ducts which are 12 inches or less in the longest dimension.

E. All duct sizes shown on the drawings are clear inside dimensions.

F. Drill or machine punch all holes in ducts required for damper rods and other necessary devices, no larger than necessary.

G. Temporarily cap with sheet metal any duct openings left unconnected overnight.

H. Wall Penetrations. Where ducts pass through walls in exposed areas, furnish and install suitable escutcheons made of sheet metal angles as closers. At all locations where ductwork passes through floors, furnish and install watertight sleeves projecting 3 inches above finished floor and flush with bottom of floor slab. Fabricate sleeves of 1/8 inch thick steel, galvanized after fabrication. Anchor into adjacent floor slab as required. Sleeves are required inside as well as outside chases. Support ducts where passing through floors with steel structural angles of adequate bearing surface, galvanized after fabrication and resting on top of the sleeve.

I. Interior Painting. Interior painting of metal ductwork exposed to view through grilles, registers, and other openings is specified in the section on painting. Do not install grilles, registers, or similar items until painting is complete.
SECTION 23 31 00 – HVAC DUCTS AND CASINGS

3.02 Low Pressure Ductwork

A. Splitters. Furnish and install adjustable, galvanized splitter-dampers pivoted at the downstream end with appropriate control device at each supply duct split, in accordance with SMACNA Duct Manual. Furnish and install a splitter for each duct branch to two or more outlets.

B. Extractors. Furnish and install Titus AG225 extractors with an appropriate control device at each rectangular zone or branch supply duct connection in accordance with SMACNA Duct Manual.

C. Volume Dampers. Furnish and install opposed-blade volume dampers with an appropriate control device in each return air, outside air and exhaust branch duct, in exhaust connections to hoods or equipment, and where otherwise indicated, in accordance with SMACNA Duct Manual.

D. Furnish and install multi-blade dampers when blade width exceeds 12 inches.

E. Elbows:

1. Rectangular. Use radius elbows with a centerline radius of not less than 1-1/2 times the duct width wherever possible. Mitered elbows may be used in lieu of radius elbows where space requirements dictate. Where square elbows are used, furnish and install Barber-Coleman double-wall airfoil turning vanes. Job-fabricated turning vanes, if used, must be double thickness of vanes of galvanized steel sheets of the same gage metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset.

2. Round and Oval Duct. Use elbows with a centerline radius of 1-1/2 times the duct diameter or duct width wherever possible. For round ducts, furnish smooth elbows or 5-piece, 90 degree elbows and 3-piece, 45 degree elbows, slip type, minimum three sheet metal screws.

F. Controls. For control devices concealed by ceilings, furring, or in other inaccessible locations, use extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. For ducts which are not concealed, or ducts which are above lay-in ceiling but accessible, furnish heavy-duty, quadrant-type, adjustable regulators having wing nuts for locking in position. Saw-mark the ends of all operating rods for dampers and air control devices to indicate damper position. Mount all controls outside duct insulation, with standoffs from the ductwork as required.
SECTION 23 31 00 – HVAC DUCTS AND CASINGS

G. Obstruction. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.

H. Remote Operated Dampers. Furnish factory-fabricated volume dampers for remote, manual volume control. Use opposed-blade, balanced type, pivoted in bronze bearings and mounted in a channel frame. Operate damper through a flexible-drive cable from a wall-mounted operating knob. Use remote operated dampers for all dampers above hard ceilings, and other locations as required.

I. Low Pressure Insulated Flexible Duct. Do not exceed 6 feet in length with any flexible duct. Support duct independently of lights, ceiling and piping.

J. Low Pressure Duct Supports.

1. Horizontal Ducts Up To 40 Inch. Support horizontal ducts up to and including 40 inches in their greater dimension by means of No. 18 U.S. gage band iron hangers attached to the ducts by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beamclamps or other approved means. Place supports on no more than 8 ft. centers. Use clamps to fasten hangers to reinforcing on sealed ducts.

2. Horizontal Ducts Larger Than 40 Inch. Support horizontal ducts larger than 40 inches in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on no more than 8 ft. centers according to the following:

<table>
<thead>
<tr>
<th>Angle Length</th>
<th>Angle</th>
<th>Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'-0”</td>
<td>1-1/2” x 1-1/2” x 1/8”</td>
<td>¼”</td>
</tr>
<tr>
<td>6'-0”</td>
<td>1-1/2” x 1-1/2” x 1/8”</td>
<td>¼”</td>
</tr>
<tr>
<td>8'-0”</td>
<td>2” x 2” x 1/8”</td>
<td>5/16”</td>
</tr>
<tr>
<td>10'-0”</td>
<td>3” x 3” x 1/8”</td>
<td>3/8”</td>
</tr>
</tbody>
</table>

3. Vertical Ducts. Support vertical ducts where they pass through the floor lines with 1-1/2” x 1-1/2” x ¼” angles for ducts up to 60 inches. Above 60 inches the angles must be increased in strength and sized on and individual basis considering space requirements.

3.03 Medium Pressure Ductwork

A. Rectangular. Construct rectangular ducts as noted in latest edition SMACNA. Furnish reinforcing method as shown without tie rods through 60-inch-size. For ducts 61 inches and over, use tie rods to keep reinforcing angles to 2-inch
SECTION 23 31 00 – HVAC DUCTS AND CASINGS

minimum. Use sealant (3M EC-800) and 4-inch-wide Glasfab at all of the joints on rectangular ducts in shop and field to provide positive seal. Furnish sufficient sealant to completely embed the cloth.

B. Round Furnish round, medium-pressure duct construction as noted in latest edition SMACNA. Seal joints with 3M EC-800, lapped a minimum of 3 inches, secured with sheet metal screws and covered with sealant, over which is applied a 4-inch—wide Glasfab cloth. Apply additional sealant until the cloth is completely embedded, or welded. Make 90-degree branch take-offs with conical tees. Weld take-off fittings to fittings or to the main duct. Clean and coat all welds with rust-inhibiting paint. Stamp elbows as smooth-type, or 5- or 3-piece gore type, with either type having centerline radius of 1-1/2 times the duct diameter.

C. Oval. Use construction, taps sealing, and other features similar to that specified for round, medium-pressure ductwork.

D. Elbows.

1. Rectangular. Construct radius and vaned elbows in accordance with SMACNA.

2. Round and Oval. Furnish elbows having centerline radii of 1-1/2 times the duct diameter or width. For round ducts, smooth elbows, or 5-piece, 90° elbows and 3-piece, 45-degree elbows are permitted.

E. Connections to VAV Terminal Units. Make hard duct connections, with a minimum of 3 times the duct diameter upstream of the connection as straight duct, at all terminal units. Flexible duct connections are not acceptable.

F. Medium Pressure Duct Supports. Install hangers and supports in accordance with SMACNA.

3.04 Exhaust Ductwork

A. Construct and leak test all exhaust ductwork as specified above for medium pressure ductwork.

3.05 Flexible Connections

A. Where ducts connect to fans or air handling units, make flexible airtight connections using “Ventglas” fabric. The fabric must be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard.
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Furnish a minimum of ½-inch slack in the connections, and a minimum of 2-1/2-inches distance between the edges of the ducts. Also furnish a minimum of 1-inch slack for each inch of static pressure on the fan system. Securely fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where rectangular connections are made in outdoor locations, seal fabric to metal with mastic. For connections to belted vent sets outdoors, furnish Duall fan connector, Koroseal, black with UV inhibitors. Secure with stainless steel bands.

3.06 Access Doors

A. Install ductwork access doors in structural angle frames and furnish with sash locks and hinges arranged for convenient access. Construct doors which occur in insulated ducts with insulation filler.

3.07 Flashing

A. Where ducts pass through roofs or exterior walls, furnish suitable flashing to prevent rain or air currents from entering the building.

Furnish flashing not less than No. 26 gage stainless steel or 16-ounce copper.

3.08 Duct Lining

A. Install glass fiber acoustical lining in return air sound traps only. Size duct to keep clean inside dimensions as indicated on the drawings. Furnish ½-inch thick, 1-1/2 pound density, flexible lining coated on the air stream side to reduce attrition. Secure to duct surfaces with Benjamin Foster 85-25 adhesive and sheet metal fasteners on 12-inch centers. Omit lining as necessary to permit satisfactory operation of air control devices. Coat all exposed edges and leading edges of cross joints with adhesive. Use liner such as Johns-Manville Lina-Coustic, which meets requirements of NFPA 90-A.

3.09 Tests

A. Equipment. Furnish equipment necessary for performing tests, including rotary blower, orifice section and U-tube gage board complete with cocks and rubber tubing.

B. Low Pressure Ductwork.

1. Allowable Leakage. Test ductwork for leaks before concealing. Maximum allowable leakage is 5 percent of total flow.
SECTION 23 31 00 – HVAC DUCTS AND CASINGS

2. Risers and Branch. Test duct riser or branch duct including flexible duct runouts in accordance with SMACNA manual.

3. Mains. Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Furnish pressure in mains above design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.

C. Medium Pressure Ductwork.

1. Pressure test according to 1985 SMACNA Chapter 10 procedures to 6 in. w.g. Maximum allowable leadage is 1% of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leadage for all sections must not exceed the allowable leakage.

2. Test the entire system including the VAV Terminal Units. After testing has proven that the ductwork is installed and performs as specified, connect the terminal units to the ductwork and seal the connections with extra care. Inform the Owner when splits, or improper sealing of the joints. Repair any leakage in the connections discovered after the systems have been put into service by complete removal of the sealing materials, thorough cleaning of the joint surfaces, and installation of multiple layers of sealing materials.

3. At Owner’s option, Contractor may be allowed to exclude the terminal units from testing by capping the supply ductwork upstream of the terminal units, then inspecting the connection to terminal units when completed. This option may only be exercised by the Owner, and then only if documented in writing prior to testing.

END OF SECTION 23 31 00
SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1: GENERAL

1.01 Scope

A. This section provides for the furnishing and installation of air distribution devices, including grilles, diffusers, registers, dampers, extractors, terminal boxes and sound attenuators.

1.02 Applicable Provisions

A. Refer to Section 23 00 00, Heating, Ventilation and Air Conditioning (HVAC).

1.03 Cooperation With Other Trades

A. Coordinate this work with work under Section 26, Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.04 Submittals

A. Submit product data for outlets, grilles, registers, control devices, terminal boxes, sound attenuators, and similar equipment.

1.05 Finishes

A. Paint devices with factory standard white enamel finish.

PART 2: PRODUCTS

2.01 Approved Diffusers Types: Obtain approval from Project Representative on locations within Building.

A. Louvered. Furnish louvered, fixed-pattern, multiple cone diffusers with removable center cone, frames and white factory finish.

   1. Select faces and necks that are circular, rectangular or square, of the size and configuration indicated.

   2. Construct diffusers and frames of aluminum.
SECTION 23 33 00 – AIR DUCT ACCESSORIES

3. Use a frame compatible with the type of ceiling in which the diffuser is installed.

B. Perforated. Furnish adjustable-pattern, aluminum diffusers and frames with white factory finish. Frame the diffuser face with a mitered and welded frame fitted with controllers of adjustable pattern.

C. Dampers. Furnish an opposed-blade damper easily adjustable through the outlet for scheduled diffusers. Furnish operating rod extensions as required for damper adjustment.

2.02 Grilles

A. Supply. Use double-deflection supply grilles made of aluminum.

1. Furnish vertical face blades and horizontal rear blades. Furnish solid, extruded aluminum blades which are individually adjustable. Space at not more than ¾-inch centers for rear blades and ½-inch centers for face blades and not less than 5/8-inch deep.

2. Employ grille frames of extruded aluminum with welded and mitered corners and mounting gaskets.

B. Return.

1. For ceiling return, furnish perforated-face or louvered type, with white factory finish. Use construction and frame styles as specified for ceiling diffusers, but without pattern controllers. Use neck sizes as shown.

2. For wall return, furnish a fixed-blade, aluminum grille, essentially sightproof, having curved or angular break, inclined blades. Space the blades at ½-inch centers to achieve sightproof feature. Furnish hemmed or fully rounded leading edges. Furnish extruded aluminum grille frames with welded and mitered corners. Include mounting gaskets.

2.03 Registers

A. Supply. Furnish double-deflection supply registers with aluminum, vertical face blades and horizontal rear blades. Use an integral, key-operated, opposed blade damper.
SECTION 23 33 00 – AIR DUCT ACCESSORIES

1. Furnish solid, extruded aluminum blades which are individually adjustable. Space not more than ¾-inch centers for rear blades and ½-inch centers for face blades and not less than 5/8-inch deep.

2. Employ grille frames of extruded aluminum with welded and mitered corners and mounting gaskets.

B. Return and Exhaust. Furnish return and exhaust registers identical to return grilles except for the addition of an integral key-operated, opposed-blade damper.

2.04 Accessories

A. Supply Grille Extractors. Furnish each supply grille with an air control device capable of positively regulating the volume of air extracted from the supply duct.

1. Select extractors similar to Titus Model AG45, tight-closing in the minimum position. Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, furnish a control rod equipped with a locking quadrant.

2. For ductwork control, use Young regulators. Furnish extractors 30 inches and longer with a support rail inside of the duct at the outboard quarter point of the extractor. Construct the support rail of angle or channel members formed of sheet metal fastened securely to the duct. Make the rails 18 inches long, except where duct width prevents the extractor from sagging when moved toward its maximum position.

3. Check extractors thoroughly for freedom of operation. If necessary, oil bearing points before installing.

B. Mounting Frames. Furnish a companion, all-purpose mounting frame constructed like a grille frame for each grille or register not equipped with a removable core to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.

1. Furnish frames with ½-inch-thick sponge rubber gasket to prevent air leakage.

2. Furnish a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.
SECTION 23 33 00 – AIR DUCT ACCESSORIES

2.05 Supply Air Sound Attenuators

A. Construct casings of not less than 22-gage galvanized steel for diameters up to 36 inches, and 18-gage for diameters up to 48 inches. Furnish perforated face sheets over acoustical material of not less than 5.0 pounds per cubic foot of compressed density glass fiber or mineral wool.

B. Furnish acoustical liners of the same density around the outside perimeter and in the center baffle of the silencer. Use attenuators with capacity to handle air quantities scheduled at no more than 0.50-inch of water pressure drop with acoustic performance as tabulated below:

<table>
<thead>
<tr>
<th>Octave Pass Bands (Hz)</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuation (dB):</td>
<td>4</td>
<td>8</td>
<td>13</td>
<td>25</td>
<td>28</td>
<td>25</td>
<td>20</td>
<td>17</td>
</tr>
</tbody>
</table>

2.06 Return Air Sound Attenuators

A. Construct casings of not less than 22-gage galvanized steel. Furnish perforated face sheets over the acoustical material of not less than 24-gage galvanized steel. Use mineral fiber or organic glass acoustical material. Apply fiberglass cloth between filler material and face sheets.

B. Coat solid surfaces with vibration-dampening material to assure that equal attenuation will be provided not only in the direction of air flow, but also through duct silencer walls. Furnish attenuators to handle air quantities as scheduled at no more than 0.25-inch of water pressure drop with acoustic performance as tabulated below:

<table>
<thead>
<tr>
<th>Octave Pass Bands (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 250 500 1000 2000 4000 8000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attenuation (dB):</th>
</tr>
</thead>
<tbody>
<tr>
<td>3’ long: 11 16 23 36 42 34 28</td>
</tr>
<tr>
<td>5’ long: 16 25 37 45 44 38 22</td>
</tr>
</tbody>
</table>

2.07 Acceptable Manufacturers

PART 3: EXECUTION

3.01 Inspection

A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return air blank-off strips and flexible duct have been properly approved. Remove and reinstall any part of the installation found incorrect.

3.02 Installation

A. Diffusers. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets securely to ductwork with sheet metal screws. For diffusers, attach the frame assembly by a concealed hinge assembly to an outer frame compatible with the type of ceiling on which the diffuser is installed.

B. VAV Boxes. Install rigid ductwork, straight length to measure a minimum of 3 diameters, upstream of all boxes. Flexible duct connections at boxes are not allowed. Seal connection at box, as required, to comply with system maximum leakage.

END OF SECTION 23 33 00
SECTION 23 36 16 – VARIABLE-AIR-VOLUME UNITS

PART 1: GENERAL

1.01 Section Includes
   A. Dual duct terminal units.
   B. Variable volume regulators.
   C. Integral damper motor operators.
   D. Integral controls.

1.02 Related Sections
   A. Section 23 00 00 – Heating, Ventilation and Air Conditioning (HVAC).
   B. Section 23 31 00 – HVAC Ducts and Casings.
   C. Section 23 09 53 – Pneumatic and Electric Control HVAC.
   D. Section 23 05 93 – System Preparation for Testing, Adjusting, and Balancing.
   E. Section 23 05 93.01 – System Testing, Adjusting, and Balancing.

1.03 References
   B. UL 181 – Factory-Made Air Ducts and Connectors.
   C. ADC 1062 – Air Distribution and Control Device Test Code.
   D. ARI 880-89 – Standard for Air Terminals.

1.04 Submittals
   A. Submit shop drawings under provisions of Section 23 00 00.
   B. Submit product data under provisions of Section 23 00 00.
   C. Submit product data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings which indicate air flow, static pressure, and NC designation.
   D. Include schedules listing discharge and radiated sound power level for each of second through seventh octave bands at inlet static pressures of one inch wg.
SECTION 23 36 16 – VARIABLE-AIR-VOLUME UNITS

E. Submit manufacturer’s installation instructions under provisions of Section 23 00 00.

F. A sample 8-inch inlet production run unit shall be submitted for examination and approval by the Architect and Owner’s Testing and Balancing (TAB) Consultant. This submittal box shall be submitted, in addition to the required written submittal, well in advance of any requirement for installation of boxes, but absolutely no later than 60 days after the start of construction stipulated in the Work Order letter from the Owner to the General Contractor. A minimum of three weeks shall be allowed by the Contractor for the testing of the box from the time of submittal to the time of determination of project worthiness. This period shall restart if the sample box is rejected and another box is resubmitted. If rejected for any reason, the Contractor shall expedite the corrections documented, and shall resubmit a sample box as soon as possible. Any delay in the submittal of the box for approval shall not be grounds for a claim of delay of the part of the Contractor. If approved, the unit shall remain in the possession of the Owner at the job site for comparison with units as shipped to the project. The unit shall be installed in the project, at an accessible, marked location to allow access to bottom, left, and right sides of terminal unit. The unit manufacturer shall provide test from an independent agency certifying that each box used on this project has been tested as specified.

1.05 Operation and Maintenance Data
   A. Submit operation and maintenance data under provisions of Section 23 00 00.
   B. Include manufacturer’s descriptive literature, operating instructions, maintenance and repair data, and parts list.

1.06 Qualifications
   A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

1.07 WARRANTY
   A. Provide one year manufacturer’s warranty under provisions of Section 23 00 00.

PART 2: PRODUCTS

2.01 Variable Volume Terminal Unit
SECTION 23 36 16 – VARIABLE-AIR-VOLUME UNITS

A. The Contractor shall furnish and install pressure independent dual duct variable air volume control assemblies with attenuator-mixers (dual duct units), of the sizes, capacities, and configurations shown on the Drawings.

B. Casing Construction.

1. The units shall be constructed of a minimum of 22 gage galvanized steel and internally lined with a minimum of 1-inch thick, three pound per cubic foot density insulation. The insulation shall be foil faced with the edges and seams sealed or “captured” using sheet metal, encapsulating all fibers of the insulation. The insulation shall be neatly installed with no rough edges to interrupt the smooth flow of air through the box. The casing shall be insulated throughout its interior.

2. All interior features of the boxes (such as mixing baffles, damper housing, etc.) shall be secured within the casing to avoid excessive movements or rattling with air movement to avoid externally terminal units shall be designed not to extend beyond the ends of the unit. (For example, the actuator mounting brackets, etc., shall not extend beyond the plane of the inlet “bulkhead.”) The only exception shall be flow sensors installed in the inlet duct connections. Note that if a separate flow station is installed within the frame within the casing, then it shall be so installed not to allow air flow to bypass the flow measurement station.

3. The terminal units shall be constructed with inlet and discharge ductwork connections. The inlet ductwork connections shall extend a minimum of 4 inches from the unit casing including an allowance for the installation of air flow station (s) or probe (s). The discharge connection shall include 1” extension with slip and drive connections for use by the contractor to secure the discharge ductwork or appurtenances to the unit and shall be reinforced to provide a rigid assembly.

C. Casing Leakage. Assembled units shall be so constructed and sealed to limit air leakage to the following listed quantities at 6” static pressure. Leakage curves or tables will be required as part of the submittal data. The following is the maximum allowable casing leakage including all components:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Maximum Allowed CFM (Area x 2000 fpm)</th>
<th>Maximum Allowable CFM Damper Leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4” – 6”</td>
<td>393</td>
<td>8.0</td>
</tr>
<tr>
<td>7” – 8”</td>
<td>698</td>
<td>14.0</td>
</tr>
<tr>
<td>9” – 10”</td>
<td>1091</td>
<td>22.0</td>
</tr>
<tr>
<td>11” – 12”</td>
<td>1571</td>
<td>30.0</td>
</tr>
<tr>
<td>13” – 14”</td>
<td>2138</td>
<td>40.0</td>
</tr>
</tbody>
</table>
D. Damper Construction. The damper blades shall be an equivalent of 18 gage galvanized steel aluminum and shall be securely riveted or bolted through the damper shafts to assure no slippage of the blades. The damper shafts shall operate in rust-proof self-lubricating bearings. Damper shafts penetrating the unit casings shall be sealed against leakage, and bearings shall be installed for protection against wear in the casing penetration. Damper shafts shall be formed of, or cut from solid stock; no hollow shafts will be allowed. The dampers shall seat against gasketed stops or the dampers shall have gasketed edges. Dampers shall be secured to the blades with adhesive and shall be so constructed to prevent “oil canning” of the damper blade. The units shall be tested for leakage in both inlets with 6” static pressure imposed on one inlet at a time. The maximum percent leakage from all tests shall be reported. Leakage curves as a function of pressure shall be supplied as part of the submittal data. The damper actuator linkage, if used, shall be constructed of material of sufficient strength to avoid bucking under extreme loads. Also, linkages shall not allow play greater than 5 degrees of damper movement. The controls for the dampers shall cause the dampers to fail in the position of last control (freeze in place) or fail to the open position.

E. Damper Leakage. The following is the maximum damper leakage allowable for the various size diameter inlets at 6” w.g. differential pressure. The damper leakage shall not exceed the values listed in the table below at 6” S.P., following ARI 880 Testing Procedures.

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Maximum Allowed CFM (Area x 2000 fpm)</th>
<th>Maximum Allowable CFM Damper Leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4” – 6”</td>
<td>393</td>
<td>6.0</td>
</tr>
<tr>
<td>7” – 8”</td>
<td>698</td>
<td>10.5</td>
</tr>
<tr>
<td>9” – 10”</td>
<td>1091</td>
<td>16.5</td>
</tr>
<tr>
<td>11” – 12”</td>
<td>1571</td>
<td>20.0</td>
</tr>
<tr>
<td>13” – 14”</td>
<td>2138</td>
<td>30.0</td>
</tr>
</tbody>
</table>

F. Unit Pressure drop. For dual duct units with an integral attenuator-mixer, but with no other accessories, the static pressure across the assembly with an equivalent 2000 fpm inlet velocity through one inlet shall not exceed 0.50 inches water gage, with the total flow through either inlet.

G. Certification. The Unit Manufacturer shall certify that each unit used on this project will perform as specified. Each unit shall bear a tag or decal listing the following specified information:

1. Test pressure.
2. Leakage CFM (damper).
CONSTRUCTION STANDARDS                DIVISION 23 – HEATING VENTILATING AND
AIR CONDITIONING

SECTION 23 36 16 – VARIABLE-AIR-VOLUME UNITS

3. Leakage CFM (casing).
4. Date of manufacture.
5. Room or area served.
6. Unit size – 6”, 8”, etc.
7. Calibrated CFM, i.e. 800 CFM.

H. Mixing. Dual duct terminal units as specified herein shall provide mixing within
the units, and not rely upon the discharge ductwork to provide for the completion
of the mixing process. The horizontal average temperature of the air as it leaves
the terminal unit shall not vary more than 1°F for each 20°F of temperature
difference between the two inlet air supplies. (For example, if the cold supply air
is 55°F and the hot supply air is 95°F, the difference is 40 degrees. The allowable
temperature variation of the discharge air is, thus, 2°F). The temperature of the
discharge air shall be measured using a pattern of four vertical, evenly spaced
columns, and three horizontal, evenly spaced rows. The rows and columns shall
be spaced so that the resulting 12 points shall be at the centers of equal areas.
The plan of the points shall be perpendicular to the direction of air flow, within 4
inches of the discharge of the terminal unit, within the discharge ductwork. The
three readings in each column shall be averaged to determine compliance with the
1°F criteria.

I. Flow Measurement. Air flow through the unit shall be accomplished by the use
of a multi-port sensing device with a minimum of four radially distributed pick-up
points connected to a center averaging chamber with adequate internal passages to
prevent restrictions that can result in control “hunting”. On VAV systems,
sensors shall be mounted in the each supply duct connection. On constant volume
dual duct systems, one sensor shall be mounted in the cold duct and one sensor
shall be mounted in the box discharge.

J. Sound. (Note that the maximum sound levels listed in this paragraph refer to raw
sound levels, with no credits taken for the construction.)

1. Discharge Sound. Maximum discharge Sound Power Levels at 2000 fpm
primary inlet velocity with 1.5 inch w.g. inlet static pressure shall not
exceed that listed in the following table. No credit for lined discharge
duct, branching, flow division, and reflection, room absorption or any
other effects shall be allowed.
SECTION 23 36 16 – VARIABLE-AIR-VOLUME UNITS

<table>
<thead>
<tr>
<th>Center Frequency</th>
<th>Sound Power Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octave Band</td>
<td>(Hz)</td>
</tr>
<tr>
<td>2</td>
<td>125</td>
</tr>
<tr>
<td>3</td>
<td>250</td>
</tr>
<tr>
<td>4</td>
<td>500</td>
</tr>
<tr>
<td>5</td>
<td>1000</td>
</tr>
<tr>
<td>6</td>
<td>2000</td>
</tr>
<tr>
<td>7</td>
<td>4000</td>
</tr>
</tbody>
</table>

2. All sound power levels shall be obtained from testing in accordance with ARI-ADC Standard 880 and shall be certified at ARI-880 certification points.

K. Testing Prior to Installation.

1. Shipment Testing. A minimum of ten percent (10%) of each size of the terminal units (but no less than one unit of each size used) may be tested for conformance to this Specification, at the Owner’s discretion. The Contractor shall allow sufficient time during construction and space for the Owner’s TAB Consultant to perform all testing as may be required.

2. Unit Non-Performance.

   a. If the results of the Shipment Testing show that any of the units do not perform as specified, then an additional ten percent (10%) of each size (but no less than one unit of a size, unless 100% of the size has been tested) of the units shall be tested. If this testing, in the Owner’s opinion, shows that ten percent (10%) or more of the units tested do not perform as specified, and then one hundred percent (100%) of all sizes shall be tested for conformance with these Specifications. The results of that testing shall be reviewed carefully between the Contractor, manufacturer, the Owner’s Construction Administrator(s), and the Owner’s Design Engineer(s). A method of repair or replacing the units will be negotiated. The Owner, however, shall maintain the right of final approval of any proposed solution.

   b. Should for any reason the testing described above under “Submittal” and “Shipment Testing” prove that any of the units do not perform as specified, the Contractor shall be responsible for all subsequent labor, travel, travel expenses, and incidental expenses, penalties, or other costs attendant to any additional testing as
described under “Unit Non-Conformance”, or as required to prove that the units perform as specified. This shall include, but not be limited to the labor, travel, and reasonable incidental expenses of not only the Contractor and Owner’s TAB Consultant, but also those incurred by the Owner as may be specifically required for this purpose. The expenses to be reimbursed to the Owner shall be labor at a rate of $300 per day or any portion of a day, plus travel and travel expenses at actual cost, plus reasonable incidental expenses at actual cost.

L. Manufacturer. All Terminal Units shall be manufactured by Titus (Model MDV-3100-UT or MDC-3100-UT), Metal*Aire (Series 400DDUT), or Naylor-Hart 3000-UT or 3200-UT. Note that the model and series numbers listed may differ slightly from catalogue information. No other manufacturers or models are acceptable. Even though specific manufacturers may be named herein, the material supplied by any approved manufacturer shall meet all of the provisions of this specification without exception.

M. General Performance. Devices using mechanical CFM limiters will not be accepted, nor shall it be necessary to change control components to make airflow rate changes. If used, DDC flow stations shall be furnished, mounted and adjusted by the terminal unit assembly manufacturer to assure their proper placement within the units. If DDC controls of another manufacturer (NOT the terminal unit manufacturer) are provided for this project, the terminal unit manufacturer shall be responsible only for the construction of the terminal unit and the installation of internal control components installed at the manufacturer’s factory, and shall not be responsible for the installation of controls not installed at the terminal unit manufacturers factory, nor shall the manufacturer be responsible for the performance of the DDC controls. The performance of DDC controls, especially in connection with the terminal units, shall be the responsibility of the DDC controls manufacturer.

N. Control Performance. Assemblies shall be able to be reset to any airflow between minimum and the maximum cfm shown on Drawings. To allow for maximum flexibility and future changes, it shall be necessary to make only simple screwdriver or keyboard adjustments to arrange each unit for any maximum airflow within the ranges for each inlet size as scheduled on the Drawings. The control devices shall be designed to maintain the desired flow regardless of inlet flow deflection. (All terminal units shall be installed with a minimum of three diameters of straight duct directly prior to the entry into each terminal unit connection.)

O. Control Sequences. The control sequence arrangement shall be as described on the Drawings; and the terminal units shall be shipped from the manufacturer with
SECTION 23 36 16 – VARIABLE-AIR-VOLUME UNITS

All necessary control devices to accomplish each sequence, except as may be prohibited by the controls manufacturer. The desired sequence shall be adjustable according to space usage or a change in space conditions. Separate maximum CFM values for hot and cold ducts with zero minimum flow values for both hot and cold ducts, with adjustable mixing of hot and cold air flow to allow for adjustable minimum total air flow from the terminal unit.

P. DDC Systems.

1. Electronic motors and controllers shall be furnished by temperature control contractor and installed by the terminal unit manufacturer. The controls manufacturer shall be responsible for the installation of the controls. The controls manufacturer shall be responsible for the operational performance of the entire system. The terminal unit manufacturer shall remain responsible only for the performance of the mechanical components of the unit. The box manufacturer shall provide a unit mounted 120 volt toggle switch and six foot cord with cap for each terminal unit for control power shut-down.

2. A temperature sensor will be installed on the discharge side of all VAV Boxes.

PART 3: EXECUTION

2.01 Installation

A. Refer also to requirements included in Part 2 of this Specification.

B. Install in accordance with manufacturer’s instructions.

C. Provide ceiling access doors or located units above easily removable ceiling components.

D. Support units individually from structure. Do not support from ductwork.

E. Connect to ductwork in accordance with Section 23 31 00.

END OF SECTION 23 36 16
PART 1: GENERAL

1.01 Related Documents

A. Drawings and provisions of the Contract, including Uniform General Conditions and Supplementary Conditions, Division 1 Specification Sections and Component Special Conditions apply.

1.02 Summary

A. Perform all work required to provide and install modular air handling units, including factory installed fans, dampers, coils, motors, and any specialty equipment as indicated in the Contract Documents with supplementary items necessary for proper installation.

B. This section includes factory-assembled modular Air Handling Unit (AHU) that includes but is not limited to the following:

1. Casing.
2. Fans.
5. Filter Sections.
6. Additional Sections
7. AHU Dampers.
8. Accessories.

1.03 References

A. AFBMA9-Load Rating and Fatigue Life for Ball Bearings.
E. AMCA 300-Test Code for Sound Rating Air Moving Devices.
G. AMCA 500-Test Methods for Louver, Dampers, and Shutters.
H. ARI 260-Sound Rating of Ducted Air Moving and Conditioning Equipment
I. ARI 410-Forced-Circulation Air-Cooling and Air-Heating Coils
SECTION 23 73 00 – AIR HANDLING UNITS

J. ARI 430-Central-Station Air-Handling Units.

K. ARI 435-Application of Central-Station Air-Handling Units.

L. ARI 610-Central System Humidifiers

M. NEMA MG1-Motors and Generators.

N. NFPA 70-National Electrical Code

O. SMACNA-HAVC Duet Construction Standards-Metal and Flexible.

P. UL 900-Test Performance of Air Filter Units.


1.04 Submittals

A. See Uniform General Conditions, Division 1 Specifications, Component Special Conditions, and technical specification for submittal requirements.

B. Shop Drawings:

1. Contractor shall submit ¼ inch scale equipment layouts showing equipment in mechanical space. Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics, connection and requirements

C. Product Data:

1. Provide literature that indicates dimensions, weights, capacities, rating, fan performance, gages and finishes of materials, electrical characteristics and connection requirements. Refer to detailed listing of submittal data under Part 3 – Air Handling Unit Submittal Data.

2. Provide data of filter media, filter performance data, filter assembly, and filter frames as tested and certified per ASHRAE standards.

3. Provide fan curves with specified operating point clearly plotted, as tested and certified per AMCA standards. Ratings shall include system effects. Fare fan ratings will not satisfy this requirement, but shall be submitted for comparison purposes.
4. Submit sound power level data for both fan outlet and casing radiation at rated capacity, as tested and certified per AMCA and ARI 260 standards.

5. Provide data on all coils as tested and certified per ARI standards.

6. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

7. All materials shall have NFPA-90 rating of 25/50 or better.

D. Base Rail Height Calculations

Provide calculations for required base rail heights to allow for proper condensate trapping.

E. Fan Performance Curves

Submit with specified operating point clearly plotted. Base performance curves on test in accordance with ARI standards. Conduct test in ARI-approved laboratory.

F. Sound Power Levels

Submit sound power levels in octave bands from 63 to 8,000 Hz for unit inlet, outlet and casing radiation at rated capacity. Base sound power levels on actual factory test data on fan sizes and accessories being furnished. Sound performance shall be rated per ARI Standard 260 and units shall bear the ARI 260 seal. The manufacturer shall factory sound test all units if they are not ARI 260 certified as manufactured. Submit factory sound test procedures with submittal for Owner’s approval prior to release of equipment for production.

G. Manufacturer’s Instructions

Provide start-up information and Operations and Maintenance Manuals.

H. Submit cataloged coil moisture carryover curves. The curves shall be plotted at the coil operating point and shall show the maximum coil moisture carryover limits.

1.05 Operation and Maintenance Data

A. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

B. Provide Operations and Maintenance manuals for all air handling units. In addition to a full set of manuals with close-out documentation, each unit shall ship with its own manual permanently mounted inside the unit casing fan section in a watertight enclosure.
C. Permanently mount condensate trapping calculation instructions within the unit Operations and Maintenance manuals that illustrates the unit casing at the condensate drain connection.

1.06 Quality Assurance

A. Performance Ratings

1. Conform to ARI Standards; bear ARI 430 certified rating seal. If unit is not ARI 430 rated, unit shall be tested in accordance with the standards to establish acceptability.

B. Sound Ratings

1. Test air handling unit in accordance with AMCA 300 (ASHRAE 68) and ARI 260 Guidelines.

C. Air Coils

1. Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.

D. Manufacturer

1. Regularly engaged in production of components that issues complete catalog data on total product and has at least two years of manufacturing experience for the product specified.

E. Base performance on sea level conditions, unless otherwise scheduled.

F. Provide complete unit including components designed to operate within range of 35 degrees F to 135 degrees F ambient temperature, and 20 to 70 percent relative humidity.

G. These specifications and drawings are based on the equipment scheduled. Contractor is advised that the use of equipment other than that scheduled may directly affect and require coordination with (but not limited to) the following items:

1. Mechanical room sizes and building structural conditions, with required clearances.

2. Electrical starter/disconnect switch, wire and conduit sizes; electrical clearances as per NEC.

3. Ductwork and piping layouts and return air opening sizes and locations.

4. Plumbing floor drain locations.
SECTION 23 73 00 – AIR HANDLING UNITS

H. Units shall fit into the space available with adequate clearance for service as determined by the Engineer. Submitted units which do not meet these criteria shall be rejected. Do not assume that all of the manufacturers listed as acceptable manufacturers will provide a unit that will fit in the space allocated. Selection of acceptable manufacturers is not based on whether the manufacturer’s standard stock unit will fit into every space allocated. A custom or semi-custom air-handling unit may be required to meet project space and performance requirements without exception. The dimensions shown on the drawing are not to be exceeded.

I. Basis of Design shall provide all demount points, section sizes, etc. for the ingress to the unit location.

1.07 Delivery, Storage, and Handling

A. Deliver, store, protect and handle products to site as required by the Contract Documents.

B. Contractor to accept products on site in factory-fabricated protective containers or covered to protect from weather and construction debris, with factory-installed shipping skids and lifting lugs. Inspect for damage and make any necessary repairs at no expense to the Owner.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish. Replace damaged equipment.

D. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.08 Schedules on Drawings

A. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the Drawings. Reference shall be made to the schedules for such information. The capacities shown are minimum capacities. Variations in the capacities of the scheduled equipment supplied under this contract will be permitted only with written direction of the Owner.

B. Where installation instructions are not included in these Specifications or Drawings, the manufacturer’s instruction shall be followed.

PART 2: PRODUCTS

2.01 Manufacturers

Provide custom air handlers as manufactured by Temtrol as a stand-alone base bid and the Engineer Basis of Design.

The manufacturers below will only be accepted as a voluntary alternate to the base bid above. These will only be accepted with a written pre-approval from the engineer of the record and the university within 14 days prior to bid date. Pre-approval letter to the engineer should include
complete unit submittal to ensure that alternate units will meet performance criteria and dimensional requirements.

A. Trane Custom

B. Carrier

C. Climate Craft

2.02 Unit Construction Description

A. General: Provide factory-fabricated air handling units with capacity as indicated on the schedule. Units shall have overall dimensions as indicated and fit into the space available with adequate clearance for service as determined by the Engineer. Units shall be completely assembled. Multiple sectioned units shall be shipped as a single factory assembled piece (except where shipping limitations prevent) and, if necessary, de-mounted into modular sections in the field by the contractor. Units shall be furnished with sufficient gasket and bolts for reassembly in the field by the contractor. Unit manufacturer shall provide certified ratings conforming to the latest edition of AMCA 210, 310, 500 and ARI 410. All electrical components and assemblies shall comply with NEMA standards. Unit internal insulation must have a flame spread rating not over 25 and smoke developed rating no higher than 50 complying with NFPA 90A, “Standard for the Installation of Air Conditioning and Ventilating Systems.” Units shall comply with NFPA 70, “National Electrical Code,” as applicable for installation and electrical connections of ancillary electrical components of air handling units. Tags and decals to aid in service or indicate caution areas shall be provided. Electrical wiring diagrams shall be attached to the control panel access doors. Operation and maintenance manuals shall be furnished with each unit. Units shall be UL or ETL listed.

B. Rigging Provision – Multiple Piece Units: Units shipped in multiple sections shall be engineered for field assembly. The base frame shall have integral lifting lugs. The lifting lugs shall be fabricated from structural steel with an appropriate rigging hole. Lifting lugs shall be located at the corner of each section (and along the sides if required) and sized to allow rigging and handling of the unit. All gasket and necessary assembly hardware shall ship loose with unit. Junction boxes with a factory supplied numbered terminal strip shall be supplied at each shipping split for reconnection of control wiring.

C. Unit Base - Floor: Unit perimeter base shall be completely welded and fabricated using heavy gauge structural steel tubing. (Note: bolted bases are not acceptable) C-Channel cross supports shall be welded to perimeter base steel tubing and located on maximum 24” centers to provide support for internal components. Base rails shall include lifting lugs welded to perimeter base at the corner of the unit or each section if de-mounted. Entire base frame is to be painted with a phenolic coating for long term corrosion resistance. Internal walk-on floor shall be thermal break construction, 16 gauge galvanized steel with
mechanically fastened and caulked seams. The outer sub-floor of the unit shall be made from 16 gauge galvanized metal. The floor cavity shall be spray foam insulated with floor seams gasketed for thermal break and sealed for airtight / watertight construction. Where access is provided to the unit interior, floor openings shall be covered with walk-on phenolic coated steel safety grating. Single wall floors with glued and pinned insulation and no sub floor are not acceptable. Base frame shall be attached to the unit at the factory.

2.03 Unit Casing

A. **Unit Casing** – The construction of the air handling unit shall consist of a (1” x 2”) steel frame with formed 16 gauge galvanized steel exterior casing panels. The exterior casing panels shall be attached to the gasketed (1 x 2) steel frame with corrosion resistant fasteners. All casing panels shall be completely removable from the unit exterior without affecting the unit’s structural integrity. (Units without framed type of construction shall be considered, provided the exterior casing panels are made from 14 gauge galvanized steel, maximum panel center lines are less than 20 inches and deflection is less than L/200 @ 9” positive pressure). The air handling unit casing shall be of the “no-through-metal” design. The casing shall incorporate insulating thermal breaks as required so that, when fully assembled, there’s no path of continuous unbroken metal to metal conduction from inner to outer surfaces. Provide necessary support to limit casing deflection to L/200 of the narrowest panel dimension. If panels cannot meet this deflection, additional internal reinforcing is required. All panel seams shall be caulked and sealed for an airtight unit. Leakage rates shall be less than 1% at design static pressure or 9” W.C. whichever is greater.

The exterior panel finish shall be: Painted with a polyester resin coating designed for long term corrosion resistance meeting or exceeding (ASTM B-117) Salt Spray Resistance at 95 degrees F. 1,000 hrs. and (ASTM D-2247) Humidity Resistance at 95 degrees F. 1,000 hrs. The color shall be sandstone.

Note: If manufacturer cannot provide thermal break (no through metal) and or removable exterior panel construction it must be noted as an exception on the bid.

B. **Double Wall Liner** - Each unit shall have double wall construction with 20 gauge solid galvanized liner in the entire unit. The double wall interior panel shall be removable from the outside of the unit without affecting the structural integrity of the unit.

C. **Insulation** - Entire unit to be insulated with a full 3” (R12.5) thick non-compressed fiberglass insulation. The insulation shall have an effective thermal conductivity (C) of .24 (BTU in./sq.ft. F°) and a noise reduction coefficient (NRC) of 0.70 / per inch thick (based on a type "A" mounting). The coefficients shall meet or exceed a 3.0 P.C.F. density material rating. Insulation shall meet the erosion requirements of UL 181 facing the air stream and fire hazard classification of 25/50 (per ASTM-84 and UL 723 and CAN/ULC S102-M88) and meet NFPA 90A and 90B. All insulation edges shall be encapsulated within the panel. All perforated sections shall have Micromat® or equal insulation with non-woven mat facing,

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5000 fpm rating and non-hygrosopic fibers as manufactured by Johns Manville or approved equal.

D. Access/Inspection Doors - The unit shall be equipped with a solid double wall insulated (same as the unit casing), hinged access doors as shown on the plans. The doorframe shall be extruded aluminum, foam filled with a built in thermal break barrier and full perimeter gasket. The door hinge assembly shall be completely adjustable die cast stainless steel. There shall be a minimum of two heavy duty handles per door. Provide ETL, UL 1995, and CAL-OSHA approved tool operated safety latch on all fan section access doors.

Note: If manufacturer cannot provide thermal break door design it must be noted as an exception on the bid.

a. Access doors in all sections shall be provided with a 10 x 10 dual thermal pane safety glass window.
b. Access doors shall be 24” wide.
c. Access doors shall be on both sides (no exceptions).

E. Coil Casings - Construct coil section so coils can be removed without affecting structural integrity of casing. Completely enclose connections, coil headers, and return bends. Provide 304 stainless steel coil frame with intermediate casing supports as required.

F. Drain Pans - IAQ style drain pans shall be provided under all cooling coils as shown on the drawings. The drain pan shall be fabricated from 16 gauge 304 stainless steel. All pans are to be triple pitched for complete drainage with no standing water in the unit. They shall be insulated minimum 3-inch "Double Bottom" construction with welded corners. Provide stainless steel, 1-1/4” MPT drain connection extended to the exterior of the unit base rail. All drain connections shall be piped and trapped separately for proper drainage. Secondary drain pan shall extend a minimum of 6” beyond all sides of the complete unit.

2.04 Fan Section with Fanwall Technology (FWT)

A. For means of redundancy, reduced maintenance and energy savings, provide Fanwall Technology in fan section of Temtrol Air Handling unit.

B. The multiple fan array systems shall include multiple, direct driven, arrangement 4 plenum fans constructed per AMCA requirements for the duty specified class III as required. Class I fans are not acceptable. Fans shall be rated in accordance with and certified by AMCA for performance. All fans shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan array shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan’s peak static pressure producing capability at the specified fan/motor speed. Each
fan/motor cube or cell shall include a minimum 10 gauge, G90 Galvanized steel intake wall, .100 aluminum spun fan inlet funnel, and a 10 gauge G90 Galvanized steel motor support plate rail and structure. All motors shall be standard foot mounted type TEAO selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. Motors shall meet the requirements of NEMA MG-1 Part 30 and 31, section 4.4.2. Motors shall be as manufactured by Baldor, Siemens, or Toshiba for use in multiple fan arrays that operate at varying synchronous speeds as driven by an approved VFD. Motor HP shall not exceed the scheduled HP as indicated in the AHU equipment schedule(s). Steel cased motors and/or ODP motors are not acceptable. All motors shall include permanently sealed (L10-400,000 hr) bearings and AEGIS™ shaft grounding to protect the motor bearings from electrical discharge machining due to stray shaft currents. Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, exceeding category BV-5, to meet or exceed an equivalent Grade G.55, producing a maximum rotational imbalance of .022” per second peak, filter in (.55 mm per second peak, filter in). Fan and motor assemblies submitted for approval incorporating larger than 22” wheel size and 215 T frames size motors shall be balanced in three orthogonal planes to demonstrate compliance with the G.55 requirement with a maximum rotational imbalance of .022” per second peak filter in (.55 mm per second peak, filter in). Copies of the certified balancing reports shall be provided with the unit O&M manuals at the time of shipment. Submittals that do not include a statement of compliance with this requirement will be returned to the contractor without review.

a. Manufacturers not able to comply with this balance grade requirement must note an exception on their bid. The balance grade is critical as many classroom buildings are in sound sensitive environments.

C. The fan array shall consist of multiple fan and motor ”cubes” or “cells”, spaced in the air way tunnel cross section to provide a uniform air flow and velocity profile across the entire air way tunnel cross section and components contained therein. In order to assure uniform velocity profile in the AHU cross section, the fan cube dimensions must be variable, such that each fan rests in an identically sized cube or cell, and in a spacing that must be such that the submitted array dimensions fill a minimum of 90% of the cross sectional area of the AHU air way tunnel. There shall be no blank off plates or “spacers” between adjacent fan columns or rows to position the fans across the air way tunnel. The array shall produce a uniform air flow profile and velocity profile within the airway tunnel of the air handling unit to equal the specified cooling coil and/or filter bank face velocity by +/- 10% when measured at a point 36” from the intake side of the fan array intake plenum wall, and at a distance of 72” from the discharge side of the fan array intake plenum wall. Submittals for units providing less than the scheduled quantity of fans and/or spacing of the fans for multiple fan arrays shall submit CFD modeling of the air flow profile for pre-bid approval that indicates uniform velocity and flow across all internal components without increasing the length of the AHU unit or changing the aspect ratio of the unit casing as designed.

D. Each fan motor shall be individually wired to a control panel containing a single VFD as the primary VFD and a backup VFD wired in bypass, as specified elsewhere. Each VFD shall be sized for the total connected HP for all fan motors contained in the fan array. Wire sizing shall
be determined, and installed, in accordance with applicable NEC standards and local code
requirements. When specified and scheduled, the multiple fan array electrical panel shall
include system optimization controls to actively control fan speed and to enable and disable
fans in the multiple fan array. The number of active fans in the array shall be automatically
determined, and the speed of the enabled fans shall be adjusted to produce the required
coincidental flow and pressure at the perimeter boundary of the unit at substantially peak
efficiency. The system optimization controls shall continuously monitor required flow and
pressure and shall automatically optimize the operating array configuration and speed for peak
efficiency. When specified, system optimization controls shall be provided that will interface
with and be compatible with the BAS as specified elsewhere. It is the responsibility of the
contractor to assure that the fan system optimization controls are compatible with the BAS
system. System optimization controls shall be provided by the AHU manufacturer to assure
single source responsibility for fan volume controls, and shall require only an input control
signal from the controls contractor for SP or flow for proper operation of the system
optimization controls. When specified, the AHU unit manufacturer shall provide a single
communication interface with the BAS and shall coordinate with the controls contractor to
make sure that all necessary data points are communicated.

E. Alternate AHU manufacturers above that are approved for bidding purposes only, other than
the basis of design manufacturer, and that are submitting multiple fan arrays, shall test one or
more of the submitted AHU’s for flow, pressure, leakage, BHP and acoustics as submitted
and approved, prior to shipment. The testing shall be witnessed by an owner’s representative
and approved by the engineer prior to shipment of any of the submitted AHU equipment. A
test report shall be provided for each tested AHU unit and the report shall be included in the
O&M manuals for the units. Costs for this tests including travel shall be covered by the AHU
manufacturer.

F. Each individual cube or cell in the multiple fan arrays shall be provided with an integral back
flow prevention device that prohibits recirculation of air in the event a fan or multiple fans
become disabled. The system effects for the back flow prevention device(s) shall be included
in the criteria for TSP determination for fan selection purposes, and shall be indicated as a
separate line item SP loss in the submittals. Submitted AHU performance that does not
indicate allowance for system effects for the back flow prevention device(s) and the system
effect for the fan and motor enclosure in which each fan is mounted, will be returned to the
contractor disapproved and will need to be resubmitted with all of the requested information
included for approval. Back Draft Damper performance data that is per AMCA ducted inlet
and discharge arrangements will not be accepted. Damper data must be for the specific
purpose of preventing back flow in any disabled fan cube and that is mounted directly at the
inlet of each fan. Motorized dampers for this purpose are not acceptable. Submitted fan
performance data which only reflect published performance for individual fans in AMCA
arrangement “A” free inlet and discharge will not be accepted. Alternate AHU Manufacturers
above that are approved for bidding that do not manufacture the fans being submitted on must
provide certified performance data for fans as installed in the AHU unit with Back Draft
damper effects included. These manufactures shall submit to a performance test which is
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witnessed by the engineer and/or the owner’s representative. Costs for this trip will be covered by the AHU manufacturer.

G. Each fan & motor assembly shall be removable through a 24” wide, free area, access door located on the discharge side of the fan wall array without removing the fan wheel from the motor. All fan/motor access doors shall open against pressure.

H. Motor Circuit Protection (Factory Mounted)

All motors in the FANWALL Array shall be provided with individual motor protection for thermal overload protection. All motor circuit protectors can be located in starting device enclosure or, if required by design, in a separate enclosure. Motor circuit protector enclosure must be located and mounted at a minimal distance from motors in a FANWALL array. Provide remote indication by means of auxiliary contacts wired in PARALLEL. This means that the manufacturer shall provide a set of auxiliary contacts PER FAN for BAS contractor to map back in fan status per fan to DDC. Provide multiple pilot lights (one per fan) cover mounted for local monitoring as well.

I. Fan Wall Technology with Redundant VFD frequency control (Factory Mounted)

As required by system design, provide one Yaskawa Z1000 VFD for normal operation and a second Yaskawa Z1000 VFD for redundant backup operation. Provide control wiring and control circuitry to transfer from main VFD to redundant VFD when main drive has faulted. The VFD shall be sized accordingly to start and hold all motors in the FANWALL Array. Provide with factory mounted circuit breaker. ABB ACH550 VFD may be used as an alternate VFD to base bid Yaskawa Z1000 Redundant VFD.

2.05 Water Coils

A. All coil assemblies shall be leak tested under water at 315 PSIG and PERFORMANCE is to be CERTIFIED under ARI Standard 410. Coils exceeding the range of ARI standard rating conditions shall be noted.

B. Cooling coils shall be mounted on stainless steel support rack to permit coils to slide out individually from the unit. Provide intermediate drain pans on all stacked cooling coils. The intermediate pan shall drain to the main drain pan through a copper downspout. Water coils shall be constructed of seamless copper tubing mechanically expanded into fin collars. All fins shall be continuous within the coil casing to eliminate carryover inherent with a split fin design. Fins are die formed Plate type.

C. Headers are to be seamless copper with die formed tube holes.
SECTION 23 73 00 – AIR HANDLING UNITS

D. Connections shall be male pipe thread (MPT) Schedule 40 Red Brass with 1/8" vent and drain provided on coil header for coil drainage. All coil connections shall be extended to the exterior of the unit casing by the manufacturer. Coils shall be suitable for 250 PSIG working pressure. Intermediate tube supports shall be supplied on coils over 44" fin length with an additional support every 42" multiple thereafter.

E. Water coils shall have the following construction:

- 5/8" o.d. x .020" wall copper tube with .028 return bends.
- .008" aluminum fins.
- 16 gauge 304 Stainless Steel casing.

### 2.08 Filter Sections

A. General

Air shall not be allowed to bypass filters. Provision shall be made to positively lock filters in place to prevent shifting. Provide filter sections as scheduled or shown on the Drawings. Each filter bank shall be provided with Dwyer Series 2000 filter gauge.

Note: Some units may have multiple filter sections and multiple filter types. Some filter section types shown here may not be used.

B. Filter Section:

1. Provide 2” Merv 8 Filter for any pre-filter or standalone single filter.

2. Provide 12” Merv 13 Filter for any final filter

C. Provide for removal of profiler from upstream and final filter downstream.

D. Refer to schedule on drawings for filtering requirements; filter sizes of 24” x 24” and 24” x 12” face are acceptable only.

### 2.09 Additional Sections

A. All additional sections of the unit, including blank sections and turning sections require for proper unit operation, maintenance, and configuration, shall meet the unit casing requirements listed in this Section. Note: Some, all, or none of the additional sections listed maybe used. Refer to Drawings and Schedules.

B. Mixing Box Section:
SECTION 23 73 00 – AIR HANDLING UNITS

1. Where specified or shown on the Drawings, provide with factory-mounted interconnected outside and return air dampers mounted in a galvanized frame. See AHU Dampers Section, below.

C. Access Section(s):

1. Provide access sections with door where specified or shown on Drawings. Floors of access section must be heavy-duty to accommodate maintenance personnel/equipment.

2.10 Accessories

A. “Marine-type” or fluorescent lights shall be installed in EACH section (no exceptions). Light shall be wired to a switch installed on the outside casing of the unit, with separate power connection from unit to allow maintenance during unit shutdown.

B. Where scheduled, ultraviolet (UV) lights will be installed in coil and filter sections (on upstream side of filter). Power source and wiring for the UV lights shall be separate from the motor power for maintenance purposes and shall be provide under Division 26 00 00.

C. Dual thermal pane windows shall be provided in all access doors. Minimum window dimensions shall be 10-inch x 10-inch.

PART 3: EXECUTION

3.01 Installation

A. Install in accordance with manufacturer’s instructions.

B. Make joints and connections fully gasketed and air-tight.

C. Install filters.

D. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated and fan has been test run under observation.

3.02 Air handling Unit submittal Data

The information for each item listed below must be furnished as part of these shop drawing submittals. Additional data may be submitted on separate sheets. Submit the requested data on the forms provided. Provide data for the air handling units noted on the Drawings.

<table>
<thead>
<tr>
<th>A. General Data</th>
<th></th>
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<tbody>
<tr>
<td>Air Handling Unit Manufacturer</td>
<td></td>
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</table>
### SECTION 23 73 00 – AIR HANDLING UNITS

<table>
<thead>
<tr>
<th>Maximum Exterior Dimensions (Assembled):</th>
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</thead>
<tbody>
<tr>
<td>Length (feet)</td>
</tr>
<tr>
<td>Width (feet)</td>
</tr>
<tr>
<td>Height (feet)</td>
</tr>
<tr>
<td>(Attach general arrangement drawing.)</td>
</tr>
<tr>
<td>Operating weight (lb.)</td>
</tr>
</tbody>
</table>

| B. Pre-filters                           |
| Manufacturer                             |
| Type                                      |
| Efficiency                                |
| Quantity                                  |
| Pressure Drop                             |
| Clean                                     |
| Dirty                                     |
| (Attach manufacturer’s literature)        |

| C. Preheat Coil                          |
| Manufacturer                             |
| Air Flow (CFM)                            |
| Air Entering Temp (°F)                    |
| Air Leaving                               |
| Fins/Inch (8 maximum)                     |
| Rows (2 maximum)                          |
| Minimum Capacity                          |
| Rated Capacity (Btuh)                     |
| Steam Flow (lb./hr)                       |
| Air Pressure Drop (Inches H20)            |

| Sound Power                               |
| (at design CFM)                           |
| At AHU Inlet                              |
| At AHU Outlet                             |
| 1<sup>st</sup> Octave                     |
| 2<sup>nd</sup> Octave                     |
| 3<sup>rd</sup> Octave                     |
| 4<sup>th</sup> Octave                     |
| 5<sup>th</sup> Octave                     |
| 6<sup>th</sup> Octave                     |
| 7<sup>th</sup> Octave                     |
## SECTION 23 73 00 – AIR HANDLING UNITS

<table>
<thead>
<tr>
<th>8th Octave</th>
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<tbody>
<tr>
<td>Fan BHP (at design CFM) (with clean filters)</td>
<td></td>
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<tr>
<td>Fan BHP (at design CFM) (with fully loaded filters)</td>
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<tr>
<td>Motor HP</td>
<td></td>
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<tr>
<td>Motor Efficiency (at design CFM)</td>
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<tr>
<td>Motor Efficiency (at 50% of design)</td>
<td></td>
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<tr>
<td>Motor Manufacturer and Model No.</td>
<td></td>
</tr>
<tr>
<td>Bearing Manufacturer and Model No.</td>
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</tbody>
</table>

### Attach Manufacturer’s Literature on:
- Fan
- Fan Curve at full RPM (Design CFM)
- Fan Curve at minimum recommended RPM
- Motor
- Fan Bearings
- Fan Drive
- Vibration Isolation
- CFM vs. Total Unit kW Curve with Clean Filers for Fan
- CFM vs. Total Unit kW Curve with Fully loaded Filers for Fan

### D.
- Cooling Coil
  - Manufacturer
  - Air Flow (CFM)
  - Air Entering Temp (°F)
    - Dry Bulb
    - Wet Bulb
  - Air Leaving Temp (°F)
    - Dry Bulb
    - Wet Bulb
  - Fins/Inch (8 maximum)
  - Rows (6 maximum)
  - Minimum Coil Capacity
  - Rated Coil Capacity (Btuh)
  - Entering Water GPM
  - Leaving Water Temp. (°F)
  - Water Pressure Drop (Feet H20)
### SECTION 23 73 00 – AIR HANDLING UNITS

<table>
<thead>
<tr>
<th>E.</th>
<th>Heating Coil</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Flow (CFM)</td>
<td></td>
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<tr>
<td>Air Entering Temp (°F)</td>
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<tr>
<td>Air Leaving Temp (°F)</td>
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<tr>
<td>Fins/Inch (8 maximum)</td>
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<tr>
<td>Rows (2 maximum)</td>
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</tr>
<tr>
<td>Minimum Coil Capacity (Btuh)</td>
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<tr>
<td>Entering Water GPM</td>
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<tr>
<td>Leaving Water Temp. (°F)</td>
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<tr>
<td>Water Pressure Drop (Feet H20)</td>
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<tr>
<td>Air Pressure Drop (Inches H20)</td>
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<tr>
<td>Water Velocity (ft/min)</td>
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<tr>
<td>Number of Sections</td>
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<td></td>
</tr>
<tr>
<td>Dimensions of each Coil Section (inches)</td>
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<td></td>
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<tr>
<td>Weight of each Coil Section (lb.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Attach manufacturer’s literature.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### F.

<table>
<thead>
<tr>
<th>Flow Element</th>
<th>Type</th>
<th>Certified Accuracy</th>
<th>Pressure Drop</th>
</tr>
</thead>
</table>

#### 3.03 EXTRA MATERIALS

A. Furnish as required by the contract documents.
DIVISION 25: INTEGRATED AUTOMATION

25 51 00 Integrated Automation Facility Controls
SECTION 25 51 00-INTEGRATED AUTOMATION FACILITY CONTROLS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. General Contractor shall furnish and commission a fully integrated building automation system (BAS), incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems as herein specified.

B. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project. All systems components shall have been thoroughly tested and proven in actual use for at least two years.

C. General Contractor and the Installing Contractors shall furnish and/or install all equipment and systems specified herein.

D. Authorized Vendors:

1. Siemens Building Industries – APOGEE/Desigo System (BACnet)
2. T.E.A.M. Solutions, Inc. – Delta Controls (BACnet)

1.02 DESCRIPTION

A. The control system will consist of a BACnet high-speed, peer-to-peer network of BTL certified controllers and a front end that operates on a BACnet IP (Internet Protocol) Network.

B. An operator workstation shall be available that allows user access. The user shall interface with the network via multi-tasking dynamic color graphics. Each mechanical system, building floor plan, and control device will be depicted by a point-and-click graphic.

C. For Local Area Network installations provide access to the control system via the Texas State University Wide Area intranet. Texas State University shall provide a connection to the Internet via high-speed cable modem, ADSL, ISDN, T1 or through the facility ISP. Texas State University shall pay for all monthly Internet access fees and connection charges.

D. The system shall support remote access, setpoint adjustment, schedule changes, calendar changes, point overrides, and graphics screens over the Texas State University WAN and the Internet.

E. The System will provide for future expansion to include monitoring of the card access, fire alarm, and lighting control systems.
SECTION 25 51 00-INTEGRATED AUTOMATION FACILITY CONTROLS

1.03 RELATED SECTIONS

A. Division 1 General and Special Conditions
B. Division 23 Mechanical
C. Division 26 Electrical
D. Drawings and general provisions of the contract, including general and Supplementary Conditions and Division 1 specification sections, apply to this section.

1.04 QUALITY ASSURANCE

A. The BAS system shall be designed, commissioned and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. Provide 800 number accesses to 24-hour support center, staffed with factory-trained personnel to assist in trouble shooting and problem resolution. Distributors or licensed installing contractors are not acceptable.

B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

C. BAS shall comply with UL 916 PAZX and 864 UDTZ, European Community, and other subsystem listings as applicable, and herein specified, and be so listed at the time of bid.

D. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, and Governing Radio Frequency Electromagnetic Interference and be so labeled.

E. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

F. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10
SECTION 25 51 00-INTEGRATED AUTOMATION FACILITY CONTROLS

years. Compatibility shall be defined as the ability to upgrade existing field panels and extend new field panels on a previously installed network.

G. Contractor/Manufacturer Qualifications:
   1. Reference Section 1.04.A as well as the following.
   2. Contractor shall have an established working relationship with the Control System Manufacturer for a minimum of 10 years.
   3. All products used in this installation shall be new, currently under manufacture, and shall be applied in standard off the shelf products. This installation shall not be used as a test site for new products unless explicitly approved by Texas State University in writing.
   4. Spare parts will be available for at least 5 years after completion of the contract.

1.05 SUBMITTALS

A. Pre-Construction Submittals:
   1. Contractor shall provide control drawings and other submittals on all hardware, software, and installation to be provided under this scope. No work may begin on any segment of this project until submittals have been reviewed and approved for conformity with the design intent.
   2. Physical copies and Electronic Submittals are to be provided to Planning, Construction and Design as well as to Technical Services for review and approval.
   3. Provide a “Comply/Non-Comply” statement for each section or sub-section of this specification with transmittal of the 25.51.00, 1.7 SUBMITTALS.
   4. Refer to A-1 in the Appendix at the end of this document.

B. Post-Construction As-Builts:
   1. All As-Builts will be provided on Magnetic/Optical Disk to Planning, Construction, and Design, where they will be required to transmit to Archive.
   2. Terminal Equipment Network/Power Trunk Connection Layouts will be provided for all Networked devices. This will be provided as a floor layout with the actual Terminal Equipment locations and how the Floor
SECTION 25 51 00-INTEGRATED AUTOMATION FACILITY CONTROLS

Level Network is run to each unit, labeling what Controller/Floor Level Network or MSTP Trunk it belongs to as well as power trunk if applicable.

1.06 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after system acceptance. Any equipment shown to be defective during the warranty period shall be adjusted, repaired or replaced at no additional charge to the owner.

B. The adjustments, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.

1.07 CODES AND STANDARDS

A. National Electric Code (NEC)
B. Uniform Building Code (UBC)
   1. Section 608, Shutoff for Smoke Control
   2. Section 403.3, Smoke Detection Group B Office Buildings and Group R, Division 1 Occupancies
   3. Section 710.5, Wiring in Plenums
   4. Section 713.10, Smoke Dampers
   5. Section 1106 Refrigeration Machinery Rooms
   6. Section 1107, Refrigeration Machinery Room Ventilation
   7. Section 1108, Refrigeration Machinery Room Equipment and Controls
   8. Section 1120, Detection and Alarm Systems
C. Uniform Mechanical Code (UMC)
D. ASHRAE 135-2001
E. FCC Regulation, Part 15- Governing Frequency Electromagnetic Interference
F. Underwriters Laboratories UL916

1.08 SYSTEM PERFORMANCE

A. The system will conform to the following standards:

1. Graphic Display. The system shall display a graphic with 20 dynamic points/objects with all current data within 10 seconds.

2. Graphic Refresh. The system shall update a graphic with 20 dynamic points/objects with all current data within 8 seconds

3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be less than 2 seconds. Analog objects should start to adjust within 2 seconds
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4. Object Scan. All changes of state and change of analog values will be transmitted over the high-speed Ethernet network such that any data used or displayed at a controller or workstation will have been current within the previous 8 seconds

5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds

6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 1 second. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control

7. Performance. Programmable controllers shall be able to execute DDC PID control loops at a frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency

8. Multiple Alarm Annunciation. All workstations on the network must receive alarms within 5 seconds of each other

9. Reporting Accuracy. The system shall report all values with an end-to-end accuracy as listed or better than those listed in Table 1.

10. Stability of Control. Control loops shall maintain measured variable at setpoint within the tolerances listed in Table 2.

a. Table 1: Reporting Accuracy

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Reported Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Temperature</td>
<td>±0.5°C [±1°F]</td>
</tr>
<tr>
<td>Ducted Air</td>
<td>±0.5°C [±1°F]</td>
</tr>
<tr>
<td>Outside Air</td>
<td>±1.0°C [±2°F]</td>
</tr>
<tr>
<td>Dew Point</td>
<td>±1.5°C [±3°F]</td>
</tr>
<tr>
<td>Water Temperature</td>
<td>±0.5°C [±1°F]</td>
</tr>
<tr>
<td>Delta-T</td>
<td>±0.15°C [±0.25°F]</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>±5% RH</td>
</tr>
<tr>
<td>Water Flow</td>
<td>±5% of full scale</td>
</tr>
<tr>
<td>Airflow (terminal)</td>
<td>±10% of full scale (see Note 1)</td>
</tr>
<tr>
<td>Airflow (measuring stations)</td>
<td>±5% of full scale</td>
</tr>
<tr>
<td>Air Pressure (ducts)</td>
<td>±25 Pa [±0.1 &quot;W.G.&quot;]</td>
</tr>
<tr>
<td>Air Pressure (space)</td>
<td>±3 Pa [±0.01 &quot;W.G.&quot;]</td>
</tr>
<tr>
<td>Water Pressure</td>
<td>±2% of full scale (see Note 2)</td>
</tr>
<tr>
<td>Electrical (A, V, W, Power factor)</td>
<td>5% of reading (see Note 3)</td>
</tr>
</tbody>
</table>
SECTION 25 51 00-INTEGRATED AUTOMATION FACILITY CONTROLS

<table>
<thead>
<tr>
<th>Controlled Variable</th>
<th>Control Accuracy</th>
<th>Range of Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>±5% of reading</td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>±50 ppm</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: 10%-100% of scale.  Note 2: For both absolute and differential pressure.  Note 3: Not including utility-supplied meters.

B. Table 2: Control Stability and Accuracy

<table>
<thead>
<tr>
<th>Controlled Variable</th>
<th>Control Accuracy</th>
<th>Range of Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Pressure</td>
<td>±50 Pa [±0.2” w.g.]</td>
<td>0-1.5 kPa [0-6” w.g.]</td>
</tr>
<tr>
<td></td>
<td>±3 Pa [±0.01” w.g.]</td>
<td>-25 to 25 Pa [-0.1 to 0.1” w.g.]</td>
</tr>
<tr>
<td>Airflow</td>
<td>±10% of full scale</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>±0.5ºC [±1.0ºF]</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>±5% RH</td>
<td></td>
</tr>
<tr>
<td>Fluid Pressure</td>
<td>±10 kPa [±1.5 psi]</td>
<td>0-1 kPa [1-150 psi]</td>
</tr>
<tr>
<td>“ “ differential</td>
<td>±250 Pa [±.20” w.g.]</td>
<td>0-12.5 kPa [0-50”w.g.]</td>
</tr>
</tbody>
</table>

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Siemens Building Technologies - Apogee System

B. Delta Controls

2.02 MATERIAL

A. All products used in this project installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by a Texas State University Representative in writing. Spare parts shall be available for at least five years after completion of this contract.

B. All DDC Controllers shall be BACnet Test Laboratory (BTL) listed.

2.03 NETWORKING COMMUNICATIONS/OPERATOR WORKSTATION INTERFACE

A. The design of the BAS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall consist of three levels; a campus-wide Ethernet based management level network on TCP/IP protocol, a high performance peer-to-peer building level network and DDC Controller floor level local area networks with access being totally transparent to the user when accessing data or developing control programs.
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B. The design of BAS shall allow the co-existence of new DDC Controllers with existing DDC Controllers in the same network without the use of gateways or protocol converters.

C. All control products provided for this project shall comprise a BACnet internetwork. Communication involving control components (i.e. all types of controllers and Operator Workstations) shall conform to ANSI/ASHRAE Standard 135-2001, BACnet.

D. Each BACnet device shall operate on the BACnet Data Link/Physical layer protocol specified for that device.

E. The time clocks in all controllers shall be automatically synchronized daily.

F. Peer-to-Peer Building Level Network:

1. All operator devices shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time. Network shall support a minimum communications speed of 115.2 Kbps.

2. The network shall support a minimum of 100 DDC controllers and PC workstations.

3. The system shall support integration of third party systems (fire alarm, security, lighting, PLCs, chiller, boiler) using integration with standard protocols including Modbus, and BACnet, as well as third party devices via existing vendor proprietary protocols. This DDC Controller shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. **DDC Controllers shall be manufactured and supported by this vendor and not supplied by a third party.** Provide examples of 5 reference projects utilizing gateways required for this project.

G. Management Level Network

1. The Building Automation System Front End shall simultaneously connect to the Ethernet and Building Level Network without the use of an interposing device (i.e. no AEM Devices or Area Routers are to be used, causing a single point of failure for the entire building)
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2. Operator Workstation shall be capable of simultaneous connection and communication with BACnet, OPC, and Apogee networks without the use of interposing devices.

3. The Management Level Network shall not impose a maximum constraint on the number of operator workstations.

4. Any PC on the Ethernet Management Level Network shall have transparent communication with controllers on the building level networks connected via Ethernet. Any Workstation shall be able to interrogate any controller on the building level network.

5. Any break in Ethernet communication from the PC to the controllers on the building level networks shall result in an alarm notification at the Work Station.

6. The Management Level Network shall reside on industry standard Ethernet utilizing standard TCP/IP, IEEE 802.3

7. Access to the system database shall be available from any client workstation on the Management Level Network.

H. DDC Controller Floor Level Network/MSTP Trunk

1. This level communication shall support a family of application specific controllers and shall communicate with the peer-to-peer network through DDC Controllers for transmission of global data. A minimum speed of 4800 Kbps shall be supported.

2. The network shall have the following minimum capacity for future expansion:

   a. Each Building Level Network will have capacity for 99 controllers.
   b. The Building Controller shall have capacity for 1000 Terminal Equipment Controllers.
   c. Each Building will have an overall capacity for 12,500 devices.

I. Building Automation System Front End

1. Building Automation System Interface

   a. The BAS shall provide a graphical interface that allows users to access the BAS data via the Internet, extranet, or Intranet.

   b. A Virtual Server, or Web Based Building Automation Interface will be supplied.
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2. Web Server:
   
a. Shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Chrome or Firefox.

b. The Web browser software shall run on any operating system running Windows 7 and higher.

c. The Web Browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface.

d. The Web Browser Client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java Authentication and encryption techniques to prevent unauthorized access shall be implemented.

2. Alarm Management: Provide alarm notification “pop-ups” that show how many active alarms are in the system. Provide a means to display a summary of all active alarms, when they occurred and a means to filter alarms by alarm classification (critical, maintenance, network, HVAC, etc). Provide an historical alarm and event log and timeline to support analysis of alarm activity, operator activity (like log-ins and commands) and changes to the system.

e. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.

f. Storage of the graphical screens shall be in the Server, without requiring any graphics to be stored on the client machine.

g. Real-time values displayed on a Web Page shall update automatically without requiring a manual “refresh” of the Web Page.

h. Users shall have administrator defined access privileges. Depending on the access privileges assigned, the user shall be able
SECTION 25 51 00-INTEGRATED AUTOMATION FACILITY CONTROLS

to modify common application objects, such as schedules, calendars, and set points in a graphical manner.

i. Graphic screens on the Web Browser Client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

j. Operator Workstation located at Texas State University designated location will communicate with the entire control system using the Texas State University existing Wide Area Network. Texas State University shall furnish appropriate static IP addresses for the new system’s BACnet Broadcast Management Device.

k. Workstation information access shall use the BACnet Protocol. Communication shall use the ISO 8802-3 (Ethernet) Data Link/Physical Layer Protocol.

l. Server Hardware will be a Virtual Server provided by Texas State University.

m. The Workstation shall support the following BACnet Interoperability Building Blocks (BIBBs).

<table>
<thead>
<tr>
<th>Data Sharing</th>
<th>Alarm &amp; Event</th>
<th>Scheduling</th>
<th>Trending</th>
<th>Device &amp; Network Mgmt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-RPM-A</td>
<td>AE-ACK-A</td>
<td></td>
<td>T-ATR-A</td>
<td>DM-DOB-A,B</td>
</tr>
<tr>
<td>DS-WP-A</td>
<td>AE-ASUM-A</td>
<td></td>
<td></td>
<td>DM-DCC-A</td>
</tr>
<tr>
<td>DS-WPM-A</td>
<td>AE-ESUM-A</td>
<td></td>
<td></td>
<td>DM-TS-A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-UTC-A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-RD-A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DM-BR-A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NM-CE-A</td>
</tr>
</tbody>
</table>

n. SYSTEM SOFTWARE

1. Operating System. Furnish a concurrent multitasking operating system. The operating system also shall support the use of other common software applications that operate under Microsoft Windows. Acceptable operating systems are Windows 7 or newer.

2. System Graphics. The operator workstation software shall be a graphical user interface (GUI). The system shall allow display of up to 10 dynamic and animated graphic screens.
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at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.

3. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Visio or AutoCAD.

4. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program. Graphics shall be created by drag-and-drop selection of graphic symbols and drag-and-link with BACnet objects with dynamic and interactive display fields.

5. Multilingual. Software shall be supported in the following languages English, Spanish, French, German, and Chinese.

6. Dynamic Data Exchange (DDE). Software shall support dynamic data sharing with other Windows-based programs for third party add-on functionality e.g. preventative maintenance, tenant billing, etc.

System Applications. Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation:

1. System Database Save and Restore. Each workstation shall store on the hard disk a copy of the current database of each
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Building Controller. This database shall be updated whenever an operator initiates a save command.

2. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to save the database from any system panel. The operator shall be able to clear a panel database via the network and may initiate a download of a specified database to any panel in the system from the network.

3. System Configuration. The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection.

4. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.

5. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the functions accessible to viewing and/or changing each system application.

6. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers.

7. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, alarm limit differentials, states, and reactions for each object in the system.

8. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm, in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying upon
9. Alarm Reactions. The operator shall be able to determine (by object) what if any actions are to be taken during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, providing audible annunciation.

10. Trend Logs. The operator shall be able to define a custom trend log for any data object in the system. This definition shall include change-of-value digital, change-of-value analog, time interval, start time, and stop time. Trend data shall be sampled and stored on the Building Controller panel, and be archivable on the hard disk and be retrievable for use in spreadsheets and standard database programs.

11. Alarm and Event Log. The operator shall be able to view all system alarms and change of states from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms.

12. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. The status shall be available by menu, on graphics, or through custom programs.

13. Clock Synchronization. The real-time clocks in all building control panels and workstations shall be using the BACnet Time Synchronization service. The system also shall be able to automatically synchronize all system clocks daily from any operator-designated device in the system. The system shall automatically adjust for daylight savings and standard time, if applicable.

p. Workstation Applications Editors. Each PC workstation shall support editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at one or more of the controller panels.

1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.
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2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and month. This shall consist of a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. The start and stop times for each object shall be adjustable from this master schedule.

q. Custom Application Programming. Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded.

r. REPORT MANAGEMENT

1. The following reporting capability shall be provided at the operator workstation.

2. Reporting:
   a. Internal reports built into operator workstation software
   b. External reporting via ODBC

3. Internal Reports
   a. User definable query reports (support advanced multiple property, multiple object).
   b. Reports shall be scheduled for automatic generation by schedule or event.
   d. Ability to save report in system report folder.
   e. Query controller hierarchy.
   f. Report to multiple destinations
      i. Email
      ii. Print
      iii. File (text, csv, xml)
      iv. Terminal

4. Enterprise Interface
   a. ODBC driver supporting common SQL statements
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(b. Allow integration to Enterprise software
c. Shall be capable of being used with third party software that supports ODBC connection such as: Microsoft Access, Excel, Crystal Reports, etc.
d. All queries shall be real time into live controller network.
e. Shall be able to both read and write using SQL.

All information exchanged over Internet shall be optionally encrypted and secure via SSH (provided by Owner).

2.04 DDC & HVAC MECHANICAL EQUIPMENT CONTROLLER

A. The DDC & HVAC Mechanical Equipment Controllers shall reside on a Building Network.

B. DDC & HVAC Mechanical Equipment Controllers that do not meet the functions specified in Section 2.4.1 and Section 2.5 for DDC Controllers or Section 2.4.2 and Section 2.5 for HVAC Mechanical Equipment Controllers are not acceptable.

2.4.1 DDC CONTROLLERS

A. DDC Controllers shall be multi-tasking, multi-user, real-time digital control processors consisting of enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of three (3) Floor Level Application Specific Controller Device Networks.

B. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:

b. Control processes
c. Energy management applications
d. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
e. Historical/trend data for points specified
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f. Maintenance support applications

g. Custom processes

h. Operator I/O

i. Manual override monitoring

C. Each DDC Controller shall support firmware upgrades without the need to replace hardware.

D. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

E. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.

2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.

F. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output.

G. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
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H. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:

1. RF-Conducted Immunity (RFCl) per ENV 50141 (IEC 1000-4-6) at 3 V

2. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact

3. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power

4. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)

5. Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:


7. UL 864 Supply Line Transients

8. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

I. In the event of the loss of normal power, non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 60 days.

1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, or from a network workstation PC.

J. Provide a separate DDC Controller for each AHU or other HVAC system as indicated in Section 3.02. It is intended that each unique system be provided with its own point resident DDC Controller.

2.05 DDC CONTROLLER RESIDENT SOFTWARE FEATURES

A. General:
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1. The software programs specified in this Section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher-level computer for execution.

2. All points shall be identified by up to 30 character point name and 16 character point descriptor. The same names shall be used at the PC workstation.

3. All digital points shall have user defined two-state status indication (descriptors with minimum of 8 characters allowed per state (i.e. summer/winter)).

B. Control Software Description:

1. The DDC Controllers shall have the ability to perform the following pre-tested control algorithms:

   a. Two-position control
   
   b. Proportional control
   
   c. Proportional plus integral control
   
   d. Proportional, integral, plus derivative control

C. DDC Controllers shall provide the following energy management routines for the purpose of optimizing energy consumption while maintaining occupant comfort.

1. Start-Stop Time Optimization (SSTO) shall automatically be coordinated with event scheduling. The SSTO program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by time of occupancy.

   a. The SSTO program shall operate in both the heating and cooling seasons.

      1.) It shall be possible to apply the SSTO program to individual fan systems.
      
      2.) The SSTO program shall operate on both outside weather conditions as well as inside zone conditions and empirical factors.

   b. The SSTO program shall meet the local code requirements for minimum outside air while the building is occupied.
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2. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or groups of points according to a stored time.

   a. It shall be possible to individually command a point or group of points.

   b. For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start or stop within that group.

   c. The operator shall be able to define the following information:

      1.) Time, day

      2.) Commands such as on, off, auto, and so forth.

      3.) Time delays between successive commands.

      4.) There shall be provisions for manual overriding of each schedule by an appropriate operator.

   d. It shall be possible to schedule events up to one year in advance.

      1.) Scheduling shall be calendar based.

      2.) Holidays shall allow for different schedules.

3. Enthalpy switchover (economizer). The Energy Management Control Software (EMCS) will control the position of the air handler relief, return, and outside air dampers. If the outside air dry bulb temperature falls below changeover set point the EMCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly changeover to an economizer system based on dry bulb temperature and will be able to override the economizer cycle and return to minimum outside air operation at any time.

5. Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.

6. Night setback control: The system shall provide the ability to automatically adjust setpoints for night control.

7. The Peak Demand Limiting (PDL) program shall limit the consumption of electricity to prevent electrical peak demand charges.
a. PDL shall continuously track the amount of electricity being consumed, by monitoring one or more electrical kilowatt-hour/demand meters. These meters may measure the electrical consumption (kWh), electrical demand (kW), or both.

b. PDL shall sample the meter data to continuously forecast the demand likely to be used during successive time intervals.

c. If the PDL forecasted demand indicates that electricity usage is likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads.

d. Once the demand peak has passed, loads that have been shed shall be restored and returned to normal control.

D. DDC Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

1. A single process shall be able to incorporate measured or calculated data from any and all other DDC within the building (i.e. Outside Air Temperature and Humidity) and if necessary on the network (i.e. Plant conditions). In addition, a single process shall be able to issue commands to points in any and all other DDC Controllers on the network if absolutely necessary.

2. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message (via pop-up dialog box, text message or e-mail) to a workstation or specified device.

3. DDC Controllers shall provide a HELP function key, providing enhanced context sensitive on-line help with task orientated information from the user manual which will be integrated into the Building Automation System.

4. DDC Controllers shall be capable of providing and displaying comment lines for sequence of operation explanation when looking at the program locally.

E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other
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panels on the network. In compliance with this standard, there will not be a single point of failure for an entire building, and all the panels that reside within.

1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.

2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after-hours destinations) or based on priority.

4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.

5. In critical applications, operator-selected alarms shall be capable of remote notification via text message or e-mail to a remote operator device.

F. A variety of historical data collection utilities shall be provided, to manually or automatically sample, store and display system data for points as specified in the I/O summary.

1. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing data samples. All trend data shall be available for transfer to a Workstation without manual intervention.

2. DDC Controllers shall also provide high-resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.
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a. Loop tuning shall be capable of being initiated either locally at the DDC Controller, from a network workstation. For all loop-tuning functions, access shall be limited to authorized personnel through password protection.

G. DDC Controllers shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.

H. The peer-to-peer network shall allow the DDC and Controllers to access any data from or send control commands and alarm reports directly to any other DDC Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC Controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device. The peer-to-peer network shall also allow any DDC Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.

2.06 FLOOR LEVEL NETWORK APPLICATION SPECIFIC CONTROLLERS (ASC)

A. Each DDC Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs) or MSTP Network Device through Floor Level Networks/MSTP Network.

B. Each ASC or MSTP Network Device shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC or MSTP Network Device shall be a microprocessor-based, multi-tasking, and real-time digital control processor.

C. Terminal Equipment Controllers/MSTP Network Devices:

1. Provide for control of each piece of equipment, including, but not limited to, the following:
   a. Variable Air Volume (VAV) boxes
   b. Constant Air Volume (CAV) boxes
   c. Exhaust Fans
   d. Series/Parallel Fan Coil Units

2. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Terminal controllers utilizing proprietary control signals and actuators shall not be acceptable. As an alternative, provide DDC Controllers or other ASCs/MSTP Network Devices with industry
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standard outputs for control of all terminal equipment including pneumatic actuation.

3. Room temperature sensors shall be provided as indicated on the drawings. Provide device as described in the Field Devices section of this specification.

2.07 FIELD DEVICES

A. Provide instrumentation as required for monitoring, control or optimization functions. All devices and equipment shall be approved for installation in the City of Temple.

B. Room Temperature Sensors

1. Digital room sensors shall have LCD display, day / night override button, and setpoint slide adjustment override options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment.

   Temperature monitoring range  
   Output signal  
   Accuracy at Calibration point  
   Set Point and Display Range

   Temperature monitoring range  
   Output signal  
   Accuracy at Calibration point  
   Set Point and Display Range

2. Liquid immersion temperature:

   Temperature monitoring range  
   Output signal  
   Accuracy at Calibration point

3. Duct (single point) temperature:

   Temperature monitoring range  
   Output signal  
   Accuracy at Calibration point

4. Duct Average temperature:

   Temperature monitoring range  
   Output signal  
   Accuracy at Calibration point  
   Sensor Probe Length

5. Outside air temperature:
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C. Liquid Differential Pressure Transmitter

Ranges
0-5/30 inches H20
0-25/150 inches H20
0-125/750 inches H20

Output
4 – 20 mA DC

Calibration Adjustments
Zero and span

Accuracy
+/-0.2% of span

Linearity
+/-0.1% of span

Hysteresis
+/-0.05% of span

D. Differential pressure:

1. Unit for fluid flow proof shall be Penn P74.

   Range
   Differential
   Maximum differential pressure
   Maximum pressure

2. Unit for air flow shall be Siemens Building Technologies SW141.

   Set point ranges: 0.5” WG to 1.0” WG (124.4 to 248.8 Pa)
   1.0” WG to 12.0” WG (248.8 to 497.6 Pa)

E. Static pressure sensor:

Range
0 to .5” WG (0 to 124.4 Pa)
0 to 1” WG (0 to 248.8 Pa)
0 to 2” WG (0 to 497.7 Pa)
0 to 5” WG (0 to 1.2 kPa)
0 to 10” WG (0 to 2.5 kPa)

Output Signal
4 – 20 mA VDC

Combined static error
0.5% full range

Operating Temperature
-40º to 175º F (-40C to 79.5ºC)

F. Air Pressure Sensor:
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Range:  
- 0 to 0.1 in. water (0 to 24.9 Pa)
- 0 to 0.25 in. water (0 to 63.2 Pa)
- 0 to 0.5 in. water (0 to 124.5 Pa)
- 0 to 1.0 in. water (0 to 249 Pa)
- 0 to 2.0 in water (0 to 498 Pa)
- 0 to 5.0 in. water (0 to 124.5 Pa)
- 0 to 10.0 in. water (0 to 249 Pa)

Output signal: 4 to 20 mA
Accuracy: ±1.0% of full scale

G. Humidity Sensors:

<table>
<thead>
<tr>
<th>Range</th>
<th>0 to 100% RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing Element</td>
<td>Bulk Polymer</td>
</tr>
<tr>
<td>Output Signal</td>
<td>4 – 20 mA DC</td>
</tr>
</tbody>
</table>

Accuracy: At 77°F (25°C) ± 2% RH

H. Insertion Flow Meters (Equal to Onicon Series F-1200)

<table>
<thead>
<tr>
<th>Sensing Method</th>
<th>Impedance Sensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>+ 2% of Actual Reading</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum Operating Pressure</th>
<th>400 PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Signal</td>
<td>4 – 20 mA</td>
</tr>
</tbody>
</table>

Bi-directional where required.

I. Pressure to Current Transducer

<table>
<thead>
<tr>
<th>Range</th>
<th>3 to 15 psig (21 to 103 kPa) or 3 to 30 psig (21 to 207 kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal</td>
<td>4 – 20 mA</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 1% of full scale (± 0.3 psig)</td>
</tr>
</tbody>
</table>

J. Control Valves (all control valves shall have electric actuators).

1. Electric Control

<table>
<thead>
<tr>
<th>Rangeability</th>
<th>40:1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Characteristics</td>
<td>Modified. Equal percentage</td>
</tr>
<tr>
<td>Control Action</td>
<td>Normal open or closed as selected</td>
</tr>
<tr>
<td>Medium</td>
<td>Steam, water, glycol</td>
</tr>
<tr>
<td>Body Type</td>
<td>Screwed ends 2” and smaller, flanged</td>
</tr>
</tbody>
</table>
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Valves 2½” and larger

<table>
<thead>
<tr>
<th>Body Material</th>
<th>Body Trim</th>
<th>Stem</th>
<th>Actuator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronze</td>
<td>Bronze</td>
<td>Stainless Steel</td>
<td>0-10 VDC, 4-20 MA or 2 position</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>24 VAC/120VAC</td>
</tr>
</tbody>
</table>

2. All automatic temperature control valves in water lines shall be provided with characterized throttling plugs and shall be sized for minimum 25% of the system pressure drop or 5 psi, whichever is less.

   a. Positive positioning relays shall be provided on pneumatic control when required to provide sufficient power for sequencing.

   b. Two position valves shall be line size.

   Maximum differential pressure 200 psi
   Maximum pressure 325 psi

3. Unit for air flow shall be Siemens Building Technologies SW141.

   Set point ranges:
   0.5” WG to 1.0” WG (124.4 to 248.8 Pa)
   1.0” WG to 12.0” WG (248.8 to 497.6 Pa)

K. Static pressure sensor:

   Range
   0 to .5” WG (0 to 124.4 Pa)
   0 to 1” WG (0 to 248.8 Pa)
   0 to 2” WG (0 to 497.7 Pa)
   0 to 5” WG (0 to 1.2 kPa)
   0 to 10” WG (0 to 2.5 kPa)

   Output Signal 4 – 20 mA VDC
   Combined static error 0.5% full range
   Operating Temperature -40º to 175º F (-40C to 79.5ºC)

L. Air Pressure Sensor:

   Range:
   0 to 0.1 in. water (0 to 24.9 Pa)
   0 to 0.25 in. water (0 to 63.2 Pa)
   0 to 0.5 in. water (0 to 124.5 Pa)
   0 to 1.0 in. water (0 to 249 Pa)
   0 to 2.0 in water 90 to 498 Pa)
   0 to 5.0 in. water (0 to 1.25 kPa)
   0 to 10.0 in. water (0 to 2.49 kPa)
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Output signal 4 to 20 mA
Accuracy ±1.0% of full scale

M. Humidity Sensors:

Range 0 to 100% RH
Sensing Element Bulk Polymer
Output Signal 4 – 20 mA DC
Accuracy At 77°F (25ºC) ± 2% RH

N. Insertion Flow Meters (Equal to Onicon Series F-1200)

Sensing Method Impedance Sensing
Accuracy + 2% of Actual Reading
Maximum Operating Pressure 400 PSI
Output Signal 4 – 20 mA

Bi-directional where required.

O. Pressure to Current Transducer

Range 3 to 15 psig (21 to 103 kPa) or
3 to 30 psig (21 to 207 kPa)
Output signal 4 – 20 mA
Accuracy ± 1% of full scale (± 0.3 psig)

P. Control Valves (all control valves shall have electric actuators).

1. Electric Control

Rangeability 40:1
Flow Characteristics Modified. Equal percentage
Control Action Normal open or closed as selected
Medium Steam, water, glycol
Body Type Screwed ends 2” and smaller, flanged
Valves 2½” and larger
Body Material Bronze
Body Trim Bronze
Stem Stainless Steel
Actuator 0-10 VDC, 4-20 MA or 2 position
24 VAC/120VAC

2. All automatic temperature control valves in water lines shall be provided with characterized throttling plugs and shall be sized for minimum 25% of the system pressure drop or 5 psi, whichever is less.
a. Positive positioning relays shall be provided on pneumatic control when required to provide sufficient power for sequencing.

b. Two position valves shall be line size.

Q. Damper Actuators

1. Electric control shall be Siemens Building Technologies OpenAir™ direct coupled actuators.

2. Damper actuators shall be brush less DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal housing, manual override, independently adjustable dual auxiliary switch.

   a. The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard ½” diameter shaft or damper blade.

3. Actuators shall be designed for mounting directly to the damper shaft without the need for connecting linkages.

4. All actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator’s output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed “v” shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with the damper shaft.

5. All actuators having more than a 100 lb-in torque output shall accept a 1” diameter shaft directly, without the need for auxiliary adapters.

6. All actuators shall be designed and manufactured using ISO900 registered procedures, and shall be Listed under Standards UL873 and CSA22.2 No. 24-93 I.

2.08 MISCELLANEOUS DEVICES

A. Thermostats

1. Room thermostats shall be of the gradual acting type with adjustable sensitivity.
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2. They shall have a bi-metal sensing element capable of responding to a temperature change of one-tenth of one degree. (Provide all thermostats with limit stops to limit adjustments as required.)

3. Thermostats shall be arranged for either horizontal or vertical mounting.

4. In the vertical position thermostat shall fit on a mullion of movable partitions without overlap.

5. Mount the thermostat covers with tamper-proof socket head screws.

B. Freezestats:

1. Install freezestats as indicated on the plans and provide protection for every square foot of coil surface area with one linear foot of element per square foot of coil.
   a. Upon detection of low temperature, the freezestats shall stop the associated supply fans and return the automatic dampers to their normal position. Provide manual reset.

C. Fireststats:

1. Provide manual reset, fixed temperature line voltage type with a bi-metal actuated switch.
   a. Switch shall have adequate rating for required load.

D. Electronic Airflow Measurement Stations and Transmitters (At Duct Locations).

1. Stations – each insertion station shall contain an array of velocity sensing elements and straightening vanes. The velocity sensing elements shall be of the RTD or thermistor type. The sensing elements shall be distributed across the duct cross section in a quality to provide accurate readings. The resistance to airflow through the airflow measurement station shall not exceed 0.08 inches water gage at an airflow of 2,000 fpm. Station construction shall be suitable for operation at airflow of up to 5,000 fpm over a temperature range of 40 to 120 degrees F, and accuracy shall be plus or minus 3 percent over a range of 125 to 2,500 fpm scaled to air volume. Each transmitter shall produce a linear, temperature compensated 4 to 40 mA DC, output corresponding to the required velocity pressure measurement.

E. Fan Inlet Airflow Measuring Station
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1. Each station shall contain parallel air straightener, total and static pressure sensing manifolds, internal piping and external pressure transmission ports with flexible tubing and quick-connect fittings. Fabricate of galvanized steel, size for fan inlet in which mounted. Maximum pressure loss through station of 0.08 inches water gage at 1500 fpm. Station shall have accuracy of 2%. Identify by model number, size, area, and specified airflow capacity.

F. Current Sensing Relay:

1. Provide solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.

2. Adjust the relay switch point so that the relay responds to motor operation under load as an “on” state and so that the relay responds to an unloaded running motor as an “off” state. A motor with a broken belt is considered an unloaded motor.

3. Provide for status device for all fans and pumps.

PART 3: EXECUTION

3.01 PROJECT MANAGEMENT

A. Provide a designated project manager who will be responsible for the following:

1. Construct and maintain project schedule

2. On-site coordination with all applicable trades and subcontractors

3. Authorized to accept and execute orders or instructions from owner/architect

4. Attend project meetings as necessary to avoid conflicts and delays

5. Make necessary field decisions relating to this scope of work

6. Coordination/Single point of contact

3.02 SEQUENCE OF OPERATION

A. Philosophy of Sequences:
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1. All control sequences shall include equipment-operating strategy, required graphics, required alarm messages, required logging, and required reporting and point list requirements.

2. The purpose of the control system is to provide a management tool for operating the complex in an efficient manner. Therefore, as much practical operating information is to be programmed into the control system as part of the base package, as possible.

B. Prior to application programming, the Controls Contractor shall meet with the Owner and Engineer to determine point name formats, Alarm Message Formats, Graphic Formats, Report Formats, Data Logging formats and final sequences of operation.

C. Specific Sequences of Operation

D. Reference Section 17250

3.03 INSTALLATION

A. Wiring.

1. All wire and cable used in the installation of the system shall be marked to identify it as part of the BAS. Cable shall be shaded blue throughout the installation.

2. Cable for building level network shall have low capacitance characteristics to support specified baud rate of 115K.

3. Cable shall be marked to indicate the name of the BAS manufacturer, the application for the cable, gauge and UL listing. Application marking shall state “PMD/LAN” for building level network; “POWER” for all 120V and 24V power runs; “TEMP CONTROL” for all point wire connections. Markings shall occur at a minimum of every 10 feet, and at each junction box and field/panel termination point.

3.04 START-UP AND COMMISSIONING

A. When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. The Installing Contractor shall complete all testing, calibrating, adjusting and final field tests. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. These procedures apply to the BAS and all gateways to other systems, including fire alarm/life safety.
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B. Provide any recommendation for system modification in writing to owner. Do not make any system modification, including operating parameters and control settings, without prior approval of owner.

C. Prior to commissioning proceeding, the following prerequisites shall be met and confirmed in writing:

1. All control hardware is installed.
2. Wiring installation is complete.
3. All terminations for power and control wiring are complete.
4. Power is from final, permanent sources.
5. Mechanical/electrical systems are substantially complete.
   a. Duct caps are removed, ductwork completed.
   b. Air and water systems are balanced.
6. Database is complete
   a. Points, including alarms
   b. Programming, including real-time control software and time-of-day scheduling
   c. Graphics, if workstation is present.
7. Coordination is completed to allow full access to systems
   a. Shutdowns, if required, are scheduled and agreed upon
   b. Coordination with other contractors who impact the startup/checkout schedule

D. The Controls Contractor shall prepare a commissioning process book with all procedures, forms and submittal information. Plan shall include the following information:

1. Track that prerequisites for checkout have been completed, with dates.
2. List of parties to be involved in checkout and required for signoff.
   a. Owner’s rep
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b. Engineer
   c. Other as required

3. List of procedures and tasks to be completed.

4. Collection of forms to capture tasks, results, dates, and signoffs for each category of task.

5. Warranty letters

6. Acceptance letter indicating executive turnover with signatures

E. Commissioning plan tasks and procedures will be included as per the following:

1. Field panel checkout
   a. Verify enclosure is not mounted on vibrating surface
   b. Verify class I and class II wiring is separated within enclosure
   c. Check for shorts/grounds/induced voltages/proper voltages
   d. Verify proper point terminations in accordance with as-builts
   e. Verify that all modules are in proper place and addressed
   f. Verify proper power voltage
   g. Load database and programming
   h. Startup the panel
   i. Point and device checkout
   j. FLN/MSTP Network and Power Trunk Diagrams are available for reference.

2. Analog input point checkout
   a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.
   b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by
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disconnecting one of the wires at the sensor, and verifying that the reading at the field panel has reacted to this change.

c. Verify the point database to be correct, (i.e., alarm ability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.

d. Verify the sensor has the correct range and input signal. (i.e., 20-120 DEG F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.

e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.

f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.

3. Digital input point checkout

a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.

b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.

c. Verify the point database is correct (i.e., point name, address, alarm ability, etc.).

d. Set-up and/or calibrate the associated equipment, i.e. smoke detector, high/low temp detector, high/low static switch, flow switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.

e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator’s terminal and that the status led is giving the proper indication in each mode of operation (on/off).
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4. Digital output point checkout
   a. Verify that device is correctly wired and terminated as shown in the design documentation package.
   b. Verify that the correct voltage is utilized in the circuit.
   c. Verify the point database to be correct (i.e. point name, address, etc.).
   d. Check and verify that the end device responds appropriately to the digital output(s).
   e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.
   f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of it. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate correctly.
   g. Verify that the controlled piece or pieces of equipment can not be cause to change state via the digital output if an associated hand-off-auto switch is in the hand /on or hand/off mode of operation, unless specified as a fireman’s override point etc.

5. Analog output point checkout
   a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.
   b. Insure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.
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c. Verify the point database to be correct. Verify that the correct COV limit has been defined.

d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.

e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three point (high, low and mid-point) calibration procedure shall take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.

f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.

g. After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals; host console devices, etc. can also command these outputs.

h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.

6. Terminal equipment controller checkout

a. Load program database

b. Enable programs

c. Verify sequence of operations

7. Programming checkout

a. Provide checkout for each system and sequence of operation.
SECTION 25 51 00-INTEGRATED AUTOMATION FACILITY CONTROLS

b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures outlined below should be verified for accuracy, and may be modified to meet your specific requirements.

c. DESCRIPTION OF TEST: AHU Alarm Checkout. Verify AHU-1 discharge air temperature alarming is operational and is received at the designated terminal.

d. INPUT TO TRIGGER TEST: Change discharge temperature high alarm limit through software to a value below the current discharge temperature (discharge temperature - 10 Deg F).

e. EXPECTED OUTCOME: A high temperature alarm will be received per the Alarm Definition Report at its designated terminal.

f. Provide signoff sheet with indication for test Pass, Fail, Date of test and Initials for signoff.

8. Customer acceptance

a. Provide customer system acceptance sign-off sheet listing job name, project number, and the following statement: “THIS SYSTEM HAS BEEN FULLY DEMONSTRATED AND EXPLAINED IN ACCORDANCE WITH THE CONTRACT AND IS APPROVED FOR ACCEPTANCE BY THE OWNERS REPRESENTATIVE ON (date) BY (name). THIS SYSTEM IS ACCEPTED WITH THE FULL KNOWLEDGE THAT THE INSTALLATION MUST UNDERGO A TOKEN DEBUGGING PERIOD AND THE UNDERSTANDING THAT ALL ITEMS ON THE ATTACHED LIST WILL BE CORRECTED IN A TIMELY MANNER FROM THE ABOVE DATE. I ACCEPT THIS SYSTEM WITH EXCEPTIONS AS NOTED BY THE ATTACHED DETAILED LIST.”

b. Provide the following spaces for signoff:

1.) Customer signatures title and date

2.) DDC contractor signatures title and date
SECTION 25 51 00-INTEGRATED AUTOMATION FACILITY CONTROLS

3.05 TRAINING

A. The Controls Contractor shall provide comprehensive training to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal working hours of 8:00 AM to 4:00 PM weekdays.

B. Provide up to 40 hours of on-site training for Owner's designated operating personnel as needed. Training shall include:

1. Explanation of drawings, operations and maintenance manuals
2. Walk-through of the job to locate control components
3. Operator workstation and peripherals
4. DDC controller and ASC/MSTP Network Device operation/function
5. Operator control functions including graphic generation and field panel programming
6. Operation of portable operator's terminal
7. Explanation of adjustment, calibration and replacement procedures

C. Provide tuition for University Facilities personnel for classroom training for Controls Equipment Training.
D. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training shall be available from the Controls Contractor. If the Owner requires such training, it will be contracted at a later date.

### Submittals Completion Checklist

<table>
<thead>
<tr>
<th>Description</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Controls Drawings</td>
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<tr>
<td>Table of Contents</td>
<td>Yes</td>
<td></td>
<td></td>
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<tr>
<td>Abbreviation Table</td>
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<td></td>
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<tr>
<td>Control Symbols Legend</td>
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<tr>
<td>Master Bill of Materials</td>
<td>Yes</td>
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<tr>
<td>Riser Diagrams</td>
<td>Yes</td>
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<tr>
<td>System Flow Diagrams</td>
<td>Yes</td>
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</tr>
<tr>
<td>System Wiring Diagrams</td>
<td>Yes</td>
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</tbody>
</table>

- **Table of Contents**: List of Contents within the submittals.
- **Abbreviation Table**: All Abbreviations used need to be listed here for easy reference.
- **Control Symbols Legend**: List of all symbols used within the document and what they reference.
- **Master Bill of Materials**: List of all parts used in project, to include at a minimum the Part Numbers, Manufacturer, Model Number, Device Tag, Device Range/Control as well as Control Type, General Description of items, and quantities used. Exclusions are Schedules (i.e. Valve/Damper etc.).
- **Riser Diagrams**: Provide detailed riser diagram of the complete system or building systems indicating all wiring types and protocols.
- **System Flow Diagrams**: Provide schematic flow diagrams for each system being controlled. Illustrate all control points/objects labeled with point/object names shown on the controller termination drawing. The schematics will graphically show the location of all control devices in each system. Each System will also contain it’s specific BOM with same specifications as the MBOM. Each system will also contain a Sequence of Operations for that specific system.
- **System Wiring Diagrams**: Provide a schematic ladder wiring diagram for each controlled system and control panel. Each schematic shall have all elements labeled. Illustrate specific termination details for all field equipment such as communication interfaces, VFD Interface I/O, Chiller Interface I/O, VRF Systems, RTU’s FAS Systems, Generator Systems, Switch Gear Interfaces, Valves, Actuators and all end device terminations.
## Submittals Completion Checklist

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<td><strong>Panel Pictorial</strong></td>
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<td>Provide scaled panel pictorial drawings indicating all components being installed in each control panel. Terminals, power outlets, power supplies, relays, switches, interface boards, terminators, controllers, any panel mounted components.</td>
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<td><strong>Schedules</strong></td>
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<tr>
<td>Valve Schedule</td>
<td>Provide valve schedules indicating Valve Number, System/Function, Tag, Quantity, Flow Rate, Media Type, Body Type, Design Pressure Drop, Calculated CV, Actual CV, Pipe Size, Valve Body Size, Flow Characteristic, Close Off Pressure, Coil Pressure Drop, Fail Safe Mode, Control Signal, Model Number, Actuator Model Number, Power Requirements, Nema Rating. All Valves installed on campus will be spring return to the appropriate position for the system unless approved in writing by Texas State University.</td>
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<td>Damper Schedule</td>
<td>Provide Damper Schedule indicating Damper Number, System/Function, Tag Quantity, Duct Dimensions, SQ/FT Area, Required Torque per SQ/FT, Actual Actuator Torque, Fail Safe Mode, Control Signal, Model Number, Actuator Model Number and Power Requirements.</td>
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<td>Air Flow Station Schedule</td>
<td>Provide Air Flow Station schedule indicating Flow Station Number, System/Function, Tag, Quantity, Duct Dimensions/Area, Control Signal, Model Number, Interface Protocol, and Power Requirements.</td>
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<tr>
<td>Water Flow Meter Schedule</td>
<td>Provide water flow meter schedules indicating Flow Meter Number, System/Function, Tag, Quantity, Pipe Size, Pipe Schedule, Flow Rate, Control Signal, Model Number, Interface Protocol, Any pertinent setup information required for maintenance, Power Requirements.</td>
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</tr>
<tr>
<td>Utility Metering Schedule</td>
<td>Provide utility metering schedule indicating (As Applicable) Meter Number, System/Function, Tag, Quantity, Pipe Size Pipe Schedule, Flow Rate, KW Rates, CT Sizes, Panel Locations, Circuit Numbers, or Metering Areas for GAS/City Water. For all utility metering provide Interface Control Signal, Model Number, Interface Protocol, and Power Requirements. Indicate who is providing the meter if it is provided by others.</td>
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<tr>
<td>Terminal Box Schedule</td>
<td>Provide Terminal Box Schedule indicating Box Number, System/Function, Tag, Duct Inlet Dimensions, Minimum CFM, Maximum CFM, Fan Operation, Reheat Operation, Space Sensor Type, Controller Model Number, Interface Protocol, and Power Requirements.</td>
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<tr>
<td>Product Data</td>
<td>Provide Product Data Sheets/Cut Sheets for all products on the MBOM. When manufacturer’s cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements.</td>
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<tbody>
<tr>
<td><strong>Integrations</strong> Products requiring integration to the controls system will supply, as part of their packages, catalog data sheets, wiring diagrams, and points lists to the Division 23 Contractor (when integrating with an Integrated Automation Facility Controls and Control System) for proper coordination of work. EACIS Contractor shall also include a complete points list/registry list of all points available to be integrated into the Automation Facility Controls. This contractor shall be responsible for As-Builts pertaining to overall Integrated Automation Facility Controls architecture and network diagrams. All As-Built drawings shall also be submitted to Planning, Construction, and Design as well as Technical Services.</td>
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<tr>
<td><strong>Training</strong> The Contractor shall provide a course outline and training manuals for all training classes at least three weeks prior to the first training class. Review and approval by Texas State University shall be completed at least one week prior to the first class. Contractor shall provide a qualified/competent trainer in the training course provided to Texas State University.</td>
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</tbody>
</table>

END OF SECTION 25 51 00
DIVISION 26:  ELECTRICAL

26 01 26  Maintenance Testing of Electrical Systems
26 05 00  Common Work Results for Electrical
26 05 13.16 Medium-Voltage, Single and Multi-Conductor Cables
26 05 19  Low-Voltage Electrical Power Conductors and Cables
26 05 19.13 Under Carpet Electrical Power Cables
26 05 33  Raceway and Boxes for Electrical Systems
26 05 36  Cable Trays for Electrical Systems
26 05 43  Underground Ducts and Raceways for Medium Voltage Electrical Systems
26 05 46  Utility Poles for Electrical Systems
26 05 53  Identification for Electrical Systems
26 12 16  Dry-Type, Medium-Voltage Transformers
26 12 19  Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers
26 13 13  Medium-Voltage Circuit Breaker Switchgear
26 22 13  Low-Voltage Distribution Transformer
26 24 13  Switchboards
26 24 16  Panel Boards
26 24 19  Motor-Control Centers
26 27 26  Wiring Devices
26 28 16  Enclosed Switches and Circuit Breakers
26 29 23  Variable Frequency Drives
26 32 13  Diesel Engine Generators (Emergency Electrical Power Supply)
26 35 13  Capacitors
26 36 23  Automatic Transfer Switches
26 42 14  Cathotic Protection-Piping and Valves-Steam Pipes
26 42 15  Cathotic Protection-Piping Chill Water and Condensate Piping & Shut-Off Valves
26 50 00  Introduction to Lighting Standard
26 51 00  Interior Lighting
26 52 00  Emergency Lighting
26 53 00  Exit Signs
26 55 00  Special Purpose Lighting
26 56 00  Exterior Lighting
26 56 13  Light Poles and Standards
26 56 16  Parking Lot Lighting
26 56 17  Parking Garage Bay Lighting
26 56 26  Landscape Lighting
26 56 33  Walkway Lighting
26 56 80  Other Exterior Lighting
SECTION 26 01 26 – MAINTENANCE TESTING OF ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Maintenance Testing of Electrical Systems.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 DESCRIPTION

General: This section specifies that the CONTRACTOR prepare a short circuit and coordination study for the electrical power system including all existing and newly installed electrical equipment.

The analysis and study shall include all power distribution systems, beginning at the main 12 kV feeder breaker at the Owner’s Power Plant to the secondary buses of each panel board as described hereafter. The short circuit and coordination study reports shall provide an evaluation of the electrical power systems and the model numbers and settings of the protective devices for setting by the CONTRACTOR.

B. Scope:

1. Provide a complete short circuit study, equipment interrupting or withstand evaluation, and a protective device coordination study for the power distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly addressed in the study. The study shall assume all motors operating at rated voltage. Electrical equipment bus impedance shall be assumed zero. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the switchboard busses and motor control centers.

2. A protective device coordination study shall be performed to determine appropriate relay settings. The study shall include all distribution switchboards, motor control centers, and panel board main circuit breakers. Panel board branch circuit devices need not be considered. The phase over current and ground-fault protection shall be included as well as settings for all other adjustable protective devices.
3. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents.

4. Any problem areas or inadequacies in the equipment shall be promptly brought to the ENGINEER’S attention.

1.03 REFERENCES

A. This Section contains references to the following documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEEE 141-86</td>
<td>Recommended Practice for Electric Power Distribution for Industrial Plants</td>
</tr>
<tr>
<td>IEEE 242-86</td>
<td>Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems</td>
</tr>
</tbody>
</table>

1.04 SCHEDULE

A. The approved reports shall be completed and a copy sent to the electrical distribution equipment manufacturer 45 days before the equipment is shipped to the Work site. The report shall be provided to the ENGINEER 90 days before the equipment is shipped to the Work site.

PART 2: PRODUCTS

2.01 REPORTS

A. The product shall be a certified report summarizing the short circuit, coordination study, arc flash hazard analysis and conclusions or recommendations which may affect the integrity of the electric power distribution system. As a minimum, the report shall include the following:

1. The equipment manufacturer's information used to prepare the study.

2. Assumptions made during the study.
SECTION 26 01 26 – MAINTENANCE TESTING OF ELECTRICAL SYSTEMS
3. Short circuit calculations listing short circuit levels at each bus.
4. Coordination study time-current curves including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker.
5. Comparison of short circuit duties of each bus to the interrupting capacity of the equipment protecting that bus.
6. All data which was used as input to the report. This data shall include cable impedances, source impedances, equipment ratings, etc.

PART 3: EXECUTION

3.01 GENERAL
A. Provide a short circuit, coordination study, and arc flash hazard analysis on the electrical power distribution system, as specified. The study shall be performed in accordance with IEEE Standards 141 and 242 and shall utilize the ANSI method of short circuit analysis in accordance with ANSI C37.010. The study shall be performed using actual equipment data for all equipment. The coordination study shall use the data from the manufacturer of protective devices.

3.02 QUALIFICATIONS
A. The short circuit and coordination report shall be performed by the manufacturer of the supplied equipment. The studies shall be signed by a Professional Engineer with proficiency in electrical engineering. The Professional Engineer shall be licensed to practice engineering in the State of Texas.

3.03 POWER SYSTEM STUDIES
A. Short-Circuit Analysis
1. Calculation of the maximum rms symmetrical three-phase short-circuit current at each significant location in the electrical system shall be made using a digital computer.
2. Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the computer calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.
3. A tabular computer printout shall be included which lists the calculated short-circuit currents, X/R ratios, equipment short-circuit interrupting or
SECTION 26 01 26 – MAINTENANCE TESTING OF ELECTRICAL SYSTEMS

4. The study shall include a computer printout of input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.

5. Include a computer printout identifying the maximum available short-circuit current in rms symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.

6. The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis.

7. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

8. The contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the short-circuit analysis to be completed prior to final installation.

9. Any inadequacies shall be called to the attention of the engineer (architect) and recommendations made for improvements as soon as they are identified.

B. Protective Device Time-Current Coordination Analysis

1. The time-current coordination analysis shall be performed with the aid of computer software intended for this purpose, and will include the determination of settings, ratings, or types for the over current protective devices supplied.

2. Where necessary, an appropriate compromise shall be made between system protection and service continuity with system protection and service continuity considered to be of equal importance.

3. A sufficient number of computer generated log-log plots shall be provided to indicate the degree of system protection and coordination by displaying
SECTION 26 01 26 – MAINTENANCE TESTING OF ELECTRICAL SYSTEMS

the time-current characteristics of series connected over current devices and other pertinent system parameters.

4. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, the short-circuit current availability at the device location when known, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.

5. The study shall include a separate, tabular computer printout containing the suggested device settings of all adjustable over current protective devices, the equipment where the device is located, and the device number corresponding to the device on the system one-line diagram.

6. A computer generated system one-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.

7. A discussion section which evaluates the degree of system protection and service continuity with over current devices, along with recommendations as required for addressing system protection or device coordination deficiencies.

8. Significant deficiencies in protection and/or coordination shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified.

9. The contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the time-current analysis to be completed prior to final installation.

C. Arc-Flash Hazard Analysis

1. The Arc-Flash Hazard Analysis shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.

2. The Arc-Flash Hazard Analysis shall be performed in conjunction with a short-circuit analysis and a time-current coordination analysis.

3. Results of the Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels,
SECTION 26 01 26 – MAINTENANCE TESTING OF ELECTRICAL SYSTEMS

flash protection boundary distances, personal-protective equipment classes and AFIE levels.

4. The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

5. The Arc-Flash Hazard Analysis shall be performed by a registered professional engineer.


7. The Arc-Flash Hazard Analysis shall include recommendations for reducing AFIE levels and enhancing worker safety.

8. The proposed vendor shall demonstrate experience with Arc-Flash Hazard Analysis by submitting names of at least ten actual Arc-Flash Hazard Analyses it has performed in the past 3 years.

9. The proposed vendor shall demonstrate capabilities in providing equipment, services, and training to reduce Arc-Flash exposure and train workers in accordance with NFPA 70E and other applicable standards.

10. The proposed vendor shall demonstrate experience in providing equipment labels in compliance with NEC-2005 section 110 and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

END OF SECTION 26 01 26
PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Common Work Results for Electrical.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. Code Compliance

1. In this document “shall”* shall have the same meaning as in the OSHA Code of Federal Regulations (CFR) Article 29 Labor Part 1926.32 (p), (*mandatory).

2. All electric work on Texas State University property shall comply with the latest version of The National Electric Code (NEC) in force at the pre-bid date as the minimum requirements.

B. General.

1. Use NFPA/NEC minimum, except where otherwise noted to exceed minimum.

2. Service conductors shall be rated at 100% of panel rating i.e.: 200A rated panel shall have minimum 3/0 75 degree C wire.

3. Ideally any new circuit breaker panels should not be more than 80% filled.

4. Anticipate that building areas will be upgraded over time; therefore, provide sufficient electrical capacity initially.

5. Do not overlook facilities for battery charging for various types of equipment and provide any such areas with ventilation.

6. All enclosed areas containing electric equipment shall be conditioned.
SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

7. Make transformer vaults accessible from building exteriors.

8. Doors on electrical rooms or closets should swing out; transformer vault rooms are required to swing out to conform to NFPA standards.

9. Provide floor drains in electric vaults.

10. Use identification systems for electric wiring and equipment.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 05 00
PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Medium-Voltage, Single-and Multi-Conductor Cables.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work

A. Feeders and service taps shall be rated at 15 KV, with a 220 mils/133% insulation factor. Service tap(s) extend from the source connection in the manhole to the line side of the fused disconnecting means or switch. The cable and means of protection beyond the switch shall be sized according to building service.

B. All cable ends shall be sealed to prevent the entrance of moisture into the insulation during shipment, storage, and installation.

C. Field testing of cables is to be performed and copies of the test results provided to the owner’s representative. Only qualified personnel shall do cable terminations. At each termination point, bond all shields, ground conductor, etc., to a ground rod and equipment ground system.

D. Arrange cables in manholes to permit subsequent installation of future cables in spare ducts and to permit repair and/or replacement of adjacent cables.

1. All cables shall be identified, at the point of entry into manholes or electrical equipment, with tape to match color coding in campus standards. Cables that pass through manholes or pull boxes without terminations shall be identified with same.

2. All cables in manholes shall be fire taped.

3. Route cables around the walls of the vaults.

4. Allow for spare taps in vaults.
SECTION 26 05 13.16 – MEDIUM-VOLTAGE, SINGLE-AND MULTI-CONDUCTOR CABLES

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 05 13.16
SECTION 26 05 19.13 – UNDER CARPET ELECTRICAL POWER CABLES

PART 1: GENERAL

A. Under carpet Electrical Power Cables are strictly forbidden on this campus.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 05 19.13
SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Low-Voltage Electrical Power Conductors and Cables.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work

A. This section includes building wire and cable rated 600V and less.

B. This is a design standard and is not intended to be used as a guideline or construction specification.

PART 2: PRODUCTS

A. All conductors, plus stranded, shall be soft drawn annealed copper, ninety-eight (98%) conductivity, continuous, from outlet to outlet.

B. Minimum size of wire shall be #12 AWG. (Exception: Control wire may be #14 AWG.)

C. All wire insulation for 600V conductors shall be type XHHW, THHN, or THWN. Metallic sheathed cable, MC or BX cable is prohibited. (Exception: Can be used as fixture tails and where both ends of the metallic cable can be accessed for replacement if needed.)

PART 3: EXECUTION

3.01 Design/Drawing Requirements

A. All branch circuit home runs shall contain no more than two multi-wire branch circuits. Multi-wire branch circuits shall not be used where the load generates harmonics, i.e. personnel computers (PC). ALL circuits installed for PC’s shall contain its own dedicated neutral conductor.
SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

B. Home runs shall be clearly indicated on the floor plans.

C. Pump Motor Requirements:
   1. Wiring Requirements:
   2. Connect all pump motors with sealed, flexible conduit no longer than 3 feet.
   3. Duplex sump pumps and condensate return pumps should be wired so that each pump is on a separate dedicated circuit. A mechanical alternator is to be provided to alternate operation of the pumps. There should be three floats in the sump; the lowest to energize the first pump, the next highest to energize both pumps and the highest to operate a N.O. set of contacts for alarm purposes.
   4. Some pumps may require emergency power. Coordinate with Texas State University representative for special requirements.

D. Only copper wire shall be used on this campus. Exception: SMEU and PEC are allowed to install aluminum conductors as their service drops.

E. Minimum wire size on campus is # 12. Circuit wire size on all runs over 100’ shall be sized no smaller than # 10.

F. All wiring, including luminaries and motor leads, and motor control, shall be stranded.

G. All wire insulation for 600V conductors shall be type XHHW, THHN, or THWN.

H. All conductors shall be soft drawn annealed copper, ninety-eight (98%) conductivity, continuous, from outlet to outlet.

I. Crimp connectors and splices shall only be used in J-boxes, gutters, and cabinets.
   1. A compression connector installation tool such as Panduit CT-720 or a compound-action crimping tool such as a VACO T1710 that provides a crimp that meets or exceeds MIL-SPEC pull-out tests shall be used for all such connections.
   2. Crimps shall be made on each wire end of the connector for as much of the length of the barrel as possible.
   3. The longest barrel/sleeve possible shall be used.
SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

J. Crimp connectors shall not be used on items that may need to be changed out periodically, i.e.: ballast’s, motors, etc.

K. Connectors shall be copper or tinned copper.

L. Plumbing Pump Motor Requirements:

1. Wiring Requirements 120 volts

2. All pumps 1 hp or less may be connected with an outlet plug and cord.

END OF SECTION 26 05 19
SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Raceway and Boxes for Electrical Systems.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work

A. This section of the standard includes minimum design requirements for raceways, boxes, and floor boxes used for electrical power.

B. This is a design standard and is not intended to be used as a construction specification.

PART 2: PRODUCTS

A. All electrical raceway design shall conform to the minimum requirements of the latest edition of the National Electric Code (NEC).

B. New Buildings and Building renovations may use UL approved fire rated poke-thru.

C. All electrical penetrations through fire rated walls or floor, must have fire rated box and fire rated seals between box and conduit and opening.

PART 3: EXECUTION

3.01 Design/Drawing Requirements

A. In addition to the minimum NEC requirements all design shall conform to the following strict guidelines:

1. Installed conduit shall be Rigid Galvanized Conduit (RGC), Intermediate Conduit (IMC), or Electric Metallic Tubing (EMT).

2. In exposed exterior areas, use only RGC or IMC.
SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

3. In wet or corrosive areas use SCH 40 PVC raceway.

4. Liquid tight flexible conduit installed in sizes ½” and larger shall not exceed 3’ in length. (Special applications may exceed this length if approved by Owner’s project representative).

5. Flexible metal conduit is permissible in sizes ½” and larger with one exception. Applications with fixture tails may be 3/8”. In no case shall the length exceed 12’.

6. Surface metal raceway:
   b. Laboratories: painted steel.

7. Liquid tight flexible conduit or EMT shall be used under raised computer floors in the length and size necessary to serve the load. The conduit must originate and terminate in the same room. Do not use rubber cord for this application.

8. All floor boxes shall be shown on floor plans and clearly denoted as such by symbology.

9. Drawing shall clearly indicate electrical conduit, with sizes, feeding the floor box.

B. Conduit shall not be mounted in or on the floor. In place of floor boxes, conduit shall be roughed in below the floor and installed by core drilling the floor after final placement is approved.

C. All electrical box design shall conform to the minimum requirements of the latest edition of the NEC and the following strict clarifications:
   1. In dry locations, provide only galvanized-coated flat rolled sheet steel outlet wiring boxes.
   2. In wet or corrosive areas, use only PVC boxes and fittings.
   3. In exposed areas, use cast aluminum boxes with galvanized conduit.

D. A minimum of ¾” conduit shall be used for all home runs.

E. All exposed conduit to be used for conductors over 600 VAC shall be rigid steel.
SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

F. All metal, flexible conduits, such as Greenfield, shall be steel.

G. Metal conduit fittings shall be steel or cast iron.

H. Conduit fittings shall not be crimp tool or snap-in type.

I. There shall be no ENT or similar product installed on Campus as the main or primary conduit. ENT or similar products shall be used only as an ‘inner duct’ or where it is accessible for its entire length and shall be labeled as LS (limited-smoke-producing characteristics).

J. There shall be no factory assembled metal clad or non-metallic-sheathed armored cable used as building wiring on Campus unless it is accessible for its entire length, such as on fixture whips, or used as exposed surface wiring and equipment leads.

K. All conduit bends shall be made with appropriate trade benders or be factory made.

L. Junction and device boxes shall be minimum 4” x 4” x 2 1/8” combination.

M. All handy 4” and 4 11/16” surface mount boxes are to be drawn type, not welded.

N. All exterior J-boxes used in earth, concrete or asphalt shall be traffic rated. These boxes shall be installed so that the top surface is at, or above grade with grade sloped up to them. Boxes should be installed so that they are not in a drain channel or “low spot”.

O. All electrical J-boxes, receptacles shall be “Accessible” as applied to wiring methods stated in NEC Article 100, I - General.

END OF SECTION 26 05 33
SECTION 26 05 36 – CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Cable Trays for Electrical Systems.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 Scope of Work

A. This section of the design standard includes requirements for telecommunications cable tray installation.

B. Cable tray shall only be utilized for telecommunications cabling.

C. Power and fire alarm cabling shall be run in conduit and are covered in a separate portion of this standard.

PART 2: PRODUCTS

A. Cable tray shall be aluminum 12 inches wide ladder bottom supported from both sides sized to support the cabling load.

B. Solid bottom cable tray is permissible in the event that the working clearances as described below cannot be met, or the ceiling space is non-accessible.

PART 3: EXECUTION

3.01 Design Requirements

A. Location: Cable tray must be designed to run in the corridors of the building. Designer shall coordinate ceiling elevation requirements through architect and other trades. Cable tray shall be run above water piping. Designer shall provide a 12” vertical working clearance above the cable tray with no continuous obstructions. In addition, a 12” space must be provided on either side for working access.

B. Electrical Engineer is responsible for coordinating the installation of the cable tray with the Telecommunications Designer. Drawings should clearly indicate that electrical contractor is responsible for cable tray installations.
SECTION 26 05 36 – CABLE TRAYS FOR ELECTRICAL SYSTEMS

C. Designer shall show all routing of cable tray on the special systems floor plans and coordinated with the telecommunications floor plans. Floor plans shall indicate firewall penetrations.

D. Fire stopping: Penetrations in fire rated walls shall be made to the size of the cable tray and filled with fire pillows.

E. Grounding: All cable trays shall be grounded per the latest requirements of the National Electric Code. Refer to standard on grounding and bonding for specific details.

F. Attachments: No medium voltage boxes or conduit shall be physically attached to the cable tray.

G. Indicate mounting height and transition locations on the floor plans.

H. Changes in horizontal and vertical directions shall be made with manufactured cable tray offsets.

I. Designer shall coordinate apparent violations of working space with Texas State University-San Marcos staff prior to final design of cable tray.

END OF SECTION 26 05 36
SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR MEDIUM VOLTAGE ELECTRICAL SYSTEM

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Underground Ducts and Raceways for Electrical System.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work

A. The work included in this section of the construction standards consists of the design requirements for the complete layout and installation of a concrete encased duct system. This is a design standard and is not intended to be used as a construction specification. The ductbank system shall be used for the distribution of electrical services. In addition to the requirements defined elsewhere, the contractor shall adhere to the following minimum requirements:

B. All excavation shall meet the current requirements of O.S.H.A. and any other governing federal, state or local authority with regards to trench safety. The project engineer shall require a Trench Safety Plan signed and sealed by a registered Engineer of the State of Texas.

C. The project engineer shall require provisions for a suitable means of containment and abatement of water run-off contaminated construction materials. These procedures shall meet all local, state, and federal regulations and requirements.

PART 2: PRODUCTS

A. Ducts:

1. Approved Manufacturers: Carlon Electrical Products, Cantex, or approved equal.

2. All ducts shall be Schedule 40 Rigid Nonmetallic Conduit or Schedule 40 Rigid Nonmetallic utility conduit with integral bell ends.
SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR MEDIUM VOLTAGE ELECTRICAL SYSTEM

3. Sleeves installed for electrical access routes under pavement shall not be used for any other utility.

B. Concrete:

1. Concrete envelope requirements shall be defined in Division 3 of the design standard. Electrical designer shall be responsible for coordinating minimum concrete standards with the project civil engineer. The minimum requirements are:
   a. 3/8” minimum aggregate
   b. Slump: 4-1/2” – 5”
   c. Strength: 3000 psi, in accordance to ASTM 039-44
   d. Electrical concrete envelope shall contain red dye at 8 lbs. per cubic yard of concrete.

C. Manholes

1. The manholes shall be precast concrete Dalworth Quickset Co. No. 612.7 or approved equal. The manhole shall have grade 60 reinforcement of H20 loading and 4500 psi concrete. Precast terminators shall be provided at each penetration shown on the drawings.

2. All manholes shall have 30” dia. round entrance covers, sump pits, and 120 VAC receptacle located at the highest point near the entrance, but not in the entry way. Manhole access or cover shall be level with finished grade. All manholes, where splices and/or terminations are made, shall be no smaller than 10’ x 10’ x 8’.

3. Entire exterior shall be waterproofed with coating such as bituminous waterproofing mastic.

4. Manholes shall not be installed where water will cover the access, such as in ‘run-off” areas or where water tends to ‘pond’.

5. Locate pulling eyes opposite raceways.

6. Manholes shall be equipped with a traffic weight manhole ring and cover with the word “ELECTRIC” stamped clearly thereon. The lid shall be 30” diameter.
SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR MEDIUM VOLTAGE ELECTRICAL SYSTEM

7. All manholes shall have a driven ground rod, with a maximum resistance reading of 25 Ohms. Ground rod shall be Cad-welded to grounding conductor. Ground rod shall be connected to a fully closed loop of grounding conductor that is used to bond all splices and non-current carrying electrical equipment in manhole. Connections shall be made to racks with listed connectors suitable for the purpose. Loop of conductors shall be between 12” and 24” above floor and shall be securely attached to wall of manhole.

8. Cable in manholes shall be placed on porcelain insulators on suitable racks.

9. Cable shall be secured by cable ties that are fungus resistant, ultra-violet and heat stabilized and are made of self-extinguishing nylon material.

10. All penetrations in manholes shall be watertight.

D. Pumps

1. Install a pump and the circuit for it in all manholes. Pump manufacturer and model is Wayne CDT 508 or equal. Circuit should come from a local source such as a building equipment room panel. Circuit identification shall be clearly marked in the neck or throat of the manhole by means of a plastic plate or tag and securely fastened into place.

PART 3: EXECUTION

3.01 Design/Drawing Requirements

A. The bank of ducts shall be installed by the built up method. Engineer shall require 3” base and intermediate Snap-Loc spacers installed 3” above the bottom of the trench and spaced throughout the ductbank at 6’ on center. The concrete envelope shall be reinforced with #4 rebar along the continuous length of the ducts and #4 stirrups located at 4’ intervals.

B. Grounding: Ductbanks containing power conductors shall have one #4/0 bare copper ground located in the lower portion of the ductbank. The ground conductor shall extend 4 feet into buildings and manholes.

C. Designer shall require factory bends and sweeps of 36” minimum radius and/or combination of 5 degree couplings.

D. All ground and asphalt repair shall be covered in the Civil related sections of the construction standard.
E. Manhole Grounding and Design

1. Grounding System:
   a. Ductbank grounding conductor shall penetrate wall of manhole on all applicable sides and extend 4’ inside the manhole.
   b. A looping grounding system consisting of #4/0 bare copper wire shall completely encircle each manhole and shall be thermowelded at all connections including the ductbank grounding conductor penetrating the manhole.

F. Drawing Requirements:

1. Ductbank detail design shall, as a standard, be coordinated through the civil engineer and civil drawings. As a minimum, the electrical engineer shall provide a site plan depicting the quantity of ducts and the general routing of the ducts through the campus infrastructure and plan profiles indicating the quantity and intended conduit layout in the ductbank. The electrical engineer shall locate new manholes, and existing manholes and ducts where applicable to coordination. New manholes shall be clearly indicated and labeled according to the campus labeling standard. The site plan shall also indicate existing utilities (other than electrical) and locations and coordinate conflicts.

2. The electrical engineer shall provide sufficient ductbank details to depict electrical requirements including grounding and minimum cover. All site repair shall be done in accordance with campus accepted civil practices and campus standard details.

3. The electrical engineer shall provide ductbank profile drawings indicating conduit layout in the ductbank. A profile drawing shall be required for each layout of ducts.

4. The electrical engineer shall provide sufficient manhole details to depict proper grounding practices, and typical ring and cover placement.

5. The electrical engineer shall provide sufficient details for building penetrations and terminations for each building affected by the design.

6. The underground feeders on campus shall be installed in 4” minimum rigid, schedule 40 minimum, PVC. The uppermost conduit shall be no less than 24” below finished grade. Terminations in manholes to be made...
SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR MEDIUM VOLTAGE ELECTRICAL SYSTEM

on bushing racks on the wall only. Terminiations in the manhole shall be sized at 600 amps. Cable terminations shall be manufactured by Elastimold, 3M or equal. ALL elbows shall have test points.

G. For reliability, full redundancy is required for the primary distribution system.

H. The system shall be designed to ensure that alternate feeder usage and switching due to the failure of any single component of the primary system will not prevent the alternate system from carrying the full capacity of the additional load.

I. Each building shall have its own building service transformer.

J. Ducts:

1. Approved Manufacturers: Carlon Electrical Products or Cantex.

2. All ducts shall be Schedule 40 Rigid Nonmetallic Conduit or Schedule 40 Rigid Nonmetallic utility conduit with integral bell ends.

3. Electrical ducts shall be 5” minimum, standard.

4. Designer shall require 3” base and intermediate Snap-Loc spacers installed 3” above the bottom of the trench and spaced throughout the duct bank at 6’ on center. The concrete envelope shall be reinforced with #4 rebar along the continuous length of the ducts and #4 stirrups located at 4’ intervals.

5. Designer shall require factory bends and sweeps of 36” minimum radius.

6. All ground and asphalt repair shall be covered in the Civil divisions of the standard.

K. Concrete:

1. Concrete envelope requirements shall be defined in Division 3 of the design standard. Electrical designer shall be responsible for coordinating minimum concrete standards with the project civil engineer. The minimum requirements are:

   a. 3/8” minimum aggregate

   b. Slump: 4-1/2” – 5”
c. Duct bank shall be totally encased in 3000 psi concrete with Red dye at 40 lbs. per cubic yard of concrete, stirred within the mix. (Not sprinkled on top).

L. Drawing Requirements:

1. Duct bank detail design shall, as a standard, be coordinated through the civil engineer and civil drawings. As a minimum, the electrical engineer shall provide a site plan depicting the quantity of ducts and the general routing of the ducts through the campus infrastructure and plan profiles indicating the quantity and intended conduit layout in the duct bank. The electrical engineer shall locate new manholes, and existing manholes and ducts where applicable to coordination. New manholes shall be clearly indicated and labeled according to the campus labeling standard. The site plan shall also indicate existing utilities (other than electrical) and locations and coordinate conflicts.

2. The electrical engineer shall provide sufficient duct bank detail to depict electrical requirements including grounding and minimum cover. All site repair shall be done in accordance with campus accepted civil practices and campus standard details.

3. The electrical engineer shall provide duct bank profile drawings indicating conduit layout in the duct bank. A profile drawing shall be required for each layout of ducts.

4. The electrical engineer shall provide sufficient manhole details to depict proper grounding practices, and typical ring and cover placement.

5. The electrical engineer shall provide sufficient details for building penetrations and terminations for each building affected by the design.

END OF SECTION 26 05 43
SECTION 26 05 46 – UTILITY POLES FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

A. Overhead electrical distribution and transformers are not allowed on this campus.

PART 2: PRODUCT (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 05 46
SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Identification for Electrical Systems.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Color Codes

A. Color coding shall be maintained in all applications including feeders, branch circuits and switch legs. Voltage color codes are as follows:


3. Three phase 120/240V Delta – High leg Orange. The two lighting legs Black and Red, Neutral marked with White


5. Ground-Green

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 05 53
SECTION 26 12 16 – DRY-TYPE, MEDIUM-VOLTAGE TRANSFORMERS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Dry-Type, Medium-Voltage Transformers.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work

A. This section includes enclosed dry type transformers for lighting and power loads, with primaries rated at 15,000 volts.

B. This is a design standard and is not intended to be used as a construction specification.

PART 2: PRODUCTS:

A. All 15KV Dry-type transformers shall meet these specifications:

   Standard: ANSI

   UL Listing: UL Labeled

   Primary Voltage: 12,470 Delta 95KV BIL

   Feed: Radial

   Frequency: 60 HZ

   Nominal Impedance: ANSI Standard

   Sound Level: NEMA Standard

   Primary Arrestors: 3ea – 15KV

   No Switches

   No Fuses
SECTION 26 12 16 – DRY-TYPE, MEDIUM-VOLTAGE TRANSFORMERS

A. Acceptable transformer manufacturers:

1. Cooper Industries
2. Cutler Hammer/Seimens
3. General Electric

B. Installation:

1. Each transformer is to be placed on a housekeeping pad of suitable height.

2. Safety Design Issues
   a. Install signs stating “DANGER HIGH VOLTAGE” on exterior panels.
   b. The signs shall use at least 1 _” red lettering on a 3” white background.

PART 3: EXECUTION

3.01 Design/Drawing Requirements

A. Distribution transformers shall be designed for location on the ground floor. The electrical engineer is responsible for coordinating maximum transformer weights and anticipated floor loading with the project structural engineer.

B. Transformers installed in electrical rooms shall be designed and sized in coordination with architect and door dimensions.

C. Electrical engineer shall provide detail layouts of electrical rooms indicating transformer locations drawn to scale with special mounting instructions as appropriate.

D. Transformers for Non-Linear Loads (K-rated) shall be used at the engineer’s discretion.

E. Factory color for Exterior Transformers:

1. The factory applied color shall match Sherwin Williams SW6108 “Latte”.

END OF SECTION 26 12 16
SECTION 26 12 19 – PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Pad-Mounted, Liquid-Filled, and Medium-Voltage Transformers.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work

A. This section includes liquid filled, pad mounted distribution transformers with primary voltage class of 15kV or 5kV, with a kVA rating as required per project.

B. The designer shall coordinate the requirements of this section with the requirements of the related sections of this standard.

C. This is a design standard and is not intended to be used as a construction specification.

PART 2: PRODUCTS

A. General: Each 15kV transformer shall consist of an incoming high voltage termination section, transformer, and outgoing bus way interconnection chamber. The transformers shall be new copper wound and designed with 55 degree Celsius rating

B. Ordering Specifications:

New (not rebuilds),
3 phase Pad-mount,
12,470 Delta 95KV BIL primary,
Dead front, 200A elbow connector bushings.
Radial feed, (unless another is specified)
Taps, split 2, 2 ½%, above and below,
Tap Changer Handle,
Lightning arrestors.
Pressure Vacuum gauge, located in a lockable box on outside of transformer.
SECTION 26 12 19 – PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

Schrader Valve located in a lockable box on outside of transformer.
Std PVR & 1” Drain Valve with sampler located in a lockable box on outside of transformer.
Oil level sight glass, NOT gauge,
Oil level plug,
Dial type Thermometer,
Drain valve and sampler,
Padlockable door handle,
Penta bolt entry,
Lifting lugs
Jacking provisions
No switch,
No fuse. (unless otherwise specified)
Custom exterior grade paint, Color: Sherwin Williams SW6108 “Latte”.
5.75% Impedance or manufacturer’s standard
H. V. BIL: 95 kV
H.V. Taps: (2) 2 _% FCAN and FCBN
L. Voltage: (according to service)
L.V. BIL: 30 kV

C. Dielectric:

Exterior installation: Mineral Oil.
Interior installation: FR-3 Oil.

D. Acceptable transformer manufacturers:

1. Cooper Industries
2. Cutler Hammer
3. General Electric

E. Safety Design Issues

1. Install signs stating “DANGER HIGH VOLTAGE” at any location where contact with live 15 kV or 5 kV parts are possible
2. Install signs stating “DANGER 600 VOLTS” at any location where contact with live 600V parts is possible.
3. The signs shall use at least 1 _” red lettering on a 3” white background.

PART 3: EXECUTION

3.01 Design/Drawing Requirements

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SECTION 26 12 19 – PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

A. Show transformer on one-line diagram with kVA rating, primary and secondary voltage ratings and % impedance.

B. The electrical engineer shall detail the designed location of the transformer(s) on enlarged room detail floor plans drawn to scale.

END OF SECTION 26 12 19
SECTION 26 13 13 – MEDIUM-VOLTAGE CIRCUIT BREAKER SWITCHGEAR

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Medium-Voltage Circuit Breaker Switchgear.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work

A. This section of the design standard includes basic requirements for the design of the metal clad switchgear used at the building service entrances.

B. This is a design standard and is not intended to be used as a construction specification.

PART 2: PRODUCTS

A. Design and construct the switchgear in accordance with the latest referenced specifications including NEMA, ANSI, and IEEE standards applicable to switchgear.

B. All switchgear parts shall be new and free from defects in material and workmanship.

C. The switchgear shall be rated 15 kV volts, metal clad, and shall operate on a 12,500-volt nominal, three phase, 60 Hz system. The switchgear shall utilize SML-20 type fuses and be rated for outdoor use.

D. Enclosure: Shall be S&C PME pad mount enclosure, with a configuration relative to service it isolates. Enclosure must have a base spacer, sized as needed, and pentalatch mechanisms and key interlocks.

E. Main Bus: Shall be copper and rated at 600A @ 15kV.

F. Ground Bus: The ground bus shall be of high conductivity copper with a continuous rating of at least 600 amps and shall extend the entire length of the switchgear.
 PART 3:  EXECUTION

3.01  Design/Drawing Requirements

A. Electrical Engineer shall provide single-line diagram showing gear with fuses.

B. Floor plans details shall be provided with electric equipment room layouts including switchgear and other substation components drawn to scale.

C. Switchgear shall be placed on a 4” housekeeping pad.

D. Single line diagram shall clearly indicate dividing lines of points of acquisition and installation responsibility.

E. Exterior Switchgear shall be factory painted to match Sherwin Williams SW6108 “Latte”.

END OF SECTION 26 13 13
SECTION 26 22 13 – LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Low-Voltage Distribution Transformers.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

PART 2: PRODUCTS

A. Up to 5 kVA: (1ph and 3ph) shall be totally enclosed, self-cooled dry-type with a 150 °C insulation system that will not exceed a 80 °C rise at a maximum ambient temperature of 40 °C.

B. 5 kVA to 25 kVA: (1ph and 3ph) shall be totally enclosed, solid fill, self-cooled with a 185 degree C insulation system that will not exceed a 115 °C rise at maximum ambient temperature of 40 °.

C. 30 kVA and above: shall be open, self-cooled dry-type, designed for free convection of air through the windings with a 220 °C insulation system that will not exceed a 150 ° rise at maximum ambient temperature of 40 ° C.

D. Taps in the high voltage winding shall be four each 2-1/2% FCBN for the following ratings: 30 KVA and above, three phase; 5 KVA through 25 KVA, single phase. Taps shall be two each 5% FCBN for all other units except that units rated below 1.0 KVA do not require taps. Additional or smaller taps may be supplied (10% total BN required) if it is the manufacturer’s standard.

E. Larger transformers for facilities shall be designed for location on the ground floor. The electrical engineer is responsible for coordinating maximum transformer weights and anticipated floor loading with the project structural engineer.

F. Transformers installed in electrical rooms shall be designed and sized in coordination with architect and door dimensions. All transformers sized
SECTION 26 22 13 – LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

above 225 kVA shall require double doors or doors in excess of standard 36” width.

G. Transformers 15 kVA and above are to be floor mounted. Up to 15 kVA may be wall mounted or ceiling mounted if appropriate for the room layout.

H. Electrical engineer shall provide detail layouts of electrical rooms indicating transformer locations drawn to scale with special mounting instructions as appropriate.

I. All transformers are to be given an alphanumeric label that will relate the transformer on the room detail to the transformer on the single line diagram.

J. The single line diagram shall indicate the alphanumeric identifier, the transformer size (kVA), and the primary and secondary voltages.

K. Transformers for Non-Linear Loads (K-rated) shall be used in applications where required.

L. Transformers shall be new (no re-builds), and have copper windings. Both High and Low voltage bushings shall be configured for lug terminations.

M. The electrical engineer shall detail the designed location of the transformer(s) on enlarged room detail floor plans drawn to scale.

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 22 13
SECTION 26 24 13 – SWITCHBOARDS

PART 1: GENERAL

1.01 Scope of Standard
   A. This standard provides general guidance concerning the specific preferences of Texas State University for Switchboards.
   B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work
   A. This section includes enclosed dead-front enclosed switchboards for application at 600 volts and less.
   B. This is a design standard and is not intended to be used as a construction specification.

PART 2: PRODUCTS

A. Switchboard shall be deadfront construction, rated 600V and shall operate on a 480/277 or 208/120 volt, three-phase, solidly grounded wye, 60 Hz system. The switchboard shall be designed in accordance with the latest NEMA, ANSI, and IEEE standards applicable to this equipment. These standards shall be referenced in the project specifications.

B. The electrical engineer shall use discretion in application of fuses or circuit breakers in the switchboard. Coordinate location of metering requirements with Texas State University staff. If metering at the distribution switchboard is required, the design shall adhere to the following:
   1. Metering circuits shall be designed such that they may be tested and calibrated without applying test currents and voltages to any other devices. Position KWH meters such that the display registers are eye-level. Must be Transdata Type Mark V meter.

C. Busing
   1. The bus shall be insulated copper with a current density of 1000A/ in 2. The insulation shall be class B (130 degree C) rated material. Bus connections (including the tie bus) shall be accessible from the rear of the
SECTION 26 24 13 – SWITCHBOARDS

switchboard. All busing shall be braced for the maximum available fault current.

2. Provide a ground bus through the length of each section of the switchboard.

D. Designer shall require the manufacturer to provide a mimic bus. Show bussing, connections and devices in single line form using black laminated plastic strips securely attached on the front panels of the switchboard.

E. Main and Tie section devices shall be individually mounted and compartmented.

F. Distribution section devices shall be individually mounted and compartmented.

G. Auxiliary section devices shall be individually mounted and compartmented.

H. Mount switchboard on 4” housekeeping pad

I. Future provisions: Switchboard shall be designed with future spaces (15% minimum) equipped with breakers and such that the future additions may be readily made in the field.

PART 3: EXECUTION

3.01 Design/Drawing Requirements

A. Electrical Engineer shall show equipment room layout, drawn to scale, indicating location of equipment and busway routing for interconnection.

B. Engineer shall label the switchboard consistently on the single-line diagram and the room layout indicative of Texas State University-San Marcos’ labeling scheme.

C. Single-line diagram shall indicate board size and required short circuit rating.

D. Engineer shall furnish a detailed specification indicating detailed control wiring, meter requirements and special construction requirements not outlined in the design standard.

E. Acceptable breaker element manufacturers:

   a. Square D

   b. Siemens Energy
SECTION 26 24 13 – SWITCHBOARDS

c. Cutler Hammer or Eaton

d. General Electric

F. The insulation shall be class B (130 degree C) rated material. Bus connections (including the tie bus) shall be accessible from the rear of the switchboard. All busing shall be braced for the maximum available fault current.

G. Neutral bars shall be full capacity rated.

1. Provide a ground bus through the length of each section of the switchboard.

H. Designer shall require the manufacturer to provide a mimic bus. Show bussing, connections and devices in single line form using black laminated plastic strips securely attached on the front panels of the switchboard.

I. Main and Tie section devices shall be individually mounted and compartmented.

J. Distribution section devices shall be individually mounted and compartmented.

K. Auxiliary section devices shall be individually mounted and compartmented.

L. Mount switchboard on 4” housekeeping pad with suitable angle iron embedded in concrete to allow for proper alignment and anchoring as recommended by the manufacturer.

M. Future provisions: Switchboard shall be designed with future spaces (15% minimum) equipped with breakers and such that the future additions may be readily made in the field.

N. Electrical Engineer shall show equipment room layout, drawn to scale, indicating location of equipment and bus way routing for interconnection.

O. Engineer shall label the switchboard consistently on the single-line diagram and the room layout indicative of Texas State University-San Marcos’ labeling scheme.

P. Single-line diagram shall indicate board size and required short circuit rating.

Q. Engineer shall furnish a detailed specification indicating detailed control wiring, meter requirements and special construction requirements not outlined in the design standard.

END OF SECTION 26 24 13

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SECTION 26 24 16 – PANEL BOARDS

PART 1:  GENERAL

1.01  Scope of Standard

A.  This standard provides general guidance concerning the specific preferences of Texas State University for Panel Boards.

B.  Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02  Scope of Work

A.  This section includes enclosed fusible switch and circuit breaker panelboards for feeders, and circuit breaker type lighting and appliance branch circuit panelboards.

B.  This is a design standard and is not intended to be used as a guideline or construction specification.

PART 2:  PRODUCTS

A.  Panel board bus shall be 98% conductivity copper. Bus shall be installed completely throughout panel to permit addition of new bolt-on breakers in available space in future without modifying bus.

B.  All panel boards shall have door locks. The front cover shall be a door in door arrangement with the inner door hinged to allow breaker handles.

C.  Panels

1.  Distribution Panels, Square D preferred, shall be of the “Panel Board” type series with a 20” minimum width.

2.  Shall have separate neutral and ground bars.

3.  Panels for computer labs shall comply with NEC as a minimum. These panels will have 200% rated neutral busses and served from K rated transformers.
PART 3: EXECUTION

3.01 Design/Drawing Requirements

A. Branch circuit panel boards shall not serve loads on more than one level of a building.

B. Molded case circuit breakers shall be bolt-on type only.

C. Do not mount panel boards in hallways or other public spaces. Where an obsolete panel is being replaced in an existing public space, the new panel shall be flush mounted.

D. Provide a separate panel board for labs or other high density electrical utilization equipment spaces where the power requirements exceed 12 poles, and locate the panel board near the entrance to and within the space. Provide door locks on all panel boards.

E. Lighting panel boards shall serve only lighting loads and should contain 15% spare capacity.

F. Receptacle panel boards, power distribution panel boards, main switchboards and motor control centers should contain 30% minimum spare capacity.

G. Panel boards should be designed in the electrical room detail layout such that feeder piping is minimized and installed efficiently. Provide a minimum of two 1” empty conduits from each flush mounted panel to an accessible point above the ceiling.

H. Panel boards shown on single line diagram shall indicate required short circuit amps interrupting capacity (AIC) rating. (may be shown in panel schedules if single-line diagram not appropriate).

I. Provide panel locations drawn to scale in electric room detail plans.

J. Panel boards shall be labeled with a descriptor indicating location, reference voltage level, and primary loads served.

K. Panel schedules shall be provided indicating panel size, AIC rating, whether main circuit breaker or main lug only style, main breaker size. Panel schedules shall indicate load information in kVA per phase.

L. Panel schedules need room number(s).
M. Distribution panel boards (400A & up) shall have a minimum of 10” of gutter space on both sides.

END OF SECTION 26 24 16
SECTION 26 24 19 – MOTOR-CONTROL CENTERS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Motor-Control Centers.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 Scope of Work

A. This section includes electric motors and their accessories that are normally supplied as part of equipment assemblies.

B. For specific motor types for each application refer to those equipment sections.

C. This is a design standard and is not intended to be used as a construction specification.

PART 2: PRODUCTS

A. Specific motors are not generally specified within this section. Refer to appropriate mechanical design requirements for specifics on motors.

B. Coordinate with mechanical designer to require that only high efficiency motors with guaranteed efficiency at least equal to NEMA standards.

C. Motors 5 HP or smaller shall have sealed, lubricated-for-life bearings. Motors 7-½ HP or larger shall have antifriction ball or roller bearings, oil or grease lubricated.

D. All motors 1 hp and larger shall be 3 phase.

1. Building Design should dictate voltages/motors/loads.

E. Motor Starters: Motor starters shall contain a NEMA integer sized contactor; one (1) overload relay per phase; 120 Volt coil for external control power; interlock on disconnect switch to de-energize external voltage control. Where external control power is not provided, include a fused control power transformer, 120 Volt secondary mounted in the starter cabinet only. Starter shall provide for the field installation of up to 3 NO and 4 NC interlocks in addition to the hold-in
SECTION 26 24 19 – MOTOR-CONTROL CENTERS

interlock. Fan starters are to have safety switches on the line side of the motor and/or Variable Frequency Drive. The safety switch is to be located inside large air handler units and close to the air handler unit on small units. Where start/stop functions are controlled through FCMS, provide a relay in the automatic circuit of the control coil such that a 24V signal will actuate the starter.

PART 3: EXECUTION

3.01 Design/Drawing Requirements

A. Variable speed drives shall be installed on the load side of the motor starter with a manual transfer switch to allow manual bypass of the drive. Provide a safety switch directly ahead of the drive if not furnished as part of the drive itself. In addition, provide a safety switch at the motor location for safety of maintenance personnel.

B. Single-line diagram shall indicate motor and motor starter size information. If motor starter information is shown on mechanical coordinate such that no discrepancies will exist.

C. Circuit information for motors may be shown either on panel schedules or the floor plan, but not both to eliminate potential for discrepancies.

D. Fan motors and associated equipment shall be sized to operate at 110% of calculated loads and capacities. Equipment shall be designed and installed to operate continuously under all actual site conditions and variations (i.e. typical voltages of 125/208 and 277/480). Motor controls (i.e. starters) shall be properly identified, labeled and located in a sheltered and secure location (mechanical room when possible).

END OF SECTION 26 24 19
SECTION 26 27 26 – WIRING DEVICES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. The Conditions of the Contract and applicable requirements of Division 0, Division 1 and Section 26 00 01, “Electrical General Provisions” govern this Section.

1.02 SCOPE OF STANDARD

A. This standard provides general guidance concerning the specific preferences of Texas State University for Wiring Devices.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

C. Products shall be designed, manufactured, tested and installed in compliance with NEMA WE 1 (General-purpose wiring devices) and NEMA WD 5 (Specific-purpose wiring devices).

1.03 DESCRIPTION OF WORK

A. Work Included: Provide wiring devise work as shown, scheduled, indicated, and specified. The types of wiring devices required include, but are not limited to, receptacles, switches, wall dimmers, pushbuttons, and wall plates.

B. This is a design standard and is not intended to be used as a construction specification.

PART 2: PRODUCTS

A. Provide products complying with the following Basis of Design.

1. All electrical switches and outlets shall be Hubbell heavy duty, specification grade or equivalent quality.

2. Minimum 20 ampere rated switches shall be used for lighting and power loads. In cases where wall dimmers are used, the dimmer shall be state-of-the-art solid state design with flicker noise control. Minimum accepted manufacturer and quality – Lutron Nova Series or approved equal.
SECTION 26 27 26 – WIRING DEVICES

3. Device faceplates shall be smooth finish nylon. Designer shall coordinate color requirements with building architectural. Use of vinyl or plastic faceplates is strictly prohibited. Galvanized face plates shall be used for all surface mounted devices.

PART 3: EXECUTION

3.01 DESIGN REQUIREMENT

A. A typical single person office space should contain a minimum of two duplex receptacles and (two) communications outlets.

B. A typical open office cubicle shall contain a minimum of two duplex receptacles per workstation.

C. Locate power and communications outlets on interior walls. Do not locate any outlets on exterior walls under windows or on the exterior of the building.

D. Receptacles shall not be used as feed through devices. All receptacles shall be pig-tailed except those at the end of the run and/or dedicated. Basis of Design for receptacles: Leviton #5340 or approved equal.

E. All wire connections on wiring devices (convenience outlets and switches) shall be wrapped around the screw in the proper direction. Exception: those with factory “pigtailed” leads. Basis of Design: Leviton #1243-I single pole ivory & #1244-I 3-way Ivory or approved equal.

F. Stab-in wiring to devices shall not be used.

G. Housekeeping Circuits

1. “Housekeeping” circuits and receptacles shall be dedicated, rated at 20 amps, 120 volt and under no circumstances include any other loads or circuits (such as classroom and/or offices). Provide one, dedicated, single receptacle/circuit at no more than 40 linear feet in hallways.

H. Vending machine receptacles.

1. Shall be located at a minimum height of 7 feet above finished floor. Exception: if there is a minimum of 3 feet between the back of machines and receptacles with proper access (min. = 6’ 8” x 32”), and provision is made to keep this distance.

2. Due to the possibility of plugging more than one high amp draw machine into a duplex receptacle ALL vending receptacles should be 20 A. single
SECTION 26 27 26 – WIRING DEVICES
receptacles with one circuit to each. Vending machine = drink, cold food, candy, copiers, laminators, or any other large type vending machine.

I. Emergency generator receptacles and covers are to be RED in color.

J. General purpose receptacles to be installed 18” to the bottom from the finished floor or grade except when installed above counter tops. Exception: Areas that require differing heights and are within code parameters.

K. All duplex receptacles to be installed with ground pointing down.


M. General purpose receptacles shall be labeled with panel name and circuit number on front side of cover or face plate. Labels shall be made with a P-touch labeler, black lettering on clear tape and the font size to be 9mm.

N. Switches shall be labeled with panel names and circuit number on the back side of the cover plate. Labels shall be made with a P-touch labeler, black lettering, on clear tape. Font size is to be 9mm.

O. All floor boxes used in new construction shall be cast-in-place.

END OF SECTION 26 27 26
SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Enclosed Switches and Circuit Breakers.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work

A. This section includes enclosed switches for use as disconnects in service and distribution systems rated 600 volts and less. Basis of Design shall be Square D.

1. Exceptions; where alterations or additions are made to existing structures, use the existing manufacturers in that building.

B. This is a design standard and is not intended to be used as a guideline or construction specification.

PART 2: PRODUCTS

Use heavy-duty type enclosed switches only.

A. Circuit breakers shall have a positive means of indicating a tripped condition (i.e.: Square D’s orange indicator). Basis of Design shall be Square D.

B. Disconnect (Safety) switches shall be rated ‘heavy duty’. Basis of Design shall be Square D.

1. Exceptions; where alterations or additions are made to existing structures, use the existing manufacturers in that building.

C. All breaker panels shall have a complete and legible circuit index positioned on the inside surface of the panel door. Basis of Design shall be Square D.

1. Use room numbers as to where circuits go.

2. exception; where alterations or additions are made to existing structures, use the existing manufacturers in that building.
SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

D. Working Space About Electric Equipment. Distances shall be measured from the enclosure front or opening if such are enclosed. Concrete, brick or tile walls shall be considered as grounded. The work space shall not be less than 30 in. wide in front of electric equipment. The work space shall be clear and extend from the floor or platform to the height required. The work space shall permit at least a 90-degree opening of equipment doors or hinged panels. The minimum headroom of working spaces about service equipment, switchboards, panelboards, or motor control centers shall be 6½ ft. (1.98m).

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 28 16
SECTION 26 29 23 – VARIABLE FREQUENCY DRIVES

PART 1: GENERAL

1.01 Scope of Standard
   A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Variable Frequency Drives.
   B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 Overview
   A. Texas State University-San Marcos maintains standard specifications and installation details for Variable Frequency Drives.
   B. The specifications list approved drive types, options and accessories.

1.03 Compatibility
   A. Due to the need for compatibility with existing VFD maintenance and inventory processes, all drives provided shall comply with current specifications.

PART 2: PRODUCTS

2.01 General Requirements
   A. Disconnect and bypass to ensure continued operation of system if VFD fails.
   B. Motor starter not integral to the VFD. Standalone starter, separate component in a self-contained enclosure.
   C. Variable torque, variable voltage/frequency type for centrifugal fan and pump applications and suitable for use with both standard and high efficiency 3-phase, squirrel cage, induction motors.
   D. Solid state with Pulse Width Modulation (PWM) output waveform. VVI, six step, and current source are not acceptable. Full wave rectifier (to prevent input line notching), AC line reactor, fuses, capacitors, and insulated bipolar transistors (IBGT’s) as the output-switching device (SCR’s, GTO’s and Darlington transistors are not acceptable). All standard and optional features included within

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SECTION 26 29 23 – VARIABLE FREQUENCY DRIVES

the VFD enclosure. Approved by the equipment manufacturer for the particular product(s) and application(s) involved.

E. Converter and an inverter section. Converter section shall convert fixed frequency and voltage AC utility power to a DC voltage. VFD shall also include three phase input fuses. The inverter section of the VFD shall invert the DC voltage into a quality output wave form, adjustable voltage and frequency output for stepless motor speed control.

F. Tested to ANSI/UL standard 508. Complete system listed by a nationally recognized testing agency such as UL, ETH CUC or CSA.

G. Power line noise limited to a voltage distortion factor and line notch depth as defined in IEEE 519-1992. Prior to installation, the VFD manufacturer shall estimate total harmonic distortion (THD) caused by the VFD. The results based on a computer aided circuit simulation of the total actual system, with information obtained from the power provider and the user.

H. Pre-wired 3-position mechanical type Hand/Off/Auto (H-O-A) selector switch and speed potentiometer. Means to communicate hand, off, or auto position.

I. Power on light to indicate that the VFD is being supplied line power. Fault light to indicate that the VFD has tripped on a fault condition.

J. Plain English, backlit LCD digital display (code numbers and letters not acceptable) and keypad.

K. Internal self-diagnostics.

L. Speed control shall be from a 4-20mA, 0-10vdc or 3-15psi pneumatic signal.

M. Enclosures shall be NEMA-1 for indoor applications and NEMA 3R for outdoor applications.

2.02 Warranty

A. 12 months from the date of certified start up. Include all parts, labor, travel time and expenses.

B. Local factory certified technicians for 24 hours, 7-day a week service. Throughout the warranty service period, response within 24 hours of initial contact for service.

C. Guaranteed spare parts availability to the Owner for a minimum of fifteen (15) years from date of purchase. Price escalation for spare parts not to exceed 10% per year over the five (5) year duration.
SECTION 26 29 23 – VARIABLE FREQUENCY DRIVES

2.03 Training

A. On-site instruction included with each VFD and within 30 days of start-up. Factory trained and certified instructor. All training aids shall be provided by trainer. Content to include care, troubleshooting, servicing, and operation of the equipment and systems installed.

B. Classroom and on-site, in-the-field instruction.

2.04 Start-Up

A. Factory trained and certified technician shall check the installation, start the VFD’s and place them into operation. Start-up within two weeks of notification.

B. Certified start-up report.

2.05 Communications

A. EIA-485 and EIA-232 ports as standard.

B. Communicate with PLC’s, DDC’s, Metasys N2 bus, BACnet, and other communication protocols. Components included for interface with the selected Building Automation System.

C. Serial printer to download drive parameters and fault logs.

D. Programmable inputs and outputs.

PART 3: EXECUTION

3.01 Design Requirements

A. The 50% Contract Document review submission shall include specifications and details for VFD’s.

B. Statement of deviations from standards. Deviations approved by Physical Plant.

C. Incorporate Physical Plant standard VFD documents and details into project contract documents.
SECTION 26 29 23 – VARIABLE FREQUENCY DRIVES

D. Show VFD locations on mechanical plans. Ensure adequate mounting space and floor area including service access. VFD preferred location is adjacent to and within the same room as equipment served.

3.02 Coordination

A. All design work shall be coordinated with electrical.

B. VFD’s shall be installed as per NEC requirements.

C. When the AHU’s, fans or pumps are being supplied as a unit with a motor installed, the mechanical contractor will supply the VFD’s and starters as required by Section 26. The units will be mounted and wired by electrical contractor unless otherwise noted.

END OF SECTION 26 29 23
SECTION 26 32 13 – DIESEL ENGINE GENERATORS (EMERGENCY ELECTRICAL POWER SUPPLY)

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Diesel Engine Generators (Emergency Electrical Power Supply).

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Reference Documents

A. Work shall be in compliance with the applicable portions of NFPA-30, 37, 99, and 110.

B. The equipment and installation shall meet the requirements of all applicable sections of NEMA Standards Publication MG 1, latest revision.

C. Definitions of rating criteria shall be in accordance with ANSI Standard IEEE 100.

D. The engine-generator set manufacturer shall verify the unit’s KW/KVA rating after derating for the range of temperatures expected and the ambient temperature and altitude of installation as specified herein.

E. A torsional analysis shall be calculated by the manufacturer of the engine-generator set to verify freedom from torsional stresses within plus or minus 10% of rated speed, with results submitted to the Owner for approval as specified herein.

F. The Total Harmonic Distortion (THD v) for the output voltage, from no load to full linear load, shall not exceed 5% and no single harmonic shall exceed 3%.

G. The Telephone Influence Factor (TIF) shall be less than 50 per NEMA MG 1.

Furnish and install all of the necessary equipment, hardware and labor for a complete on-site generated electric power supply for the Emergency Electrical System. The complete System shall be factory painted Sherwin Williams 6108 Latte. All Equipment and labor shall meet the below listed specifications.
2.01 Engine and Equipment

Acceptable Manufacturers: Caterpillar, Cummins

A. Standby/Emergency Power System

1. Diesel engine: the motor/generator unit shall be rated as a stand-by service for handling 120% of critical loads. (Critical loads being defined as life saving systems (fire alarm), elevators and any other loads specified on building plans). Further criteria for the system are a 0.8 power factor, three phase, 60 cycle. System shall be package equipment consisting of:

2. Engine mounted start/stop control system.

3. Mounted accessories as specified

4. 250 gallon, double-walled storage tank mounted between skids.

5. System shall be built, tested and shipped by manufacturer of alternator so there is one source of supply and responsibility. Performance of electrical plant series shall be certified by Independent Testing Laboratory as to plants full power rating, stability and voltage and frequency response.

6. Engine shall be diesel fueled four cycle, water-cooled, with mounted radiator, fan and water pump. A rating of continuous horsepower at the operating speed of no more than 1800 RPM shall be developed to drive the generator continuously without overload. Full pressure lubrication shall be supplied by gear oil pump. Engine shall have an oil filter with replaceable element; oil cooler and fuel pump. Engine speed shall be governed by a hydraulic governor to maintain alternator output. Engine shall have a 24-volt, DC, battery charging alternator with transistorized voltage regulator. Starting shall be by volt, solenoid shift start.

7. Cooling system shall consist of a water cooled radiator, blower type fan, temperature control valve, engine water inlet and outlet connected to the radiator and an engine driven jacket circulating pump. Provide combination of water and ethylene glycol anti-freeze solution to protect the radiator to 0 degrees.

8. Alternator shall be brushless, 4 pole revolving field type with rotating rectifier exciter and solid-state voltage regulator. Stator shall be directly connected to the engine flywheel housing, and rotor shall be driven through a semi-flexible driving flange to insure permanent alignment.
SECTION 26 32 13 – DIESEL ENGINE GENERATORS (EMERGENCY ELECTRICAL POWER SUPPLY)

Voltage regulation shall be within plus or minus 2% of rated voltage from no load to full load. Instantaneous voltage dip shall be less than 20% of rated when full loaded and rated power factor is applied to alternator. Recovery to stable operation is defined as operation with terminal voltage remaining constant, within plus or minus 1% of rated voltage. A rheostat shall provide minimum of plus or minus 5% of voltage adjustment from rated value. Temperature rise shall be within rating as defined by NEMA MG1-22.40.

9. Motor generator unit shall be mounted on a welded structural steel base, which shall provide suitable mounting room for a 250-gallon minimum, double-walled fuel storage tank. Set base on spring isolators. Motor/generator shall be enclosed in a weatherproof metal housing.

10. Accessories needed for proper operation of the plant shall be furnished. These shall include critical muffler with side inlets complete with flexible connections to engine and condensate traps in riser and gravity type flapper exhaust caps, 24 volt starting circuits, battery cables, battery rack, and all interconnecting piping between day tank and engine.

11. Provide tank type insertion block heaters, 2500 watt, 208 volt, single phase.

12. Provide lead/acid storage batteries; heavy-duty, diesel starting type. Battery voltage shall be compatible with starting system. Battery set shall be of sufficient capacity to provide for 1-1/2 minutes total cranking time without recharging. Battery rack and necessary cables and clamps shall be provided. Batteries shall be isolated to prevent continuous discharge and reduce possibility of batteries discharging to point of battery cell destruction.

13. Provide current limiting battery charger to automatically recharge batteries. It shall include overload protection, silicone diode full wave rectifier, voltage surge suppressor, D.C. ammeter and fused A.C. input. A.C. input voltages shall be same as generator output voltage. Amperage output shall be not less than 5 amperes.

2.02 Alternator and Control

Acceptable Manufacturers: Onan, Kohler, Cummins

A. The AC alternator shall be a synchronous generator, four pole, revolving field, drip proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with a flexible disc.
B. The armature shall have skewed laminations of insulated electrical grade steel, two-thirds pitch winding. The rotor shall have an amortisseur (damper) winding, with layer wound mechanically wedged construction. The rotor shall be dynamically balanced. Surge suppressers shall be connected in parallel with the field winding. Use of field discharge resistance shall not be acceptable. Systems using three-wire solid-state devices shall mount the unit in a stationary location.

C. The insulation system components shall meet NEMA MG1 standard temperature limits for Class H insulation. Actual temperature rise measured by the resistance method at full load of KW/KVA shall not exceed 80° C with a 40° C ambient.

D. The alternator characteristic shall be matched to the torque characteristics of the engine in such a manner that with full load connected to the generator terminals, the generator can utilize all the available engine power without exceeding it at all speeds up to and through synchronous speed.

E. The alternator bearing shall be electrically insulated from the generator end bell to block potentially damaging shaft currents caused by imprecise manufacturing tolerances or variations in electrical steel.

F. The alternator shall be equipped with heaters operating on 120 or 208 VAC to control moisture condensation. Power for heaters shall be automatically turned off when unit is running.

G. The AC output leads of the alternator shall be brought out to a main molded case thermal-magnetic circuit breaker of suitable voltage and continuous and interrupting current rating. The circuit breaker shall be UL listed and accessible through removable plates on either side of a sheet metal output box DD. A control unit shall be installed and shall include an alternator field excitation circuit breaker of suitable continuous duty and interrupting ratings; AC ammeter and 3 phase selector switch; AC voltmeter and selector switch for all phase-to-phase and phase-to-neutral voltages; frequency meter; voltage adjust rheostat with +/- 5% adjustment; automatic voltage regulator; and necessary wiring and interconnections in accordance with the wiring methods set forth elsewhere in these Specifications.

2.03 Engine Exhaust System (Not mounted on housing)
2.04 Emergency System

A. General

1. The emergency system shall consist of an emergency panel fed from an automatic transfer switch which shall have a normal feeder from the new facility and an emergency feeder from Texas State University’s existing 480 volt, 4 wire grounded wye emergency system. This system shall be provided even if no emergency power source is currently available.

2. Emergency power shall be provided for the following:
   - All stairwell lighting
   - Fixtures in corridors and public areas that are considered “night lighting”
   - Elevator lighting
   - Egress lighting
   - Fire Alarm System
   - Communication system
   - Sump pumps
   - Stairwell pressurization fans

3. Emergency power shall be provided for one elevator motor in each bank of elevators in high rise buildings as defined by the National Fire Codes. A keyed selector switch shall be located on the ground floor allowing rescue personnel to select any elevator in the bank.

4. If due to size and location, emergency power is not available from Texas State University-San Marcos’ emergency power system or by generator set, provide individual equipment, i.e. light fixtures with individually mounted battery packs.

5. All buildings shall have a U.L. approved “Master Label” lightning protection system.

6. Fire pumps shall be connected to the emergency system per applicable codes.

2.05 Instrumentation and Controls

A. Engine instrument panel shall contain an oil pressure gauge, water temperature gauge, battery charge rate ammeter, manual starting pushbutton and speed control. Alternator instrument panel shall be wired, tested and shock mounted on the electric emergency/standby electric plant by the manufacturer of the alternator. It shall contain running time meter, AC volt meter, voltage adjusting
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rheostat, AC ammeter with phase selector switch, dry contacts, and remote alarms wired to terminal strips and panel lights.

B. Provide two remote alarm annunciators designed for either surface or flush mounting indicating alarm functions described in next item. Annunciator shall be sheet metal steel enclosures with removable front panels. Face of front panel shall have visual signals, audible alarms, toggle switch marked normal and off, and lamp test push button. Annunciator shall be factory wired to a terminal block and have terminals labeled.

C. Set shall be provided with necessary external contacts and factory wiring to a labeled terminal block so that following items can be connected to central alarm stations.

1. Electric plant operating (Generating)
2. Electric plant failed to start (over crank)
3. Low lube oil pressure (low oil pressure)
4. Excessive water temperature (Hi engine temperature)
5. Low water jacket temperature (low engine temperature)
6. Engine overspeed
7. Low fuel supply (low fuel)
8. Low battery voltage (low battery volt)

D. Complete engine start control switch operates on closing contact and stop control operates on opening contacts. Cranking limiter shall be provided to open starting circuit in approximately 45 seconds if plant is not started within that time. Electric plant controls shall also include a three-position selector switch with the following positions: RUN-STOP-REMOTE. High water temperature, low oil pressure, and over speed trips shall be provided. Signal lights and alarm terminals shall indicate when safety device has operated.

E. Central alarm station annunciator shall be equipped with dry contact output and wired to subject building energy management system.

2.06 Operating Sequence and Instructions

A. Sequence of operation shall begin upon failure of normal source of power; engine shall be automatically cranked and brought up to full operating speed required by
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the generator. Cranking motor circuit shall be instantly broken when the engine starts. Within 10 seconds generator shall be brought up to operating speed, generator voltage shall operate an automatic line transfer switch, transferring load from the normal source of supply and connecting emergency load. Upon restoration of normal source of supply, sequence of operation shall be reversed, stopping the engine and restoring the line transfer switch to normal operating position, disconnecting load from the emergency generator, set will continue to operate for a cool down period of 20 minutes after restoration of normal source of supply. Should engine fail to start at once, cranking cycle shall cease and 12-volt bell alarm shall be energized to indicate malfunctioning of system. Control set shall automatically stop engine in event cooling water temperature becomes too high, if oil pressure drops below a predetermined pressure, or if engine over speeds. Upon failure of engine for any reason, an indicating lamp will operate, indicating condition under which engine was shut down. Also, alarm bell signal shall be energized. Automatic line transfer switches and emergency change over mechanism, which is to be installed is not part of the engine generator set, will be described elsewhere in these specifications.

B. Operating instructions: shall be provided and installed in a suitable metal frame with cover glass making the display weather proof. Operating instructions for the emergency/standby generator shall be complete.

C. After completing of system installation, manufacturer’s representative shall demonstrate to the owner or owner’s representative, operation of the system. Manufacturer’s representative shall certify in WRITING, to the owner, that work was supervised, approved, and in accordance with these specifications.

2.07 Circuit Protection

A. Provide main line molded case circuit breaker of rated amperes and install as load circuit interrupting and protective device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions. Trip for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short-circuit protection. Circuit breaker shall meet standard established by NEMA, NECA, and UL codes. Generator/exciter field circuit breakers do not meet above electrical standards and are unacceptable for line protection.

2.08 Automatic Load Transfer Switch

Acceptable Manufacturers: Cummins, Kohler, Onan, ASCO (in order of preference)

A. An automatic transfer and bypass isolation-switch shall be provided to manually permit convenient electrical bypass and isolation of the automatic transfer switch that could not otherwise be tested and maintained without interrupting the load.
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Bypass of the load to either the normal or emergency power source with complete isolation of the automatic transfer switch shall be possible regardless of the status of the automatic transfer switch. The bypass isolation switch shall permit proper operation by one person through the movement of a maximum of two handles at a common dead front panel. The entire system shall consist of two elements: The automatic transfer switch and the by-pass-isolation switch, furnished completely factory interconnected and tested.

B. Each switch shall be electrically operated and mechanically held in each direction by a single solenoid mechanism momentarily energized from the source to which the load is to be transferred. Switch shall be inherently double-throw with both sets of main contacts moving simultaneously. Mechanical or electrical interlocking of single-throw devices such as circuit breakers, or motor starters is not acceptable. Disarrangement of any part or failure of any coil shall not permit a neutral position and shall not permit both sides to be closed at the same time. Molded plastic parts shall not be a part of the driving mechanics. The mechanical interlocks and driving mechanism shall be electrically dead.

C. Switches shall not consist of adapted devices which were not originally intended to repeatedly open and close on load current to 600 percent of rated at 0.40-0.50 power factor in accordance with test procedures of U.S. Standard # 508 Tenth Edition (Industrial Control Equipment).

D. Main contacts shall be silver-alloy protected by ARC barriers and ARC quenchers. All sizes shall have separate Arcing contactors.

E. Switches shall meet or exceed the following standards using the original set of main contacts for all requirements. These requirements shall be met without cleaning and/or adjusting between any of the tests. All switching shall be performed at the rate of 6 operations per minute between two 480 VAC sources which are 120 degrees out of phase. The time of transfer in either direction shall not exceed 1/15 second and the power factor for all tests shall be 0.40-0.50. One operation shall be considered as transfer of the load from normal to emergency followed by retransfer of the load back to normal.

1. Endurance: Minimum of 6000 operations at 200 percent of rated current.

2. Overload: Minimum of 50 operations at 600 percent of rated current.

3. Temperature Rise: Following the endurance and overload test the temperature rise of the main contactor shall not exceed allowable NEMA standards of 65 degrees C when carry rated current while installed in a non-ventilated enclosure.
SECTION 26 32 13 – DIESEL ENGINE GENERATORS (EMERGENCY ELECTRICAL POWER SUPPLY)

F. All switch and relay contacts, coils, springs, and control elements shall be removable from the front of the transfer switch without disconnection of the drive linkage or power conductors. Sensing and control logic shall be solid state and mounted on plug in printed circuit boards, which are keyed to prevent incorrect installation. Interfacing relays shall be industrial control grade plug in type.

G. Voltage sensing relays located across each phase of the normal source shall detect failure when anyone phase drops below 70% of rated voltage and sense restoration of normal when all phases have returned to 90% or more of normal rated voltage. A voltage-frequency relay shall prevent transfer of the load until the emergency source reaches at least 90% of rated voltage and frequency.

H. The switch shall be rated for all classes of loads including motor, ballast, tungsten and resistance as defined by U.L. Standard # 508, Tenth Edition (Industrial Controls Equipment). The full load continuous duty rating, the normal and emergency source voltage, and the number of poles shall be as shown on the plans.

I. The following accessories and/or features shall be included with the Automatic Load Transfer Switch.

1. Adjustable 1-10 second time delay to override momentary trips in the normal source.

2. Adjustable time-delay on retransfer (up to 25 minutes) of the load to normal with a by-pass circuit to nullify the time-delay in the event the emergency source fails. Shall also include an additional 30-minute unloaded running of the generator before shutdown.

3. Adjustable time-delay transfer of load to emergency. (0-1 minute adj.).

4. A test switch to test the emergency system, keyed to Cutler-Hammer, key # 92239.

5. A handle to permit emergency operation of main poles in either direction.

6. Auxiliary contact (1-NC and 1-NO) to activate and deactivate the engine starting Controls.

7. Auxiliary pilot contact closed when the switch is in the normal position (10AMP).

8. Auxiliary pilot contact closed when the switch is in the emergency position (10AMP).
9. A solid neutral with fully rated terminals.

10. Other accessories or features as may be required for automatic operation and/or as specified elsewhere.

11. Automatic transfer switches serving elevators shall have the following additional accessories:
   
a. A signal must be provided to the elevator system 20 seconds before normal power is to be restored to the system. This allows time for each elevator operating on emergency power to make a normal stop at the next available floor thus avoiding trapping passengers between floors.
   
b. A signal must be provided to the elevator 20 seconds before switching from normal power to emergency power during the periodic testing of the emergency power plant. This time allows for the elevator to make a normal stop at the next available floor thus avoiding trapping passengers between floors.
   
c. Times given in a and b are to be sufficient to cover time from start of elevator door to close until doors open fully at next landing.

J. Automatic transfer switch and by-pass isolation switch shall provide manual bypass of the load and isolation of all service and load terminals of the automatic transfer switch to permit periodic testing, maintenance, and service of the automatic transfer switch without interrupting power to the load.

K. The by-pass isolation switch shall be capable of bypassing the load to either source. Load by-pass to the automatic transfer switch’s connected source shall be affected without load interruption. Provisions shall be made to assure continuity of auxiliary circuits necessary for the proper operation of the system.

L. The isolation handle shall provide three positions: Closed, Test, and Open. The test position shall permit electrical testing of the automatic transfer switch without disturbing the load. The open position shall completely isolate the transfer switch from both lines and load without actual removal of the line or load conductors, and allow for its removal for inspection, adjustment and maintenance. The transfer switch shall be arranged for draw out operation to facilitate its removal. Also while in the test or open position, the by-pass switch shall function as a manual transfer switch to allow load transfer to either source of power regardless of the position or condition of the transfer switch, including the condition when the automatic transfer switch is removed, and without reconnecting the load terminals of the automatic transfer switch.
SECTION 26 32 13 – DIESEL ENGINE GENERATORS (EMERGENCY ELECTRICAL POWER SUPPLY)

M. Each switch shall be provided with an operator’s manual providing installation and operating instructions.

N. Acceptable manufacturers are: Kohler, ASCO, or ONAN.

2.09 Switch Gear

A. System shall be guaranteed, (equipment and wiring) free from inherent mechanical or electrical defects for one year from date of acceptance. Manufacturer shall furnish, at no additional cost to owner, a one-year WRITTEN CONTRACT effective from date of acceptance, for maintenance and inspection services of manufacturer’s equipment with minimum of two inspections during contract year.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all the requirements of this specification. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those specified at the time of submittal shall be included in the certification.

2.10 Standby/Emergency Generator Set

A. Testing of Generator Set: Unit shall be given a complete shop test before shipment. It shall be installed on job site under supervision of manufacturer’s representative, and such tests as deemed necessary by these specifications and by the architect, shall run to prove performance of the unit. Owner’s authorized representative shall be instructed in the operation and maintenance of the unit. Complete unit, including control and alarm systems shall be certified in writing.

B. Contractor is to provide a full tank (250 gallons) minimum, of diesel fuel prior to acceptance of unit by owner.

C. Acceptable manufacturers: Caterpillar, Cummins.

D. Unit is to be of sufficient size to replace normal power feed to building (s) without limiting use of facilities.

E. Standby/Emergency Generator set shall be located no less than 100 ft. downwind of any fresh air intakes, based on the normal prevailing wind direction in the area.

F. If dictated by Aesthetics or Security and Generator set must be placed in a building style enclosure, enclosure location is as previously specified for emergency generator sets and the enclosure itself must provide internal room around the generator set of five (5) feet on all sides. When in this configuration,
SECTION 26 32 13 – DIESEL ENGINE GENERATORS (EMERGENCY ELECTRICAL POWER SUPPLY)

the radiator must be equipped with a vertical deflector to route hot air clear of building and away from air intake.

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 32 13
SECTION 26 35 13 – CAPACITORS

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Capacitors

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 Scope of Work

A. This section includes unit capacitors for power factor correction.

B. Power factor capacitors shall be used in conjunction with Variable Frequency Drives (VFD’s) as provided in Section 26 29 23 of this standard. This is a design standard and is not intended to be used as a guideline or construction specification.

PART 2: PRODUCTS

A. The capacitor unit shall be indoor, metal enclosed, and factory assembled, prewired tested and ready for installation. The following are acceptable manufacturer’s:

1. Versatex
2. Myron Zucker
3. Cornell Dubiler
4. Asea Brown Boveri
5. General Electric
6. Commonwealth Sprague

B. Capacitor unit ratings shall be the following:

1. KVAR 150
SECTION 26 35 13 – CAPACITORS

2. VOLTAGE: 480
3. STEP KVAR: 25
4. NUMBER of STEPS: 6
5. FREQUENCY (HZ): 60
6. WATT LOSS/KVAR: 0.7 max.

C. Capacitor bank shall be rated for a life expectancy of at least 20 years. The enclosure shall be freestanding type NEMA 12. The assembly shall be accessible from the front with a continuously hinged door with a three point locking handle mechanism.

D. All capacitor cells shall be three phase industrial grade, metal encased, utilizing threaded type terminals installed with am insulating plastic terminal plate. Only three phase units shall be furnished. Single phase units that have been interconnected shall not be allowed. The capacitors shall be specifically designed for power factor correction and continuous duty.

E. The following control type items shall be included with each assembly:

1. A microprocessor based field programmable automatic power factor controller shall be provided and designed with the following features:
   a. Digital LED readout or meter indication of actual power factor and power factor setpoint. The setpoint shall be continually adjustable to settings that are leading or lagging from 0.7 inductive to 0.7 capacitive.
   b. Capacitor step display on number of steps activated and the number available.
   c. Automatic or manual mode of operation.

2. Instrument transformers shall be provided for the necessary inputs into the automatic controller. Control and potential transformers shall be appropriately fused on both sides of the primary and secondary.
SECTION 26 35 13 – CAPACITORS

3. Control power transformers shall be provided, if required, for the contractors and associated equipment.

PART 3: EXECUTION

3.01 Design/Drawing Requirements

A. The engineer shall show on the single line diagram the planned locations for installing power factor correction capacitor banks.

B. The drawings shall also indicate location of the capacitor banks in a detail of the electrical room layout.

C. The capacitor assembly shall be installed a minimum of 200 electrical feet from the nearest SCR drive or as indicated in the VFD manufacturer’s Harmonic Analysis Study.
SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCHES

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Automatic Transfer Switches.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Scope of Work

A. This section includes automatic transfer switches and bypass/isolation switches for systems rated 600 volts and less.

B. The transfer switches shall be the means of automatically switching the Emergency Electrical System loads between normal and emergency power.

C. This applies in the instances where an emergency generator is a part of the project scope.

D. This is a design standard and is not intended to be used as a construction specification.

PART 2: PRODUCTS

A. The switch shall be rated at 208Y/120 VAC or 480Y/277 VAC per application, 60 Hertz 4 wire operations. The transfer switch shall be contactor type. Molded case circuit breakers functioning as transfer switches shall not be allowed. The switch shall be enclosed in a NEMA 1 steel cabinet. The front door shall be key lockable. All components shall be front accessible.

B. The switch shall be designed with generator start controls.

C. The design shall require that the transfer switch have an isolation-bypass feature. This feature allows the removal of the transfer switch mechanism for repair without interruption to the load.
SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCHES

PART 3: EXECUTION

3.01 Design/Drawing Requirements

A. Normal and emergency circuits feeding into the switch shall be protected by molded case circuit breakers.

B. The continuous duty ampere rating shall be for the complete downstream load.

C. Drawings shall indicate location, drawn to scale in the electrical rooms. An alphanumeric designator consistent with the standards of Texas State University shall be applied to the room layout and the single line diagram. The single-line diagram shall show the continuous duty rating, both sources of power with appropriate feeders and the switch shown in the normal operating position.

D. The engineer shall coordinate with Texas State University Facilities on precise sequence of operation, but the minimum baseline requirement shall adhere to the following:

1. Under voltage Sensing: All phases of normal and emergency power shall be monitored with solid state under voltage sensors. When normal load voltage drops to 80% of normal, transfer switch shall initiate emergency generator and transfer when emergency source is at minimum of 90% voltage and proper frequency.

2. Overvoltage Sensing: All phases of normal and emergency power shall be monitored with solid state adjustable overvoltage sensors. These sensors shall be adjustable for pick-up settings from a minimum of 100% to a maximum of 130% (+/- 5%), with a dropout of 5% (+/- 1%) of nominal voltage above the pick-up setting. An adjustable time delay of 0.5 – 2.2 seconds shall be provided.

3. Frequency Sensing: Solid state and adjustable for pickup of +/- 4% to +/- 20% of nominal frequency. Dropout shall be +/- 5% of nominal wider than the pick-up frequency bandwidth. The time delay shall be adjustable from 0.115 seconds.

4. Retransfer: Retransfer to normal power shall occur when normal source has stabilized to 95% voltage for minimum of 15 minutes. Control shall be adjustable from 0 – 30 minutes. Appropriate controls for cooling down generator shall be provided prior to stopping (factory set at 30 minutes).

E. The transfer switch shall be contactor type. Molded case circuit breakers functioning as transfer switches shall not be allowed. The switch shall be
SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCHES

enclosed in a steel cabinet. The front door shall be key lockable. All components shall be front accessible.

1. Acceptable manufacturers are:

   a. Cummins
   b. Kohler
   c. ASCO
   d. ONAN

END OF SECTION 26 36 23
SECTION 26 42 14 – CATHOTIC PROTECTION-PIPING AND VALVES-STEAM PIPES

PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Cathotic Protection-Piping and Valves-Chill Water Steam Condensate.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

PART 2: PRODUCTS

A. As standard procedure on any new construction or building renovation. The steam line shall be isolated from building piping by use of a dielectric gasket and isolation kit after the first valve after entering the building, or buildings concerned and between the first valve and the main supply line.

B. To accomplish this, use a cathodic isolation kit as supplied by the Pic-o-Tec Corporation and a dielectric gasket. This gasket is to be Garlock Style ST-706 gasket material as manufactured by the Garlock Corporation. Gasket is to be 1/16” and flanges are to be raised face. Flange bolts are to be at least grade 6 and torqued to the maximum for their class to give maximum preload to the gasket.

C. On new construction the Design Professional shall consult with Mr. Patrick Dunn of Polyguard products Inc., for the design of the supply piping insulation.

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 42 14
PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Cathodic Protection-Piping and Valves-Shut off Valves.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

PART 2: PRODUCTS

A. Chill water supply and return lines, steam and condensate lines and domestic water lines shall be flanged on the building site of the initial penetration as close to the initial penetration as conveniently possible and shall be equipped with an appropriate style and pressure rated bubble tight shut off valve.

B. Between the first building side flange and the valve shall be placed an isolation kit and flange gasket. These isolation kits and flange gaskets shall be Pikotek GRE flange isolation kits equipped with spring energized Teflon gaskets (temperature range -250°F to +350°F).

C. These same isolation kits and gaskets shall be used on all metal natural gas lines prior to the natural gas line entering the building.

D. These isolation kits are necessary in order to isolate distribution piping and buildings in order to develop an effective cathodic protection system.

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 42 15
SECTION 26 50 00 – INTRODUCTION TO LIGHTING STANDARD

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Introduction to Lighting Standard.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General

A. PURPOSE: This portion of the STANDARDS has been prepared to address lighting applications across a campus with diverse needs and a wide variety of users. The intent is to make a wide range of lighting design options for the design professional, while meeting quality and quantity requirements. Further, these STANDARDS should provide lighting systems that are easy to maintain and energy efficient.

1. Nothing in these STANDARDS shall be construed as instruction from the University for the design professional to fail to comply with all applicable codes or the design professional’s responsibility to exercise good design judgment and standard of care required in the contract for services.

2. Where specific products are required in these STANDARDS, the design professional shall select and specify compatible products. (For example, metal halide downlights shall be compatible with coated lamps.)

B. UNIVERSITY’S BUILDING PROGRAMMATIC REQUIREMENTS: The University’s program (along with these STANDARDS) shall be the basis for establishing project lighting requirements, as outlined in the professional agreement.

1. USERS GROUPS: The requests of USER GROUPS shall be evaluated by the design professional and the impact of their requests shall be evaluated for inclusion in the project. In the event a request from a user conflicts with these STANDARDS, the program requirement (including budget), the design project shall secure written approval of the University prior to proceeding.
C. COMPLIANCE: It is the design professional’s responsibility to comply with all portions of these standards as well as complying with all terms of the contract for professional services. The University will from time to time review the documents provided by the design professional. The University’s review and acceptance of the design professional’s recommendations shall in no way be interpreted as approval of any item that fails to meet these STANDARDS or any other codes or projects requirements.

1. The prime consulting firm of the design professional shall be responsible for coordination the efforts and RESULTS of the other members of the DESIGN TEAM.

D. ILLUMINANCE STANDARDS: The University recognizes a relationship between lighting QUALITY and QUANTITY. The intent of these STANDARDS, and an expectation of the design professional, is to provide high quality interior and exterior environments with adequate luminance levels.

E. ENERGY SAVINGS: Lighting and lighting controls shall be designed for energy efficiency and ease of maintenance. See REFERENCED DOCUMENTS AND STANDARDS, below.

F. OVERLAP: Where two or more STANDARDS or cited references apply to a project or portion of a project, care shall be taken by the design professional to clarify the final design requirements. For example, IESNA RP-3, LIGHTING FOR EDUCATIONAL FACILITIES and IESNA RP-29, LIGHTING FOR HOSPITALS AND HEALTH CARE FACILITIES, will likely affect a classroom for healthcare education.

G. COMPLIMENTARY: All portions of this STANDARD are to be considered complimentary. No single part of the STANDARD can be interpreted or applied in the absence of or without considering other portions of the STANDARD.

H. VARIANCES: Should the design profession deem it necessary to vary from these standards, the professional shall submit a written request citing the paragraph of the reference and the reason for the variance. The professional shall obtain the University’s written approval prior to proceeding with a variance from the STANDARDS.

1. The variance request shall be submitted using a form approved by the University.

I. TIMELINESS: Where University’s approval or response is required, the design professional shall submit adequate documentation in a timely manner to allow such response within the schedule requirements of the project. The University
SECTION 26 50 00 – INTRODUCTION TO LIGHTING STANDARD

shall respond within seven business days of receipt of design professional’s request.

J. ALTERNATE PRODUCTS: The design professional shall include requirements in the contract documents for prior written approval for all substituted products that are proposed by a bidder and are not specifically included in this STANDARD.

K. SCOPE: The design professional shall evaluate all exterior lighting within the limits of the project scope, including preparing recommendations for upgrading to existing lighting to comply with these standards. The design professional shall cooperate with the University when lighting improvements are undertaken outside but adjacent to the project scope.

L. Care shall be taken to blend with existing surrounding areas.

M. CHANGES: After the University reviews and accepts of any portion of the project, no changes shall be made without the University’s express, written approval.

1.03 Referenced Documents and Cited Standards

A. GENERAL INFORMATION: All projects shall be designed to meet or exceed the recommendations/requirements in the current version of the documents listed below. The current version of the document shall be the last version prior to the date of the contract for professional services.

1. TEXAS STATE UNIVERSITY MASTER PLAN: Lighting shall comply with the current 2006-2015 Texas State University Campus Master Plan.

2. Lighting levels shall comply with sections 26 51 00 thru 26 56 80.

3. THE ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA) LIGHTING HANDBOOK and the following:

a. IESNA RP-20, LIGHTING FOR PARKING FACILITIES

b. IESNA RP-8, LIGHTING FOR ROADWAYS

c. IESNA RP-3, LIGHTING FOR EDUCATIONAL FACILITIES

d. IESNA RP-33, LIGHTING FOR EXTERIOR ENVIRONMENTS

e. IESNA DG-5, RECOMMENDED LIGHTING FOR WALKWAYS AND CLASS 1 BIKEWAYS

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f. Other IESNA RECOMMENDED PRACTICES and DESIGN GUIDES as justified by specific project type, lighting application or as cited in this STANDARD

4. AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING ENGINEERS (ASHRAE) STANDARD 90.1 ENERGY STANDARD FOR BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS

5. NATIONAL ELECTRIC CODE

6. NATIONAL FIRE PROTECTION AGENCY LIFE SAFETY CODE

7. UNITED STATES GREEN BUILDING COUNCIL (USGBC) LEED™ GREEN BUILDING RATING SYSTEM

B. In the event no standard is included above for an aspect of the project, the design professional shall submit a written recommendation to the University. The design professional shall obtain University’s written approval prior to proceeding.

1.04 General Lighting Guidelines for all Projects

A. The University’s long-term interest is best served by high value lighting solutions for all projects. As such, the following general guidelines shall be considered by the design professional for all projects:

1. Lighting solutions shall be designed to accommodate the users of each space with comfort. This requires the appropriate level of luminance (not excessively high or low) and successful control of glare. This lighting design goal applies to interior and exterior spaces alike.

2. In task areas, consider lighter architectural finishes to help achieve higher luminance levels at lower wattage densities. Coordinate the design effort with the University to determine applications where users can rely on task lighting.

3. The University recognizes that certain light fixtures can add value to a project based on the design and appearance of the product. However, the selection of special products must remain appropriate for the long-term investment of the university. The design professional shall avoid extravagant, inappropriate fixture selections or design applications.

4. Since all projects will comply with ASHRAE 90.1, total wattage available on any project will be limited. The design professional shall design the entire project with the required balance, avoiding conditions where one
SECTION 26 50 00 – INTRODUCTION TO LIGHTING STANDARD

portion of the project receives an inordinate amount of wattage in favor of another portion.

5. In any university, maintenance resources are always limited. As a result, the design professional shall design for low maintenance installations.

   a. Service access to fixtures (interior and exterior) shall be considered and resolved at the design development phase. The general goal is to limit lighting solutions to those serviceable from a 12-foot stepladder.

   b. Light fixtures shall not be installed above stairs or steps unless approved by the University in writing.

   c. The variety of lamp and ballast types shall be kept as restricted as possible for each project.

   d. All fixtures shall be selected with consideration for ease of maintenance. Fixtures designed in a manner that collect dirt or that are inherently difficult to clean or maintain should not be specified.

   e. Incandescent and halogen are strictly prohibited. LED, CFL (compact fluorescent lamps) and T8’s shall be used.

   f. Downlights require more maintenance than linear fluorescent products. Therefore, downlights included in any project shall be limited to those applications where their use is specifically justified.

6. A primary goal of the University is the safety of all those using the campus and related facilities. The design professional shall consider safety a primary goal of all projects.

PART 2: PRODUCTS

A. Lighting Panelboard Schedule

   1. All lighting loads shall be clearly scheduled in the Panelboard schedules with room numbers listed. See applicable STANDARDS for Panelboards.

B. Lighting Fixture Schedule

   1. All light fixtures shall be specified in a LIGHT FIXTURE SCHEDULE included in the contract documents. The fixture schedule shall include a

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designation each fixture. The fixture designation shall be clearly referenced on the lighting documents.

a. In addition to the fixture designation, the schedule shall specify the manufacturer and model number, fixture voltage and total wattage, and the quantity and model number of the lamp(s).

b. The schedule shall include an unambiguous description of the fixture, including material used in constructing the fixture, lens material (if any), ballast or transformer specification, maximum wattage of the fixtures (for those fixtures which will accommodate multiple lamp types) and any other appropriate features required to clearly specify the product.

C. Commissioning of Electrical Systems

1. All lighting and lighting controls shall be commissioned as required elsewhere in these STANDARDS.

D. Instrumentation and Control for Electrical Systems

1. Lighting controls will vary from project to project, based on such variables as user requirements, code requirements, budget and complexity of the project. Design professional shall evaluate the project and recommend lighting control components or lighting control system.

2. Each project may require multiple control strategies, many of which are shown below.

E. Lighting Control Devices

1. Exterior lightening shall be ultimately controlled by the use of a single photo-cell on each structure. Any or all zones may be controlled secondly by use of a time clock.

a. Any time clock(s) installed shall contain battery back-up for retaining timing functions in the event of power failure.

2. Interior lighting that is controlled by Occupancy Sensors (such as those made by WATTSTOPPER) shall do so in accordance with ASHRAE 90.1.

F. Theatrical Lighting Controls

1. Theatrical lighting control and power distribution shall be designed to comply with latest recommendations of the United States Institute for
Theatre Technology (USITT). Control system shall be designed using ‘dimmer per circuit’ design approach

G. Lamp and Ballast for All Lighting

1. Lamp selections shall comply with the following:
   a. The lighting engineer should consider LED type lamps and fixtures, wherever practical, for Energy Code reasons, and for life cycle cost savings.
   
   b. The preferred fluorescent lamp for all interior lighting is FO32T8, 48-inch fluorescent lamp with low mercury content. Where required by design application (as in coves), an acceptable lamp is FO25T8, 36-inch version matching the 48-inch lamp. All linear fluorescent lamps shall have a minimum rated life of 24,000 hours.
   
   c. The preferred compact fluorescent lamp is F26TBXT4. F32TBXT4 and F42TBXT4 lamps are also acceptable, where required by application.
   
   d. All fluorescent lamps shall have a color temperature of 3,500 degrees Kelvin and a color-rendering index of at least 80.
   
   e. Metal halide lamps rated at 175 watt and below shall be ED17 type, medium base with a color temperature of 3,200 degrees Kelvin and a color-rendering index of at least 70. Lamp shall be coated or clear, as required by the fixture and the application.
   
   f. Metal halide lamps rated at 250 or 400 watt shall have a color temperature of 3,200 degrees Kelvin and a color-rendering index of at least 70. Lamp shall be coated or clear, as required by the fixture and the application.
   
   g. Unless required by the application and approved by the University, all interior metal halide down lights below 175 watt shall be specified without lenses. The specified metal halide lamps shall be mogul, base, ED17 and rated for use in open fixtures.
   
   h. Ceramic metal halide, pulse start lamps are no longer used on Campus.
   
   i. All discharge lamps shall be low mercury content.
SECTION 26 50 00 – INTRODUCTION TO LIGHTING STANDARD

2. Ballast selection shall match the lamp and application, and shall comply with the following:
   
a. All interior fluorescent ballasts shall be electronic with a minimum ballast efficacy factor (BEF) of 10.

b. All compact fluorescent lamps shall incorporate end of life (EOL) protection.

c. All metal halide ballasts shall be electronic ballasts.

3. Additional requirements include the following:
   
a. All fixtures shall be compatible with and specifically manufactured for the mounting condition and ceiling type.

b. Lens type troffers shall be used in all food service applications, as required by applicable health code. The fixture shall be gasketed and installed with inverted lens to ease surface cleaning. Based on application, other lensed type fixtures (of equal performance/function) may be approved by the University.

H. The following types of sources and fixtures are prohibited from use on the campus:

1. Eight foot long fluorescent lamps

2. Neon

3. Cold cathode

4. Electroluminescent products

5. Plastic parabolic cube louvers (typically 0.5 inch cube cells)

6. Fixtures with master/slave ballast wiring configuration

7. Self-luminous lighting products except Exit Lights, where power is unavailable

8. Bollards or step lights with metal halide or high pressure sodium lamps

9. Non-cut off wall mounted fixtures (such as wall packs) or wall mounted floodlights for area lighting

Revised Jan-15 Introduction to Lighting Standard-26 50 00-8
SECTION 26 50 00 – INTRODUCTION TO LIGHTING STANDARD

10. Metal halide downlights in soffits below 18 feet high

11. High pressure sodium lamps are no longer used on Campus.

PART 3: EXECUTION

3.01 Project Deliverables

In addition to the documents require elsewhere in these standards, the design professional shall submit the following documents for review by the University:

A. CONCEPTUAL DESIGN PHASE

1. LIGHTING DESIGN CONCEPT STATEMENT

2. SCHEDULE OF LIGHTING LEVELS AND STANDARDS

3. CONCEPT STATEMENT FOR LIGHTING CONTROLS FOR THE PROJECT

4. CONCEPT STATEMENT FOR ACCESSIBILITY AND SERVICEABILITY OF ALL LIGHTING PRODUCTS

5. DESCRIPTION OF ALL NON-STANDARD LIGHTING AND CONTROL APPLICATIONS

B. DESIGN DEVELOPMENT PHASE

1. LIGHTING PLANS AND SCHEDULES

2. POINT-BY-POINT ILLUMINANCE MODEL OF ALL EXTERIOR SPACES

3. POINT-BY-POINT ILLUMINANCE MODELS OF REPRESENTATIVE INTERIOR SPACES

4. PRODUCT DATA SHEETS OF LIGHTING AND LIGHTING CONTROL EQUIPMENT

5. WATTAGE DENSITY CALCULATIONS

6. COST ESTIMATE BY FIXTURE TYPE AND LIGHTING CONTROL SYSTEM COMPONENTS

7. OUTLINE OF SPECIFICATIONS

Revised Jan-15 Introduction to Lighting Standard-26 50 00-9
SECTION 26 50 00 – INTRODUCTION TO LIGHTING STANDARD

8. DETAILS FOR EXTERIOR POLE HEIGHTS AND FOOTINGS

C. CONTRACT DOCUMENT PHASE

1. ALL DOCUMENTS REQUIRED FOR DESIGN DEVELOPMENT PHASE, UPDATED FOR THE FINAL DESIGN OF THE PROJECT

2. SPECIFICATION REQUIREMENT FOR UNIT PRICING FOR ALL LIGHTING PRODUCTS AND LIGHTING CONTROL SYSTEM COMPONENTS

3. DESCRIPTION OF ALL NON-STANDARD LIGHTING AND CONTROL APPLICATIONS, WITH UNIVERSITIES APPROVAL FOR EACH APPLICATION

D. BIDDING AND NEGOTIATION

1. APPROPRIATE BID FORM FOR UNIT PRICING REQUIREMENT ABOVE

E. CONTRACT ADMINISTRATION

1. AS REQUIRED BY PROJECT

3.02 Document Format

A. Documents submitted for University’s review or for record purposes shall be submitted in a quantity and format(s) required by the professional agreement. Electronic documents shall be submitted in AutoCAD version 2005 format (with .DWG file name extension) and Adobe Acrobat Reader (with .PDF file name extension).

3.03 Miscellaneous Requirements

A. Specifications for all new projects shall include requirements for replacement parts to be furnished by the contractor for the University’s use in maintenance of the project. Additional components shall be provided in manufacturer’s original box/container (or other approved packaging) and delivered to the University in an approved manner.

1. Lamps and ballasts

2. Relays and contactors for lighting controls

3. Dimmer modules
SECTION 26 50 00 – INTRODUCTION TO LIGHTING STANDARD

4. Wall box dimmers

B. Additional components shall be provided for the following items. Other items may be appropriate, based on the specific project. Quantity of components shall be determined on a project-by-project basis.
### 3.04 Project Review Checklist

#### Conceptual Design Phase
- **Concept Statement**
- **Schedule of Lighting Levels and Standards**
- **Concept Statement for Lighting Controls for the Project**
- **Concept Statement for Accessibility and Serviceability of All Lighting Products**
- **Description of All Non-Standard Lighting and Control Applications**

#### Design Development Phase
- **Lighting Plans and Schedules**
- **Point-by-Point Illuminance Model of All Exterior Spaces**
- **Point-by-Point Illuminance Models of Representative Interior Spaces**
- **Product Data Sheets of Lighting and Lighting Control Equipment**
- **Wattage Density Calculations**
- **Cost Estimate by Fixture Type and Lighting Control System Components**
- **Outline of Specifications**
- **Details for Exterior Pole Heights and Footings**
## PROJECT REVIEW CHECKLIST

**Texas State University-San Marcos**

Insert date checked and the name of the person reviewing the documents only after the documents are found to comply with list of deliverables.

<table>
<thead>
<tr>
<th>CONTRACT DOCUMENT PHASE</th>
<th>DATE CHECKED</th>
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</thead>
<tbody>
<tr>
<td>All documents required for design development phase, updated for the final design of the project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specification requirement for unit pricing for all lighting products and lighting control system components</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description of all non-standard lighting and control applications, with universities approval for each application</td>
<td></td>
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<tr>
<th>BIDDING AND NEGOTIATION</th>
<th>DATE CHECKED</th>
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<tbody>
<tr>
<td>Appropriate bid form for unit pricing requirement above</td>
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<th>CONTRACT ADMINISTRATION</th>
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**End of Section 26 50 00**
PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University for Interior Lighting.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General Illuminance Level Requirements for Interior Lighting

A. Illuminance levels shall be designated based on careful consideration of the use of each space. The following schedule is a general guide for lighting levels. The schedule is not intended to replace or supplant the information included in the cited references, and is included here for general information only.
### SECTION 26 51 00 – INTERIOR LIGHTING

<table>
<thead>
<tr>
<th>AREA OR SPACE</th>
<th>ILLUMINANCE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditoria</td>
<td>0 to 50 fc</td>
<td>Provide full range lighting control via preset dimming</td>
</tr>
<tr>
<td>Bathrooms</td>
<td>20 fc</td>
<td></td>
</tr>
<tr>
<td>Classrooms</td>
<td>20 / 50 fc</td>
<td>Provide multi-level lighting via split ballast switching</td>
</tr>
<tr>
<td>Computer rooms</td>
<td>20 / 50 fc</td>
<td>Provide multi-level lighting via split ballast switching</td>
</tr>
<tr>
<td>Conference rooms</td>
<td>20 / 50 fc</td>
<td>Provide multi-level lighting via split ballast switching</td>
</tr>
<tr>
<td>Corridors, stairways</td>
<td>20 fc</td>
<td></td>
</tr>
<tr>
<td>Dining rooms/Lounges</td>
<td>10 fc</td>
<td></td>
</tr>
<tr>
<td>Dormitory rooms</td>
<td>20 fc</td>
<td></td>
</tr>
<tr>
<td>Elevators</td>
<td>10 fc</td>
<td></td>
</tr>
<tr>
<td>Library/reading rooms</td>
<td>20 / 50 fc</td>
<td></td>
</tr>
<tr>
<td>Library/stack areas</td>
<td>30 fc</td>
<td></td>
</tr>
<tr>
<td>Library/stack areas</td>
<td>5 fc&lt;sub&gt;v&lt;/sub&gt;</td>
<td>Vertical illuminance at lower shelf</td>
</tr>
<tr>
<td>Offices</td>
<td>20 / 50 fc</td>
<td>Provide multi-level lighting via split ballast switching</td>
</tr>
<tr>
<td>Public lobbies, atria</td>
<td>20 fc</td>
<td></td>
</tr>
<tr>
<td>Science Labs</td>
<td>30 / 70 fc</td>
<td>Provide multi-level lighting via split ballast switching</td>
</tr>
<tr>
<td>Server/technology rms</td>
<td>50 fc</td>
<td></td>
</tr>
<tr>
<td>Support/utility spaces</td>
<td>20 fc</td>
<td></td>
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</tbody>
</table>

All illuminance levels shown above are horizontal foot-candles measure at the work plane (30 inches above the floor) unless notes otherwise. See Section 26 50 00, Part 3, and 3.01 Project Deliverables for documentation requirements related to illuminance levels.

### 1.03 Space by Space Requirements for Interior Lighting

#### A. BATHROOMS

1. Bathroom lighting shall be designed for uniform lighting for the comfort of the users and to aid in maintenance and cleaning. Downlights installed above fixture stalls are prohibited.

2. The primary source of light in all bathrooms shall be the FO32T8 lamp or LED lighting.
3. Lighting shall be controlled by a ceiling mounted occupancy sensor(s) suitable for the configuration of the room. At least one emergency fixture shall be provided above the vanity of each bathroom. This fixture shall serve as a night-light to avoid a user entering a completely dark room.

B. CLASSROOMS

1. Unless otherwise specifically required by the program, lighting in classrooms shall be standard 2x4 parabolic, three lamp troffers (T8) with split ballast switching or LED lighting.

2. Local switching shall be provided for control at each room entrance and near the marker board (for control by the presenter).

3. Lighting and switching shall be coordinated with audio video equipment. See Audio Video Lighting Requirements for additional requirements.

C. AUDITORIA AND RAISED FLOOR CLASSROOMS

1. Lighting applications for auditoria and raise floor classrooms shall be designed to accommodate the varying uses in each space.

2. Illumination levels at teaching areas shall be capable of levels 50 percent brighter than the seating portions of the space. This difference is lighting levels shall be accomplished through a combination of lighting controls and specification/placement of light fixtures.

3. Lighting controls shall be provided as required by the program requirements and in accordance with other sections of these STANDARDS.

4. In all spaces with fixed seated, provide aisle light fixtures to provide illumination in low lighting level settings.

5. See Audio Video Lighting Requirements for additional requirements.
SECTION 26 51 00 – INTERIOR LIGHTING

D. LOBBIES AND ATRIA

1. Lobbies and atria shall be designed with service access to light fixtures being a primary consideration. Adequate lighting levels must be provided, and fixture maintenance is necessary for the meeting this long-term goal.

2. Multiple lighting levels shall be provided in these spaces through switch control of fixtures so public areas can be used for a variety of functions, included receptions.

3. At locations designated by the University, provide lighting for art or other display.

4. These areas shall be illuminated by LED, Fluorescent (T8), and Compact Fluorescent Lighting.

E. TECHNOLOGY ROOMS

1. Technology rooms where only equipment is located shall include surface mounted wrap around style fluorescent fixture with F32T8 lamps.

2. Technology rooms where computers are used shall be meeting the standards for COMPUTER LABORATORIES AND CLASSROOMS shown below.

3. This area shall be illuminated by LED lighting.

F. CORRIDORS

1. Lighting in corridors shall be recessed and positioned to provide adequate general lighting.

2. In general, fixtures shall use F32T8 lamps. Where design requirements dictate, fixtures shall be compact fluorescent downlights.

3. At locations designated by the University, provide lighting for art or other display.

4. See Emergency Lighting for additional requirements.

5. These areas shall be illuminated by Led, Fluorescent (T8) and Compact Fluorescent Lighting.
SECTION 26 51 00 – INTERIOR LIGHTING

G. STAIRWAYS

1. Lighting in most STAIRWAYS shall be designed for safety and emergency operation. **Fixtures shall not be located above 9 foot above the floor or landing.** Fixtures shall use F32T8 lamps or LED lighting.

2. For STAIRWAYS considered to be part of a lobby or atria (or other grand stairs), lighting shall be designed to be consistent with these STANDARDS and the architectural design of the space.

3. Fixtures shall not be located above the steps in STAIRWAYS.

4. See Emergency Lighting for additional requirements.

H. DORMITORY ROOMS

1. Design of lighting in dormitories (especially the residence floors) shall balance the need for durability (and perhaps vandal resistance) with a desire for a residential look.

2. Dormitory bedrooms and vestibules shall be lighting using vandal resistant fixtures with compact fluorescent lamps and electronic ballasts. When two fixtures are required because of room layout, two fixtures shall be specified which use the same wattage lamp. Varying lighting levels should be accomplished by number of lamps in each fixture.

3. Lighting in bathrooms shall be based on wall mounted fluorescent fixtures with F32T8 lamps. Compact fluorescent fixtures shall be included in shower alcoves or vestibules where required due to room layout.

I. SUPPORT SPACES (MECHANICAL, ELECTRICAL AND EQUIPMENT ROOMS)

1. Luminaires shall be rigidly attached to structure or equivalent mounting surface. Luminaires suspended by chain or cables are prohibited.

2. Use F32T8 Lamp Fixtures or LED lighting in mechanical and electrical rooms.

J. OFFICES

1. Unless otherwise specifically required by the program, lighting in office shall be standard 2x4 parabolic, three lamp troffers (T8) with split ballast switching or LED lighting.
SECTION 26 51 00 – INTERIOR LIGHTING

2. Control shall be provided using an occupancy sensor suitable for split ballast switching, manual on/automatic off and with photocell for daylight sensing. Daylight sensing photocell will hold a portion of lighting off when adequate daylight is present.

K. CONFERENCE ROOMS

1. If designated by the University, provide preset lighting control system with dimming capabilities.

2. See Audio Video Lighting Requirements for additional requirements.

3. These areas shall be illuminated with LED, Fluorescent (T8), or CFL Lighting

L. COMPUTER LABORATORIES AND CLASSROOMS

1. Computer laboratories and classrooms where the primary task involves working with computers shall be designed with recessed indirect fixtures using three F32T8 lamps. Provide split ballast switching for multiple lighting levels.

2. Lighting control and Audio Video requirements shall be the same as those for CLASSROOMS.

M. LIBRARIES

1. CLASSROOMS, LOBBIES and ATRIA, AUDITORIA and other spaces in libraries shall be design to comply with the applicable portions of these STANDARDS.

2. Lighting in stacks shall be designed to provide adequate illumination at the lower shelf of all stacks.

3. Lighting controls in LIBRARIES shall be carefully coordinated with the user groups based on hours of operation and patterns of use.

N. SCIENCE LABS AND SIMILAR SPACES

1. Lighting in SCIENCE LABS AND SIMILAR SPACES shall be similar to classrooms, except all lamps shall be enclosed and illuminance levels shall be increased as required for the tasks.

2. Where required, lighting shall be designed to meet all requirements for handling of chemicals and any other hazardous materials.
SECTION 26 51 00 – INTERIOR LIGHTING

O. CRAWL SPACES

1. Provide vapor tight, four-foot fluorescent fixtures at each crawl space. The minimum requirement is one fixture installed inside each entrance to the crawl space.

2. If required by the University or if serviceable equipment is located in the crawl space, provide additional fixtures throughout the crawl space to allow access to the equipment. Locate one fixture at each access panel for serviceable equipment. Provide additional fixture along the walkway to the equipment (maximum 40 foot spacing).

3. Lighting control shall be a toggle switch with pilot light installed in a visible location.

PART 2: PRODUCTS

2.01 Interior Lighting Fixtures, Lamps, Ballasts and LED

A. All interior lights shall have Electronic Ballasts (T8)

B. Light fixture selection shall comply with the following:

1. The preferred light fixture shall be a 24-inch by 48-inch, 18-cell, and 3-inch deep parabolic troffer with low iridescent louver finish designed for lay in ceilings. Fixture shall include two or three lamps, as required by the application.

2. As an alternate to the preferred troffer fixture noted above, a matching 24” X 24” troffer is acceptable. Fixture shall include one, two or three lamps, as required by the application.

3. Compact fluorescent downlights are acceptable, but are considered a second choice to fixtures using F32T8 linear fluorescents. This requirement is due to the shorter rated life of the compact fluorescent lamps. **Exception: LED**

4. Where lensed troffers are used, acrylic lens shall be 0.125 inch thick.

5. Where used, compact fluorescent downlights shall include one, two or three lamps, as required by the application. Single lamp fixtures shall have vertical lamp orientation.
SECTION 26 51 00 – INTERIOR LIGHTING

6. In spaces with video display terminal use, recessed indirect fixture shall be used with three lamps. Split ballast switching shall be incorporated to provide a variety of lighting levels.

7. Pendant type fixtures of any type shall require University written approval for each application.

8. See 26 50 00, PART 2, G. LAMP AND BALLAST GUIDELINES FOR ALL LIGHTING.

9. T5 Lamps and Ballast are strictly prohibited.

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 51 00
SECTION 26 52 00 – EMERGENCY LIGHTING

PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University for Emergency Lighting.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General

A. Where emergency lighting products require battery packs, batteries shall be nickel cadmium type. This requirement applies to all emergency lighting fixtures, including exit signs.

B. Where possible, emergency lighting shall be provided emergency power and function to architectural fixtures. The use of self-contained emergency lighting units shall be prohibited unless approved by the University in writing.

1. An acceptable option to self-contained emergency lighting units is compact fluorescent or LED down lights designed to only operate in the event of a power failure. This option must be approved by the University due to maintenance considerations.

C. Emergency lighting for all interior spaces shall comply with all applicable codes and standards and the following additional requirements.

1. Test switches for battery packs shall not be mounted more than 8 feet above finish floor, unless the device is provided with remote test features.

2. For testing purposes, provide remote, lockable switching for emergency light units at lighting panel locations and mark ‘Emergency lights’. Where multiple switches are required, install all switches in a lockable enclosure.

D. Emergency lighting for all exterior spaces shall comply with all applicable codes and standards and the following additional requirements.
SECTION 26 52 00 – EMERGENCY LIGHTING

1. Provide an average of two footcandles on the walking surface for the space immediately outside each building exit. The source of power for the emergency light shall comply with same code or standards that apply to the emergency lighting at the building interior.

E. For projects with an emergency generator, light fixtures that require lighting control shall be provided with an approved generator transfer device to allow normal switching operation while maintaining emergency operation. The generator transfer device shall be provided on a fixture or lighting zone basis.

1. For projects with an emergency generators, a minimum of one fixture at every other landing in each stair shall be provided with emergency battery pack to provide continuous light during the startup of the generator.

F. All emergency lighting/fixtures for interior or exterior shall be LED.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 52 00
SECTION 26 53 00 – EXIT SIGNS

PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Exit Signs.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 General

A. All emergency exit signs shall be LED type. Where possible, exit sign shall be wall mounted directly above the exit door. In this configuration, the exit sign shall be mounted with back to wall. In addition, exit signs shall comply with the following:

1. The exit sign configuration shall be determined based on code requirements for exit paths. Configuration considerations include number of faces and direction of chevron/arrows showing path to exit.

2. In spaces designated by the University as upgraded interiors, exit signs shall be acrylic edge lit type.

PART 2: PRODUCTS

A. Preferred Exit Light is Lithonia Quantum Style #LQM-S-W-3-R-120/277-ELN-FA.

B. During a Power Outage, exit light should flash and have audible intermittent alert.

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 53 00
PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University for Special Purpose Lighting.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Types of Lights

A. Outline Lighting

1. Outline lighting (and all other forms) of decorative lighting shall be approved in writing by the University. In situations where approval is granted, decorative lighting shall be durable products with long life and low maintenance, such as LED.

2. See Prohibited Lighting Products above.

3. Light Controls: Refer to 26 50 00, PART 2, D.

B. Underwater Lighting

1. All lighting products specified for underwater installation shall be designed for the intended application. In addition, all such lighting shall comply with the following:

   a. All fixtures shall be installed with flexible cord to allow fixture to be relocated to above water level for service without draining water feature.

   b. All light sources shall be long lamp life products.

   c. All light sources for underwater applications shall be controlled via an automatic time clock (or the equivalent control system) and programmed for the shortest operating time possible.

C. Hazard Warning Lighting
SECTION 26 55 00 – SPECIAL PURPOSE LIGHTING

1. No STANDARDS this section.

D. Obstruction Lighting

1. Obstruction lighting, where required, shall be designed to comply with all applicable codes and standards. The design professional shall determine the need for obstruction lighting for all buildings, including requirements of the Federal Aviation Administration.

E. Security Lighting

1. All interior and exterior lighting shall be designed with a concern for security. Security includes concern for people and property.

2. Where possible, standard project lighting shall be designed to meet the objectives of security lighting. This will avoid fixtures designed for the specific purpose of providing security lighting levels.

3. Where security is critical, provide more than one light fixture in the area so a single lamp failure will not darken the entire area.

4. All fixtures for special purpose lighting shall be LED.

F. Display Lighting

1. Display lighting includes lighting for museums, other artwork, display cases (for trophies and similar memorabilia) and special architectural features. Locations for display lighting shall be designated by or approved by the University.

2. Unless approved in writing by the University, display lighting shall be fixtures using fluorescent sources.

3. Where approved by the University, halogen lighting shall be medium base PAR type lamps or MR16 lamps.

4. Display lighting using festoon lamps, low voltage bi-pin (except MR16 lamps) or other similar short life products shall be prohibited.

5. Lighting and controls for museums (or similar designated spaces) shall be designed to comply with the recommendations of IESNA RP-30, Museum and Art Gallery Lighting.
SECTION 26 55 00 – SPECIAL PURPOSE LIGHTING

G. Theatrical Lighting

1. All lighting for theatrical requirements shall be designed to conform to recommendations of United States Institute for Theatre Technology (USITT).

2. All house and emergency lighting shall be coordinated with the theatrical lighting for design and control requirements.

3. A stand-alone switch shall be provided in the control booth to flash a portion of the lobby lighting to notify of curtain call. The portion of the fixtures shall be selected to adequately notify the audience without completely darkening the space. The flash feature shall not be designed to control emergency lighting.

4. All theatrical lighting shall be LED.

H. Detention Lighting

1. No STANDARDS this section.

I. Healthcare Lighting

1. Lighting and controls for healthcare related spaces shall be designed to comply with the recommendations of IESNA RP-29, LIGHTING FOR HOSPITALS AND HEALTH CARE FACILITIES.

2. Facilities most likely affected by this portion of the STANDARD are portions of the College of Health Professions.

3. All Healthcare Lighting shall be LED.

J. Audio Video Lighting Requirements

1. Spaces designed for presentation purposes using AUDIO/VIDEO equipment shall be designed in compliance with the applicable University STANDARDS, and as follows:
   
a. In spaces with ceiling mounted projectors, emergency lighting shall be controlled such that lighting can be completely turned off during functions requiring use of the projector. See section regarding EMERGENCY LIGHTING for generator transfer devices.
SECTION 26 55 00 – SPECIAL PURPOSE LIGHTING

b. In spaces with projector screens, fixtures within 8 feet of the screen shall be switched independently of remaining fixtures to improve quality of the projected image.

K. Marker Board Lighting

1. All spaces with fixed, wall mounted marker boards (or equivalent writing surface) adequate lighting of the marker board shall be provided by one of the following:

a. Wall mounted light fixtures specifically designed for the purpose of lighting marker boards.

b. Ceiling mounting fixtures positioned to light the marker board.

c. Other lighting solutions approved in advance by the University.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 55 00
SECTION 26 56 00 – EXTERIOR LIGHTING

PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University for Exterior Lighting.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General Requirements for Exterior Fixtures

A. Light fixture selection shall comply with the following:

1. All pole mount fixtures, ground mounted and wall mounted fixtures shall have die cast aluminum housings with powder coat painted finish.

2. All exterior wall mounted fixture mounted below 12 foot above grade shall be “vandal resistant” design. Additionally, all fixtures installed below 5 foot above grade shall have tamperproof screws.

3. All exterior fixtures shall have internal electrical components (socket and ballast) in a tray type configuration with connectors for simplified replacement of failed components.

4. Where required to control light trespass, exterior fixture shall be provided with “house side shields” (or the equivalent). Fixtures using “barn doors” are not acceptable.

5. Light controls: Refer to 26 50 00, PART 2, D.

B. See 26 50 00, PART 2, G. LAMP AND BALLAST GUIDELINES FOR ALL LIGHTING.

1.03 General Illuminance Levels for Exterior Lighting

A. Illuminance levels shall be designed based careful consideration of the use. The following schedule is a general guide for lighting levels. The schedule is not intended to replace or supplant the information included in the cited references, and is included here for general information.

Revised Jan-15
SECTION 26 56 00 – EXTERIOR LIGHTING

RECOMMENDED MAINTAINED ILLUMINANCE VALUES FOR PARKING FACILITIES (FROM IESNA RP-20-98)

<table>
<thead>
<tr>
<th>AREA OR SPACE</th>
<th>MIN AVG</th>
<th>MINIMUM</th>
<th>MAX:MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking garage (night)</td>
<td>NA</td>
<td>1.00 fc</td>
<td>10:1</td>
</tr>
<tr>
<td>Parking garage ramps (day)</td>
<td>NA</td>
<td>2.0 FC</td>
<td>10:1</td>
</tr>
<tr>
<td>Parking garage ramps (night)</td>
<td>NA</td>
<td>1.0 FC</td>
<td>10:1</td>
</tr>
<tr>
<td>Parking garage entrances (day)</td>
<td>50</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Parking garage entrances (night)</td>
<td>NA</td>
<td>1.0 fc</td>
<td>10:1</td>
</tr>
<tr>
<td>Parking (levels open to sky)</td>
<td>NA</td>
<td>0.5 fc</td>
<td>15:1</td>
</tr>
<tr>
<td>STAIRWAYS (serving structured parking)</td>
<td>NA</td>
<td>2.0 fc</td>
<td>NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREA OR SPACE</th>
<th>MINIMUM</th>
<th>MAX:MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking lots (enhanced security)</td>
<td>0.5 fc</td>
<td>15:1</td>
</tr>
</tbody>
</table>

RECOMMENDED MAINTAINED ILLUMINANCE VALUES FOR ROADWAYS (FROM IESNA RP-8-00)

<table>
<thead>
<tr>
<th>AREA OR SPACE</th>
<th>MIN AVG</th>
<th>AVG:MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadways (Collector)</td>
<td>1.2 fc</td>
<td>4.0</td>
</tr>
</tbody>
</table>

RECOMMENDED MAINTAINED ILLUMINANCE VALUES FOR PEDESTRIAN WAYS (FROM IESNA RP-33-99)

<table>
<thead>
<tr>
<th>AREA OR SPACE</th>
<th>MIN AVG</th>
<th>MAX:MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian stairways</td>
<td>0.5 fc</td>
<td>10:1</td>
</tr>
<tr>
<td>Sidewalks (roadside)</td>
<td>0.5 fc</td>
<td>10:1</td>
</tr>
<tr>
<td>Walkways distant from roadways</td>
<td>0.5 fc</td>
<td>10:1</td>
</tr>
</tbody>
</table>

Sidewalk and walkways illuminance values are based on a pedestrian activity for an intermediate area.

All illuminance levels are horizontal footcandles measured at the ground plane. See the cited IESNA documents for requirements for vertical illuminance levels. See paragraph 26 50 00, PART 3, 3.01 PROJECT DELIVERABLES for documentation requirements related to illuminance levels.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 56 00

Revised Jan-15

Exterior Lighting - 26 56 002
CONSTRUCTION STANDARDS                     DIVISION 26 - ELECTRICAL
SECTION 26 56 13 – LIGHTING POLES AND STANDARDS

PART 1:  GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University for Lighting Poles and Standards.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General Requirements

A. Parking Lot light pole concrete base shall be 30” above finished grade.

B. Pedestrian Walk Light Pole concrete base, located in landscaping, shall be 6” above finish grade or finished paving.

C. Pedestrian Walk Light Pole concrete base, located on sidewalk, shall be flush with sidewalks.

D. The depth of the concrete pole base shall be determined by a structural engineer based on soil conditions on the site. Pole base details shall be submitted for review by the University during the DESIGN DEVELOPMENT phase of the project.

E. The pole base diameter shall be 18 inches, unless otherwise approved by the University.

F. All poles shall be provided with bolt covers securely attached to pole bases.

G. Location of pole fixtures shall allow vehicular access to accommodate service requirements. Poles shall not be located in walking paths or any conflicts with vehicular circulation.

1. Pole fixtures at or above 12 foot high shall be provided with service access drive capable of supporting a lift truck. On 12’ or higher poles: If fixture is not accessible by lift truck, a “break-over” type pole base shall be installed to allow pole to be laid down for maintenance.

H. Care should be taken by the design professional to avoid small “slivers” of landscape materials between pole bases and sidewalks.
1. No pole-mounted fixtures shall be positioned, specified or designed in such a manner to create abnormally difficult access to the fixture and poles.

I. Provide pole mounting height and pole base installation detail. Poles, fixtures and color shall follow campus standard manufacture with wire accessibility near the base.

J. PART 2: PRODUCTS

A. Parking Light Poles: The standards pole for the Texas State University-San Marcos campus is: GARDCO, Galvanized Steel, 5” diameter, straight round pole SRS-25-5.0 (24’-10” high), primed painted for galvanizing, black thermally cured TGIC polyester powder coat finish.

B. Walkway Poles: The standard pole for the Texas State University-San Marcos campus is: Architectural Area Lighting, Aluminum, straight, 4” round pole maximum height of 12’, including the base; DB8, black thermally cured TGIC polyester powder coat.

C. All fixtures shall have electronic ballasts.

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 56 13
SECTION 26 56 16 – PARKING LOT LIGHTING

PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University for Parking Lighting.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General Requirements

A. Parking lot luminaries shall be GARDCO GULLWING type fixture installed pole mounted in fixture configurations of one, two or four fixtures per pole. The preferred configuration is one and two fixtures per pole.

1. LED Lighting
2. Lighting distribution shall be any standard IESNA type offered (type 1 through 5) to meet the lighting design requirements of the application. Where possible, preference should be given to luminaries with type 3 optics.
3. Light Controls: Refer to 26 50 00, PART 2, D.
4. Parking Lot lights must have Electronic Ballasts.

PART 2: PRODUCTS

A. The Texas State University campus standard parking light is: GARDRO, “GULLWING”, G18-2-2XL-250MH-BLP-None, (twin light configuration, 2XL Type II distribution, LED, black paint TGIC powder coat finish, no option parts).

B. Multiple head configurations of the Parking Lot Light above may be used, if required.

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 56 16
SECTION 26 56 17 – PARKING GARAGE BAY LIGHTING

PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University for Parking Garage Bay Lighting.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines

A. For safety and higher brightness effect, the ceiling structure and beams of each floor of the Parking Garage shall be painted a light color (to be approved by Project Representative).

B. The illumination levels of Parking Garages shall comply with Section 26 56 00, 1.03.

C. The lighting controls shall comply with Section 26 50 00, PART 2, D.

D. 1. Lighting fixtures in Parking Garage Bays shall be: LED, Max Light, Down Light.

E. Project Deliverables shall comply with Section 26 50 00, PART 3, 3.01.

PART 2: PRODUCTS

A. Approved fixtures:

1. LED, Max Light, Down Light

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 56 17
CONSTRUCTION STANDARDS DIVISION 26 - ELECTRICAL

SECTION 26 56 26 – LANDSCAPE LIGHTING

PART 1: GENERAL

1.0 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Landscape Lighting.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.01 Design Guidelines

A. All exterior lights must have Electronic Ballasts.

1.02 General Requirements

A. Landscape lighting shall be designed for low maintenance.

B. Fixture locations shall be coordinated with irrigation design so sprinkler water does not spray directly onto luminaires.

C. All landscape fixtures shall be mounted on a suitably designed concrete base or foundation. Based shall be designed to allow easy maintenance of luminaire and adjacent landscape.

1. Direct bury fixtures shall be installed in a concrete base with an apron around fixture of no less than 6 inches. Such fixtures shall be installed a suitable distance above finish grade to prevent water collecting on or around fixture.

D. Fixtures that are ground mounted using a “spike” or non-fixed manner are prohibited.

E. Landscape fixtures shall not exceed 70-watt metal halide, ED17 lamps.

F. Light Controls: Refer to 26 50 00, PART 2, D.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 56 26

Revised Jan-15 Landscape Lighting - 26 56 26- 1
SECTION 26 56 33 – WALKWAY LIGHTING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. The conditions of the Contract and applicable requirements of Division 0 and 1 Section 26 00 00, “ELECTRICAL” govern this section.

1.02 SCOPE OF STANDARDS

A. This standard is intended to provide useful information to the Architect/Engineer (A/E) to establish a basis of design for Walkway Lighting for new construction and renovation. The responsibility of the professional services provider is to apply the principals of this section such that the University may achieve a level of quality and consistency in design.

B. Lighting design shall meet the requirement of ASHRAE 90.1 as currently adopted by the State of Texas Energy Code and meet the recommended illumination level of the current edition of the Texas Energy Code and meet the recommended illumination levels of the current edition of the Illuminating Engineering Society of North America (IESNA) Lighting Handbook or as required to meet the University’s security needs, whichever is higher.

C. The Owner shall not be held responsible for the omission or absence of any detail, construction feature which may be required in the production of the fixtures.

1.03 GENERAL REQUIREMENTS

A. All exterior walkways, stairs and ramps shall be designed to comply with the cited standards noted above. Care shall be taken to provide adequate lighting at all exterior hazards such as: steps and similar changes of grade, stair (including landings), and ramps (including landings).

B. Light Controls: Refer to 26 50 00, PART 2, D.

C. Exterior and site lighting shall be shown on the site plan. List distance between poles, fixtures and other site lighting devices.
SECTION 26 56 33 – WALKWAY LIGHTING

1.04 SUBMITTALS

A. Shop Drawing Submittals shall include dimensioned drawings and performance data including coefficient of utilization, candela distribution, spacing and mounting height ratio, efficiency and visual comfort probability.

PART 2: PRODUCTS

2.01 PEDESTRIAN WALK, PLAZA LIGHT STANDARD

A. Luminaries – Basis of design 70 Watt LED; Architectural Area Lighting (AAL), PROV T5 32LED-5K-700 BLK, Medium Head - or approved equal.

B. Banner Arms - Architectural Area Lighting (AAL) BBD4-24-DB8.

C. Walkway Poles - Architectural Area Lighting (AAL), straight aluminum pole with a maximum height of 12 feet including the base. Finish shall be black thermally cured TGIC polyester powder coat. NO Exceptions to this criterion.

D. Provide all poles with base covers, mounting arms, anchor bolts and miscellaneous accessories as required for a complete installation.

E. Walkway poles located in sidewalks shall be flush with the finished grade of the sidewalk.

F. Multiple head configurations of the above walkway light may be used, if required.

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 56 33
PART 1: GENERAL

1.00 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Other Exterior Lighting.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.01 Design Guidelines

A. All exterior lights must have Electronic Ballasts.

1.02 Flood Lighting

A. Flood lighting shall prohibited in all applications, except as follows:

1. Floodlight for illumination of flags and monuments shall be specified with beam pattern and lamp wattage to specifically serve the intended task.

2. Exterior building lighting as approved by the University.

1.03 Exterior Athletic Lighting

A. Lighting and controls for exterior athletic facilities shall be designed to comply with the recommendations of IESNA R-P06, Sports and Recreational Area Lighting.

B. Specific care shall be taken by the design professional to control glare from exterior athletic facilities lighting when viewed from adjacent property and to eliminate light trespass onto adjacent property.

1.04 Other Exterior Lighting

A. EXTERIOR ASSEMBLY AREA LIGHTING: Exterior assembly areas are unique. As such, this type of lighting application shall be determined based on a case-by-case evaluation of each project.
SECTION 26 56 80 – OTHER EXTERIOR LIGHTING

1. Lighting for exterior assembly areas shall be designed to be additional lighting above the general walkway, parking and landscape lighting in the area.

2. Lighting for exterior assembly areas shall be controlled independently of other lighting in the area. Location of control override shall be approved by the University.

B. BUS STOP LIGHTING: In addition to roadway lighting, provide lighting at all bus stops for increased safety and improved way finding. Additional lighting shall be accomplished using pedestrian pole fixtures or light fixture installed within a bus shelter.

C. CONSTRUCTION SITE LIGHTING: The design professional shall include requirements in the project specifications requiring temporary construction lighting to be installed to comply with the following:

1. All floodlights shall be installed with a hood or louver to control glare and lamp visibility.

2. Floodlights shall be positioned to aim into project site, unless installer 100 feet from property line.

3. If the University forwards a complaint about glare from temporary construction lighting, the contractor shall adjust the fixture or otherwise remedy the problem.

D. TEMPORARY LIGHTING: All temporary lighting shall be approved by the University in writing.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 26 56 80
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 00 00</td>
<td>Communications</td>
</tr>
<tr>
<td>27 01 00</td>
<td>Operation and Maintenance of Communications Systems</td>
</tr>
<tr>
<td>27 05 13</td>
<td>Communications Services</td>
</tr>
<tr>
<td>27 05 28</td>
<td>Pathways for Communications Systems</td>
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<tr>
<td>27 05 43</td>
<td>Underground Ducts and Raceways for Communications Systems</td>
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<td>27 05 53</td>
<td>Identification for Communications Systems</td>
</tr>
<tr>
<td>27 06 00</td>
<td>Schedules for Communications</td>
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<tr>
<td>27 11 00</td>
<td>Communications Equipment Room Fittings</td>
</tr>
<tr>
<td>27 13 00</td>
<td>Communications Backbone Cabling</td>
</tr>
<tr>
<td>27 15 00</td>
<td>Communications Horizontal Cabling</td>
</tr>
<tr>
<td>27 16 00</td>
<td>Communications Connecting Cords, Devices, and Adapters</td>
</tr>
<tr>
<td>27 20 00</td>
<td>Data Communications</td>
</tr>
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<td>27 21 33</td>
<td>Data Communications Wireless Access Points</td>
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<tr>
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<td>Voice Communications</td>
</tr>
<tr>
<td>27 36 00</td>
<td>Data and Voice Equipment</td>
</tr>
<tr>
<td>27 41 16.51</td>
<td>Integrated Audio-Video Systems and Equipment for Classrooms</td>
</tr>
<tr>
<td>27 41 16.61</td>
<td>Integrated Audio-Video Systems and Equipment for Theaters</td>
</tr>
<tr>
<td>27 41 16.62</td>
<td>Integrated Audio-Video Systems and Equipment for Auditoriums</td>
</tr>
</tbody>
</table>
27 00 00 – Communication

1.01 Scope of Standard

A. These guidelines identify and define Texas State University requirements and policies for designing and installing telecommunications infrastructure and substructure at all Texas State University facilities. Use of, and compliance with these guidelines is mandatory for Texas State University personnel, and for architects, engineers, and installation contractors working on Texas State University projects.

2.01 Design Guidelines

A. The Texas State University Telecommunications Infrastructure Standards are based upon the code requirements and telecommunications industry standards contained in the following guidelines. These guidelines will not duplicate the information contained in those references, except where necessary to provide guidance, clarification or direction. It is imperative that Texas State University personnel, architects, engineers, and installation contractors working on Texas State University projects become familiar with these guidelines and the industry telecommunications standards referenced.

B. In instances where several technical alternatives may be available to provide a design solution, these guidelines will identify the preferred solution to meet Texas State University needs. However, each facility and project is unique. Design for new construction will differ from design for retrofit of existing facilities. These guidelines will differentiate certain design approaches and solutions to be applied to new construction versus existing facilities, and different types of Texas State University facilities. However, designers and installers shall always use sound engineering judgment in order to comply with the requirements of the codes and standards identified in this section. Design or installation questions shall be referred to the Texas State University IT staff via Office of Campus Construction for resolution.

3.01 Reference Standards

A. Adherence to, and compliance with, the codes and standards referenced, and Texas State University unique requirements and design solutions identified in the manual, is mandatory. Requests to deviate from the industry standards and design solutions prescribed in these guidelines may be submitted, on a case-by-case basis, in accordance with the instructions in the Policy and Procedures section of these guidelines. No deviation from the requirements of the National Electrical Code will be allowed.
Architects, Consultants and Contractors shall always reference the most recent standards available. Most references listed below can be purchased directly from the individual standards organization, or from:

Global Engineering Documents

Inverness Way East
Englewood, CO 80112-5776
Telephone: (800) 854-7179 (303) 397-7956
Fax: (303) 397-2740
http://www.global.ihs.com

4.01 Codes, Standards, References, and Applicability

A. ALWAYS REFER TO LATEST RELEASE OF ALL CODES, STANDARDS, AND REFERENCES

B. NATIONAL ELECTRICAL CODE, NFPA 70

1. The National Fire Protection Association has acted as the sponsor of the National Electrical Code (NEC) since 1911. The original Code was developed in 1897 as a result of the united efforts of various insurance, electrical, architectural, and allied interests. The purpose of the NEC is the practical safeguarding of persons and property from hazards arising from the use of electricity. The NEC provides the minimum code requirements for electrical safety. In telecommunications distribution design, the NEC must be used in concert with the ANSI/EIA/TIA standards identified below, which are intended to insure the performance of the telecommunications infrastructure.

C. ANSI/TIA/EIA STANDARDS

1. The Telecommunications Industry Association/Electronics Industry Association (TIA/EIA) engineering standards and publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers. The standards facilitate interchangeability and improvement of products, and assist the purchaser in selecting and obtaining the proper product for his or her particular need.

2. Applicable Standards include but are not limited to, the TIA/ EIA Collection- Telecommunications Building Wiring Standards: TIA-526-7, TIA-526-14, TIA/EIA-568, TIA-569, TIA-570, TIA-598, TIA/EIA-606, J-STD-607 and TIA-758
D. FIBER OPTIC TEST STANDARDS, TIA/EIA-526 (SERIES)

1. The TIA/EIA-455 series, together with its addenda, provides uniform test procedures for testing the fiber optic components intended for, or forming a part of, optical communications and data transmission systems. This series contains standard test procedures for optical fibers, cables, transducers, and connecting and terminating devices.

E. CABLING STANDARD, ANSI/TIA/EIA-568 (SERIES)

1. The ANSI/TIA/EIA-568-A (series) is the Commercial Building Telecommunications Cabling Standard. This standard defines a generic telecommunications wiring system for commercial buildings that will support a multi-product, multi-vendor environment. It also provides direction for the design of telecommunications products for commercial enterprise.

   a. The purpose of the standard is to enable planning and installation of building wiring with little knowledge of the telecommunications products that subsequently will be installed. Installation of wiring systems during building construction or renovation is significantly less expensive and less disruptive than after the building is occupied. TIA/EIA-568-A establishes performance and technical criteria for various wiring system configurations for interfacing and connecting their respective elements.

F. PATHWAYS AND SPACES, ANSI/TIA/EIA-569-A (SERIES).

1. The ANSI/EIA/TIA-569-A (series) is the Commercial Building Standard for Telecommunications Pathways and Spaces. This standard will be followed for all low voltage systems in all Texas State University buildings. This standard encompasses telecommunications considerations both within and between buildings, and recognizes three fundamental concepts:

   a. Buildings are dynamic. Over the life of a building, or campus, remodeling is more the rule than the exception. The standard recognizes that changes will take place.

   b. Building telecommunications systems and media are dynamic. Over the life of a building, or campus, both telecommunications equipment and cabling change dramatically. The standard recognizes this fact by being as independent as possible from specific vendor equipment and media.
c. Telecommunications is more than just voice and data. Telecommunications also encompasses many building systems including environmental controls, security, audio, television, sensing, alarms and paging. Telecommunications includes all low voltage signal systems that convey information within or between buildings.

2. In order to have a building, or campus, successfully designed, constructed, and provisioned for telecommunications, it is imperative that the telecommunications design be incorporated during the preliminary architectural design phase. To accomplish this, the architect must work closely with the designated IT staff member via office of campus construction.

G. ADMINISTRATION STANDARD, ANSI/TIA/EIA-606 (SERIES)

1. The ANSI/TIA/EIA-606 (series) is the Administration Standard for the Telecommunications Infrastructure of Commercial Buildings. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, telecommunications closets, and other telecommunications spaces. The purpose of this standard is to provide a uniform administration scheme that is independent of applications, which may change several times throughout the life of a building. Unless specified otherwise in these Texas State University Design and Construction Guidelines administration standard at all Texas State University facilities will be in compliance with TIA/EIA-606.

H. GROUNDING AND BONDING, ANSI/TIA/EIA-607 (SERIES)

1. The ANSI/TIA/EIA-606 (series) is the Commercial Building Grounding and Bonding Requirements for Telecommunications. The National Electrical Code (NEC) provides grounding, bonding, and electrical protection requirements to ensure life safety. Modern telecommunications systems require an effective grounding infrastructure to insure optimum performance of the wide variety of electronic information transport systems that may be used throughout the life of a building. The grounding and bonding requirements of this standard are additional technical requirements for telecommunications that are beyond the scope of the NEC. These standards are intended to work in concert with the cabling topology specified in ANSI/TIA/EIA-568-A, and installed in the pathways and spaces designed in accordance with ANSI/TIA/EIA-569-A.

I. CUSTOMER OWNED OUTSIDE PLANT (OSP), ANSI/TIA/EIA-758
1. The ANSI/TIA/EIA-758 provides industry standards for the design and construction of customer owned OSP infrastructure. Unless specified otherwise in the Texas State University standard OSP designed and constructed at all Texas State University facilities will be in compliance with ANSI/TIA/EIA-758.

J. TRANSMISSION PERFORMANCE SPECIFICATIONS, TIA/EIA BULLETIN TSB67

1. TSB67 is the Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair (UTP) Cabling Systems. This bulletin specifies the electrical characteristics and performance requirements of field test instruments, test methods, and the minimum transmission requirements for UTP cabling. All testing of horizontal distribution cabling at Texas State University facilities will be performed with a TSB67 Level II test instrument.

K. ADDITIONAL HORIZONTAL CABLING PRACTICES FOR OPEN OFFICES, TIA/EIA BULLETIN TSB75

1. This document specifies optional practices for open office environments, for any horizontal telecommunications cabling recognized in TIA/EIA-568. It specifies optional cabling schemes and topologies for horizontal cabling routed through modular office furniture or movable partitions, which are frequently reconfigured. These optional practices may be applied at Texas State University classrooms, offices and multipurpose rooms.

L. LOCAL AREA NETWORK ETHERNET STANDARD, IEEE 802.3 (SERIES)

1. Texas State University utilizes the Ethernet LAN protocol at all facilities. All Texas State University telecommunications infrastructure must be designed to support the Institute of Electrical and Electronic Engineers (IEEE) Ethernet 802.3 standards, which define protocols and signaling technologies. All newly installed cabling must support 1000Base-X Gigabit Ethernet protocol based on the IEEE 802.3z standard.

M. THE BICSI TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL

1. The Building Industry Consulting Service International, Inc. (BICSI) is a Telecommunications Association whose mission is to provide state-of-the-art telecommunications knowledge to the industry, resulting in good service to the end user. BICSI develops and publishes the
Telecommunications Distribution Methods Manual (TDMM). The TDMM is not a code or standard. The TDMM is an extensive volume of information on the various aspects of telecommunications systems and telecommunications distribution. The TDMM provides discussions and examples of various engineering methods and design solutions that can be selected and employed in order to meet the requirements of the NEC and ANSI/TIA/EIA standards. Designers and installers are encouraged to use the TDMM as an engineering tool, within the constraints of the unique requirements of the Texas State University Telecommunications Infrastructure Standards.

END OF SECTION 27 00 00
27 01 00 – Operation and Maintenance of Communications Systems

1.01 POLICY AND PROCEDURES

A. Management of Texas State University’s Campus Network is the responsibility of the IT staff. This includes network design, operations, performance monitoring, optimization, troubleshooting, and disaster recovery. The IT staff at Texas State University is also responsible for the planning and development of operational and design standards for local area networks (LANs) and voice communication systems at all Texas State University facilities, including the telecommunications infrastructure and substructure.

B. Texas State University IT staff will be responsible for installation and support of LAN hardware, software, data communications and voice system backplane hardware.

2.01 DESIGN PHILOSOPHY

A. Texas State University requires that the telecommunications infrastructure and substructure be designed and installed in accordance with applicable codes and industry standards. Due to the unique physical characteristics of many Texas State University facilities, some technical design solutions are better suited than others. These guidelines identify which design solutions are appropriate and approved for the various types of buildings and areas in Texas State University facilities.

3.01 PRELIMINARY ARCHITECTURAL DESIGN PHASE

A. Texas State University requires that the telecommunications design be incorporated during the preliminary architectural design phase. This will insure that the building(s) will be successfully designed, constructed, and provisioned for telecommunications.

4.01 IT ROLE IN CAMPUS BUILDING PROJECTS

A. Texas State University requires the architect and designers to work closely with the Texas State University IT designated staff as a team throughout the entire project life cycle, starting at the preliminary architectural design phase.

B. The Director of Telecommunications Services responsibility is to improve communication on capital projects, ensure successful design and implementation of telecommunications infrastructure throughout the lifecycle of each project and to ensure integration of project design into existing campus infrastructure.

C. The Director of Instructional Technology’s responsibility is to ensure compliance of latest classroom design concerning telecommunications infrastructure and technology used by classroom instructors.
5.01 NEW CONSTRUCTION

A. All new construction projects shall contain a telecommunications infrastructure designed and installed in accordance with the requirements of these guidelines.

6.01 RENOVATION TO EXISTING STRUCTURES

A. All Texas State University facilities undergoing renovation or remodeling shall incorporate a telecommunications infrastructure designed and installed in accordance with the requirements of these guidelines.

7.01 UPGRADING TELECOM INFRASTRUCTURE TO NEW STANDARDS

A. Every effort should be made to upgrade existing telecommunications infrastructure at any Texas State University facility, during renovation, to meet the standards and specifications of these guidelines.

8.01 DESIGN PROCEDURES

A. In order to have a building successfully designed, constructed, and provisioned for telecommunications, it is imperative that the telecommunications design be incorporated during the preliminary architectural design phase. To accomplish this, the architect must work closely with the designated Texas State University IT staff.

9.01 APPROVAL FOR ALTERNATIVE DESIGN SOLUTIONS

A. This guideline identifies specific design solutions that are intended to meet the technical requirements of Texas State University telecommunications and information technology systems. Requests to deviate from industry standards or Texas State University design solutions will be considered on a case-by-case basis. Any request to deviate from the requirements of the National Electrical Code will not be accepted.

B. Requests to apply alternative design solutions shall be submitted to the Texas State University Director of Telecommunications Services for consideration. Approval will only be granted in writing.
C. The request must include: A complete description of the proposed alternative design solution identifying: The type of facility; the conditions at the facility; the approved design solution contained in these guidelines and the relevant standards identified in section 27 01 00; the proposed alternative design; identify all standards referenced in these guidelines which the alternative design will not be in compliance with, and the effect of non-compliance, both short and long term; and the reason for wishing to use the alternative design.

10.01 PROCUREMENT AND INSTALLATION POLICY

A. In larger construction projects, the telecommunications infrastructure installation will be part of the general construction contract. A competitive acquisition should still be pursued with the contractors listed by Texas State University Telecommunications as approved contractors. The procurement and installation of the telecommunications infrastructure in large construction projects will be a combined effort between the Texas State University IT and Texas State University Facilities staff.

11.01 STRUCTURED CABLING SYSTEM WARRANTY AND CERTIFICATION.

A. Texas State University requires a warranty on the installation of the Structured Cabling System of at least one year from building acceptance. In addition, Texas State University requires that 100% of the cables and termination equipment installed be tested and certified at the designed and intended performance level.

12.01 INSTALLER QUALIFICATIONS

A. The installation contractor must be engaged in the normal business of installing telecommunications cabling systems, and licensed to operate in the State of Texas. All installation technicians must be familiar with the codes, standards, and procedures required by these guidelines and must be Ortronics trained and certified for installations.

END OF SECTION 27 01 00
27 05 13 Communications Services

1.01 Texas State University Network Operations provides dial tone services and networked connections to most university owned property.

2.01 Grande Communications provides cable television services to most campus areas.

END OF SECTION 27 05 13
27 05 26  Grounding and Bonding for Communications Systems

1.01  GROUNDING, BONDING, AND ELECTRICAL PROTECTION

A.  A #6 AWG insulated stranded copper cable shall be provided from the Equipment Room (ER) to the building main electrical service ground electrode. A Telecommunications Main Grounding Busbar (TMGB) shall be installed in the ER. All metallic conduits entering the ER, all equipment racks in the ER, and all exposed non-current carrying metal parts of telecommunications and information technology equipment in the ER must be bonded to the TMGB.

2.01  SPECIFIC ELECTRICAL REQUIREMENTS MAY CHANGE ON A PROJECT BASIS- PLEASE CONSULT TEXAS STATE UNIVERSITY TELECOMMUNICATIONS SERVICES FOR SPECIFIC SPECIFICATIONS IN ADDITION TO THE SPECIFICATIONS CONTAINED IN THIS SECTION AND IN THE EQUIPMENT ROOM SECTION(S).

END OF SECTION 27 05 26
27 05 28 Pathways for Communications Systems

1.01 DESIGN CRITERIA FOR INSIDE PLANT CONDUIT

A. Telecommunications conduit must be properly designed and installed. The design and installation practices for telecommunications conduit have some unique requirements beyond those normally seen in standard electrical conduit. The following items are required to be included in the design and installation of interior telecommunications conduit:

1. Conduits must be designed and installed in the most direct route possible from the telecommunications closet to the work area.

2. The maximum length of LAN copper horizontal distribution cable is 90 meters (295 ft) from the work station outlet to the Telecommunications Closet (TC) patch panel, no exceptions. Where this length would be exceeded the designer will add additional TCs as required.

3. Telecommunications cabling is always installed in a home-run fashion with individual cables running from the work area all the way to the telecommunications closet. Splices in horizontal distribution cable are not allowed.

4. Factory-manufactured sweeps which meet ANSI/TIA/EIA569-A bend radius requirements shall be used for all telecommunications conduit. The bend radius of the sweeps must be a minimum of 10-times the internal conduit diameter. Bending conduit in the field using manual or mechanical methods is not acceptable. Standard electrical elbows shall not be used. This sweep radius is necessary to insure that the conduits can accept future fiber optic cables. All horizontal conduit will be tested by the conduit installation contractor with a mandrel to prove compliance with the sweep radius requirements throughout the conduit run.

5. Each telecommunications outlet box shall have an individual conduit routing to the telecommunications closet, or to the pull box or pulling point, connecting to a major cable pathway routing to the telecommunications closet. Box shall be located in serviceable space. Looping, or “daisy-chaining,” of conduits between outlet boxes is not allowed.

6. All conduit ends shall have plastic bushings installed before the cable is pulled into the conduit.

7. Conduits will not be run next to hot water lines, steam pipes, or other utilities that may present a safety hazard or cause a degradation of system performance.

Revised Jan-15
8. Conduits entering the Telecommunications Closet should be designed and located allowing for the most flexibility in the routing and racking of cables.

9. Conduits or conduit sleeves entering through the floor of the Telecommunications Closet shall terminate four (4) inches above the finished floor.

10. All metallic telecommunications conduits entering the Telecommunications Closet, Equipment Room, or Entrance Facility shall be bonded together, and bonded to the Telecommunications Main Grounding Busbar with a #6 AWG ground cable.

11. All in-use and spare conduits entering the Telecommunications Closet, Equipment Room, or Entrance Facility shall be sealed to prevent the intrusion of water, gasses, and rodents throughout the construction project. Within five days of releasing the conduit for the installation of cable, the conduit installation contractor shall prove all conduits to be clean and dry.

12. All conduits and cables that penetrate fire rated walls or floors must be fire stopped.

13. All ISP conduits and innerduct, used and spare, shall be plugged with watertight plugs at both ends to prevent the intrusion of water, gasses, and rodents throughout the construction project. All ISP conduits shall have pull lines rated at a minimum of 90 kg (200 lb) pulling tension installed. The pull lines must be re-pulled each time an additional cable is installed. Prior to releasing the conduit for the installation of cables, all ISP conduits must be cleaned with a brush pulled through the conduit at least two times in the same direction and swabbed with clean rags until the rag comes out of the conduit clean and dry. All ISP conduits must be tested with a mandrel to prove compliance with the sweep radius requirements throughout the conduit run. Within five days of releasing the conduit for the installation of cable, the conduit installation contractor shall prove all conduits to be clean and dry.

2.01 DESIGN CRITERIA FOR INSIDE PLANT PULLBOXES

A. Pull boxes used with telecommunications conduits in interior locations shall be rated NEMA-1. Pull boxes used in damp or wet locations such as plumbing chases or out of doors shall be rated NEMA-3R. Pull boxes shall be installed in conduits at an interval no greater than every 100 feet. A pull box shall be installed in conduit runs whenever there are two 90°sweeps, or a total of 180°of sweeps, in a conduit run. Any deviations from these criteria must have prior approval from Texas State University IT.
3.01 CABLE PATHWAYS AND SUPPORT STRUCTURES

A. The Inside Plant (ISP) telecommunications substructure are the cable pathways and support structures necessary for routing telecommunications cabling between telecommunications closets, and from the telecommunications closet to the work area. There are numerous products and methods that can be employed to build the substructure. Some of these methods include: Enclosed conduit system, Open or enclosed cable trays, Routing above a false ceiling using cable supports, and in-slab floor ducts.

B. The conduit system shall be routed inside ceilings, floors, and walls to the greatest extent possible. Surface mounted conduit shall be used only when there is no other route to provide service to the desired location.

C. For the main floor in slab on grade constructed buildings, conduit will route in walls and ceilings not in or under the slab. If this design is not possible, an alternate must be presented and approved following the “Approval for Alternate Design Solutions” process detailed in section 27 01 00. If an under slab route solution is approved, the conduit must be installed with at least 1” of concrete encasement around all sides of the conduit. Exceptions occur in cases of modular furniture installation; in which in slab conduit routing is sometimes necessary; design should work in conjunction with modular furniture.

D. Telecommunications outlets shall be located to minimize the length of patch cord required to connect the computer or telephone to the outlet.

E. All outlets shall have a minimum three-quarter inch conduit. Increase the conduit size as necessary for the quantity of cables to be installed. Cable fill shall not exceed 40%.

F. All wall outlets shall be mounted in a minimum four (4)-inch by four (4)-inch by two and one-half (2 ½)-inch deep double gang outlet box.

G. An electrical outlet shall always be located within three (3) feet of a telecommunications outlet.

H. Telecommunications cable and conduit shall maintain the minimum separation distance from power as listed below.

I. For power systems operating at 480V or greater, including electrical distribution panels, step down devices or transformers, maintain a minimum separation distance of 6 m (20 ft) from all telecommunications cross-connects.

J. For power systems operating at 480V or greater, maintain a minimum separation distance of 3 m (10 ft) from all telecommunications cabling. Pathways should cross perpendicular to electrical power cables or conduits.
K. For large electrical motors or transformers, maintain a minimum separation distance of 1.2 m (4 ft) from all telecommunications cabling.

L. For lightning protection system conductors (NEC 800-13), maintain a minimum separation distance of 1.8 m (6 ft) from all telecommunications cabling.

M. For power systems operating at less than 480V, including all conduit and cables used for electrical power distribution, maintain a minimum separation distance of 0.6 m (2 ft) from all telecommunications cabling. Pathways should cross perpendicular to electrical power cables or conduits.

N. For fluorescent lighting, maintain a minimum separation distance of 12 cm (5 in) from all telecommunications cabling. Pathways should cross perpendicular to fluorescent lighting.

O. For branch circuits (secondary) power (120/240V, 20A) where electric light or power circuits coexist with telecommunications cabling, maintain a minimum separation distance of 0.50 mm (2 in).

4.01 Cable Routing in Non-Traditional Locations/ Modular Furniture

A. Cable routing and outlet placement in non-traditional locations (locations other than wall outlets), such as modular furniture, classroom desks, and floor outlets require close coordination in the design process. This coordination must consider all trades and manufacturers; including but not limited to: electrical, telecommunications, structural, and furniture manufacturer/ installer in order to provide a cohesive final product.

1. Cable ingress point into location must meet all acceptable cable routing standards; including specified manufacture’s recommended space for outlet and associated cabling, fill ratios and power separation.

2. Cable pathway within modular furniture must meet all acceptable cable routing standards; including fill ratios and power separation.

3. Outlet locations must be designed to accommodate knock out/ bezel size for standard Ortronics Series II connector and or faceplate.

4. Alternative design solutions, such as MUTOA’s and Consolidation Points may be considered for these spaces. But must be approved by Texas State University Network Operations.

5. Transition Points and under carpet cabling shall never be an approved design alternative.
B. Engineers, Designers and Consultants must coordinate with Texas State University Network Operations for approval on design solutions for these pathways and spaces.

END OF SECTION 27 05 28
27 05 43 Underground Ducts and Raceways for Communications Systems

1.01 TELECOMMUNICATIONS SUBSTRUCTURE—OUTSIDE PLANT

A. The Outside Plant Substructure is the physical pathway used to distribute backbone cabling between buildings, and to bring the entrance cable from the nearest campus backbone access point across Texas State University property to the Entrance Facility. Underground conduit is the standard method of distribution between buildings on campus. Input from Texas State University IT and site operations staff must be incorporated in developing the initial and on-going construction schedules. This input is especially important when an early or phased turn-up of buildings is required. Timing on the construction of the main telecommunications room and building, and the backbone cable plant connecting it to key buildings, would be a vital consideration in bringing key buildings online at required dates. In new construction, the outside plant substructure must be sized to accommodate all low voltage services planned for initial installation, plus a minimum of 25% growth capacity.

2.01 UNDERGROUND DISTRIBUTION

A. Underground distribution of low voltage services on Texas State University property will consist of appropriately sized conduits and telecommunications manholes or handholes. Telecommunications services (voice and data) and other low voltage services such as fire alarm, security systems, and CATV distribution shall not share the same underground distribution conduits and manholes as electrical power distribution.

B. UNDERGROUND CONDUIT

1. Direct burial of telecommunications cable is not desired, and will only be approved under unique circumstances on a case-by-case basis. Requests to direct bury cable must follow the “Approval for Alternative Design Solutions” process described in section 27 01 00. The major cost in placing underground utilities is the labor for digging the trench. Therefore, underground telecommunications distribution to permanent facilities shall always be placed in conduit, and encased in a concrete duct bank, to facilitate the easy installation of additional future cables. Key requirements for underground conduit installation include:

   a. OSP conduit quantity and size shall be determined based on the requirements for the initial installation of cable and a realistic prediction of future expansion in the area. Always provide a minimum of 25% spare capacity above the initial installation requirements and known growth.
b. OSP conduit quantities shall be based on a maximum of 40% cable fill per conduit.

c. All OSP telecommunications conduit installations shall have a minimum of two spare conduits.

d. All OSP telecommunications conduits shall be Schedule 40 or Schedule 80 Rigid Nonmetallic conduit, Polyvinyl Chloride (PVC), and must meet the requirements of NEMA TC 6. All conduit sections shall be glued with PVC pipe glue to form a watertight joint. All schedule 40 pipes to be embedded in sand. Spacers are required to maintain proper separation between multiple conduits in a run.

e. All OSP conduits shall be installed with a slight drain slope (0.125 inches-per-foot) away from buildings to prevent the accumulation of water in the conduit or ingress to the buildings.

f. Factory-manufactured sweeps which meet ANSI/TIA/EIA569-A bend radius requirements shall be used for all telecommunications conduit. The bend radius of the sweeps must be a minimum of 10-times the internal conduit diameter. Bending conduit in the field using manual or mechanical methods is not acceptable. Standard electrical elbows shall not be used.

g. All campus distribution conduits must be buried a minimum of 24 inches below grade, with preferred depth of 36 inches. All conduit must be encased in concrete, and the concrete will be colored with “RED” dye.

h. All cable shall be installed in the lowest available conduit in a duct bank, working up as additional cables are installed.

i. All OSP conduits and innerduct, used and spare, shall be plugged with watertight plugs at both ends to prevent the intrusion of water, gasses, and rodents throughout the construction project. All OSP conduits shall have quarter (1/4)-inch polypropylene pull ropes installed. The pull ropes must be re-pulled each time an additional cable is installed. All OSP conduits must be tested with a mandrel to prove compliance with the bend radius requirements throughout the conduit run. Within five days of releasing the conduit for the installation of cable, the conduit installation contractor shall prove all conduits to be clean and dry.
j. In new construction and new conduit, fiber optic backbone cables shall always be installed in fiber optic innerduct. Normally, three to four innerduct can be placed in a four (4)-inch conduit. Where fiber optic cable is installed into existing conduits, the use of fiber optic innerduct is preferred if space is available. Innerduct is used to separate and segregate cables, and to prevent the tangling of cables in a conduit. Types of textile innerduct may be used if pre-approved by Texas State University Telecommunications.

k. Splices in backbone fiber optic cable are not allowed, design OSP conduit accordingly.

3.01 TELECOMMUNICATIONS MANHOLES

A. Telecommunications manholes shall be placed in outside plant conduit runs at an interval no greater than every 500 feet. Conduits routing between two telecommunications manholes, or between a manhole and a building, shall contain no more than two 90° sweeps or a total of 180° of sweeps. If additional conduit sweeps are required, place additional manholes as needed. Telecommunications manholes are typically constructed in pre-fabricated cast concrete, and contain a floor section, wall section, and top section. Manholes are sized based on the ultimate duct structure and equipment that will be located in the manhole. Minimum size of any manhole shall be 6’X8’X7’. Key requirements for telecommunications manhole installation include:

1. Telecommunications manhole sections must be installed with a watertight joint sealer between the sections of the manhole.

2. Telecommunications manholes must be equipped with a pre-cast concrete floor section. Bare earth for the floor of a manhole is not allowed. The floor section must contain a sump to facilitate the use of a submersible pump for de-watering the manhole.

3. A submersible sum pump shall be placed in each manhole; with necessary power requirements.

4. Telecommunications manholes must be equipped with steel pulling eyes pre-cast in the walls opposite to each duct bank to facilitate cable-pulling apparatus.

5. Telecommunications manholes must contain 18 hole or 37 hole cable racks for dressing and securing cables that route through the manhole. Must contain at least two sets per manhole wall.
6. Telecommunications manholes over five (5) feet deep must have permanently installed ladders.

7. All telecommunications manholes shall have a minimum of one grounding rod.

8. All metal hardware in the manhole or handhole (racks and ladders) must be grounded to the bonding tabs pre-cast in the manhole, with the bonding tabs bonded to the ground rod.

9. The cover of all telecommunications manholes must be a minimum of one (1) inch above the finished grade after all landscaping is completed. If manholes are located in paved areas, the pavement must be tapered up to the manhole cover.

4.01 TELECOMMUNICATIONS HANDHOLE

A. A handhole is similar to a miniature manhole that is used solely as a pulling point to expedite the installation of cable in conduit runs over 500 feet or with more than two 90° sweeps. Maximum size of handhole is 4X4X4. The following rules apply to the use of handholes:

1. A handhole shall not be used if the ultimate or total requirements exceed the capacity of two four (4)-inch conduits, in and out.

2. Where more than two four (4)-inch conduits are used in a duct bank, telecommunications manholes must be used in lieu of handholes.

3. A handhole shall not be utilized for splicing cables together.

4. Conduit entering the handhole shall be aligned on opposite walls of the handhole at the same elevation.
27 05 53  Identification for Communications Systems

1.01  TELECOMMUNICATIONS ADMINISTRATION

A. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, telecommunications closets, and other telecommunications spaces. All Texas State University facilities shall apply and maintain a system for documenting and administering the telecommunications infrastructure.

B. In order to create a consistent environment, Texas State University maintains a campus wide numbering scheme for voice and data outlets and patch panels.

1. All voice and data outlets and patch panels shall be clearly marked using permanent means. Voice and data outlets shall us the following system of numbering:
   a. DATA: D + Actual room number of the IDF/MDF where cable is terminated + the patch panel port number. Actual Room number of the IDF/MDF where cable is terminated and the punch block position.
   b. VOICE: V + Actual room number of jack + punch block position
   c. When more than one TC is needed per floor, the room number of the TC shall be added to the numbering scheme.
   d. When more than one data patch panel is needed per TC, the numbering scheme shall continue consecutively. Example: If two 48 port patch panels are needed, the second patch panel will be labeled starting with port 49.
   e. All voice and data outlet and port numbering must match actual room numbers. Careful consideration should be given when developing and maintaining a numbering scheme that the scheme matches exactly the actual room numbers; **not builders room number**.
   f. All voice and data terminations made in the TCs shall be made in a numerical order by room number of each jack.
   g. Outlet numbers shall be marked by permanent means on each cable at the outlet and at the TC.
2.01 RECORDS

A. A record is a collection of information about or related to a specific element of the telecommunications infrastructure. Records must be maintained in a computer spreadsheet, or in a computer database. Paper records are encouraged, but are optional. A cable record is prepared for each backbone cable. The record will show the cable name, and must describe the origin point and destination point of the cable. The cable record will record what services and/or connections are assigned to each cable pair or strand. An equipment record is prepared for services distributed from a certain piece of equipment, such as a router, or a system such as the telephone system PBX.

B. NOTICE***As-built records of actual telecommunications ports installed are required 2 weeks prior to first fire inspection. Texas State University will NOT provide dial tone to any emergency phone until these records are provided. These records must be in spreadsheet form (or raw test data) and unique identifiers must match final port label. These records are not to be considered final project deliverables.

3.01 DRAWINGS

A. Drawings are used to illustrate different stages of telecommunications infrastructure planning, installation, and administration.

B. Installation or Construction Drawings

1. Installation or construction drawings are the plans that show the installer how the infrastructure is to be installed. The quality of the installation can be directly impacted by the level of detail in the installation drawings and written specifications. Installation drawings for Texas State University projects shall, at a minimum, show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and wiring details including identifier assignments.

C. As-built Drawings

1. The as-built drawings graphically document the installed telecommunications infrastructure through floor plan, elevation, and detail drawings. In many cases, these drawings will differ from the installation drawings because of changes made during construction and specific site conditions. In the as-built drawings, the identifiers for major infrastructure components must be recorded. The pathways, spaces, and wiring portions of the infrastructure each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings. As-built drawings are a vital component of the telecommunications administration.
system, and must be kept current as adds, moves, and changes take place. Texas State University requires the installer to provide a complete and accurate set of as-built drawings.

2. **NOTICE:** As-built drawings of actual telecommunications ports installed are required 2 weeks prior to first fire inspection. Texas State University will NOT provide dial tone to any emergency phone until these records are provided. These records may be delivered as a printed drawing set or as a CAD file. These records are not to be considered final project deliverables.

### 4.01 LABELING AND COLOR CODING

#### A. Labeling

1. Labels are generally of either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.

2. Outside plant labels shall be totally waterproof, even when submerged.

3. All labels shall be machine printed.

4. Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.

5. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used, and must be used in the manner intended by the manufacturer.

6. See Section 27 05 53, 1.01, B, 1, a-g.

#### B. Color Coding – Cable Termination Fields

1. Industry standard (ANSI/TIA/EIA 606) color coding shall be applied to all cable termination fields in Telecommunications Closets, Equipment Rooms, and Entrance Facilities. Color coding may also be used to identify specific cables in a pathway, or the function of specific equipment racks or equipment. The same color is always applied to both ends of any given
cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the plywood backboard behind the termination block, may be the color of a plastic cover on a termination block, or may be the actual color of the insert label on a termination block or patch panel. The following color code shall be used in all Texas State University facilities:

a. Orange – Reserved for identification of the telecommunication service demarcation point (demarc). Orange may only be used by the telephone company.

b. Green – Used to identify the termination of network connections on the customer (Texas State University) side of the demarc.

c. Purple – Used to identify cables originating from common equipment, such as the telephone PBX, LAN hubs, or multiplexer.

d. White – Used to identify the first-level backbone telecommunications media termination in the building containing the main cross-connect. The main cross-connect is usually in the Equipment Room. In buildings that do not contain the main cross-connect, white may be used to identify the second-level backbone terminations.

e. Gray – Used to identify the second-level backbone telecommunications media termination in the building containing the main cross-connect.

f. Blue – Used to identify the termination of horizontal distribution cables routing from the Telecommunications Closet or Equipment Room to the Work-Area. A blue color coding is only required at the TC or ER end, not at the work-area end of the cable.

g. Brown – Used to identify interbuilding backbone cable terminations.

h. Yellow – Used to identify termination of auxiliary circuits, alarms, maintenance, security, and other miscellaneous circuits.

END OF SECTION 27 05 53
1.01 CRITICAL DELIVERABLES EXPECTED FROM TELE-COMMUNICATIONS CONTRACTOR

A. It is essential for Texas State University Telecom to receive all test results and as-built drawings prior to job acceptance. The test results must adhere to the following specifications, formats and delivery conditions:

1. Specifications

   a. Complete end-to-end test results for all copper UTP and fiber optic lines installed is required.

   b. All fiber optic cable must be visually inspected and optically tested on the reel upon delivery to the installation site. Using an Optical Time Domain Reflectometer (OTDR), an access jumper with like fiber, a pigtail, and a mechanical splice, all fibers shall be tested for continuity and attenuation. Testing for continuity and attenuation on the reel must confirm factory specifications to ensure that the fiber optic cable was not damaged during shipment. The test results must match the results of the factory-attached tag on the reel, or the fiber shall not be used. Reel data sheet must be provided showing test results.

   c. End to end test measurements shall be provided for singlemode and multimode fibers (2 wave lengths per test is required). Test results must be submitted for review as part of the installation inspection requirements. Test results shall be in paper form and electronic form, and must contain the names and signatures of the technicians performing the tests.

   d. Testing shall be performed on 100% of the fibers in the completed end-to-end system. ANSI/TIA/EIA-568-A, Annex H, provides the technical criteria and formulae to be used in fiber optic testing. Note however, that all Texas State University fiber must be tested, rated and guaranteed for Ethernet GigaSPEED 1000B-X performance. Additionally, all fiber optic cable links must pass all installation and performance tests both recommended and mandated by the cable manufacturer.

   e. 100% of all pairs in backbone copper cables shall be tested for continuity and wire-map.

   f. The transmission performance of a cabling system depends upon the characteristics of the horizontal cable, connecting hardware,
patch cords, equipment cords, work area cords, cross-connect wiring, the total number of connections, and the care with which they are installed and maintained. The development of high-speed applications requires that cabling systems be characterized by transmission parameters such as insertion loss, PSNEXT loss, return loss, and PSELFEXT. System designers use these performance criteria to develop applications that utilize all four pairs in a cabling system for simultaneous bi-directional transmission. This Standard provides minimum cabling component performance criteria as well as procedures for component and cabling performance validation.

2. Format

   a. Test Results must be submitted in 2 formats. First, must be original file(s) downloaded from tester. Second, the file must be cohesively placed in excel format with the following fields: ER/TC RM # / RM # of drop / Port # / all relevant test information in as many fields as necessary.

   b. Care, with reference to above format criteria, should be taken when recording the information in the tester, proper consistency with port identification is required.

   c. As Built drawings must be submitted with .design or .drawing file extensions.

3. Delivery

   a. Test Results may be electronically submitted to the Office of Telecommunication Services. Contact information will be provided after contract is awarded and before project completion.

END OF SECTION 27 06 00
**27 11 00 Communications Equipment Room Fittings**

1.01 MAIN TELECOMMUNICATIONS EQUIPMENT ROOM (ER)

A. The Main Telecommunications Equipment Room (ER) is the central location in a building where the major telecommunications equipment is located. The ER typically contains the telephone switching system, the data switching equipment with LAN switching equipment, the CATV “head end” distribution equipment, closed circuit TV and security systems, and additional low voltage systems. To minimize both conduit and cable lengths, the ER shall be located as close as practical to the center of the building. ER shall be a minimum of 10’ by 10’. In new construction, the ER shall be sized and provisioned to contain all major voice, data, and video equipment required to support the building, and all other computer based and networked low voltage systems. During renovation or remodeling of existing facilities, every reasonable effort shall be made to collocate these systems in a common equipment room. Designs that propose locating data switching equipment in buildings other than the main ER must follow the “Approval for Alternative Design Solutions” process described above in section 27 01 00, and must have the written authorization of the Texas State University Director of Telecommunications Services. There are financial implications to Texas State University for the LAN equipment when alternative fiber optic designs are implemented. If the data switching equipment is in a location other than the ER, Texas State University IT must be consulted to design appropriately sized fiber optic cables to route from the ER to the data switching equipment. All interconnections between the data switching equipment backbone and the campus distribution fiber optic backbone shall be in the ER.

B. ER PLANNING, LAYOUT, AND SIZING

1. The first step in determining the size required for the ER is to identify the systems that will be installed into the ER. In this process, first identify the size of the area that will be served from the ER. Next, identify the quantity, size and variety of systems to be installed to support the area, and the space required for each of the systems. Once the size and quantity of systems are identified, they shall be laid out in a functionally efficient arrangement. Some equipment, such as voice cross connects, LAN switches and patch panels will require regular access, and shall be located where they are easily accessible. Texas State University IT staff must be involved in this process, and must approve the final space requirements and design layout for all equipment and racks as well as conduit paths in ER. When laying out the arrangement of the ER, the following requirements and issues shall be addressed:

   a. Groups of like equipment types shall be located together; i.e., voice, data for both LAN and video.
b. Wall space and equipment rack space must be designated for particular uses by particular people. Set aside specific backboard space and equipment rack space for the service providers demarc, and any associated equipment. Designate specific adjacent areas for each of the various service providers. Keeping all of the service providers on a common wall and row of equipment racks will limit their access to other areas of the equipment room.

c. Separate wall and equipment rack space is designated for the termination and cross connection of campus distribution cables, both copper and fiber optic. These areas shall be located adjacent to the equipment providing the services, such as the PBX, routers, and switches.

d. Careful design planning must be performed to ensure that all telecommunications cabling has the minimum setback distanced from all potential sources of electromagnetic interference (EMI) or radio frequency interference (RFI), such as electric motors, power transformers, etc. Incorrect planning can result in expensive changes at a later date.

e. Equipment racks and rack mounted equipment must have a minimum of three (3) feet of unrestricted clearance in front and back for technician access. In smaller installations, wall mounted swing-out equipment racks can be used to save space, but must have three (3)-feet clearance to the front of the rack. Note that some LAN equipment may be large, or may require clearance at both the front and back, and wall mounted swing-out racks may not be appropriate.

f. Once an acceptable equipment layout is developed, the size of the equipment room can be calculated. Always provide a minimum of 25% spare space for future growth. With the size determined, the location of the equipment room can be selected.

C. EQUIPMENT ROOM CHARACTERISTICS

1. The characteristics of the ER have a significant impact on all other aspects of telecommunications design. Next to insuring adequate size, selecting a suitable location is the most critical step in planning the ER. The major factors that must be considered when planning and locating the ER are:

a. Access for delivery and installation of large equipment into the ER.
b. Access by Texas State University and service provider maintenance personnel.

c. Restrictions on unauthorized access.

d. Close proximity to electrical service.

e. The ER must be dedicated to the telecommunications and information technology function. Shared use of boiler rooms, washrooms, janitor closets, electrical closets, or storage rooms is **not allowed**.

f. The floor, walls, and ceiling shall be sealed to reduce dust. Finishes shall be light in color to enhance room lighting. Flooring materials having antistatic properties shall be selected.

g. The room must be free of plumbing and electrical utilities not directly required to support the telecommunications functions.

h. Close proximity to service entrances for telecommunications and power.

i. Close proximity and centralized to the campus telecommunications distribution pathways (conduits and/or aerial distribution) to minimize the backbone cable lengths.

D. EQUIPMENT ROOM LOCATIONS

1. **Unacceptable Room Locations**: Any areas subject to water or steam infiltration, particularly basements. A floor drain is required if there is any risk of water entering the ER. Any areas exposed to excessive heat or direct sunlight. Any areas exposed to corrosive atmospheric or environmental conditions. Near or adjacent to any potential sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc welding equipment, or high power radio transmitting antennas. This is a critical consideration, as EMI and RFI can render IT networks totally inoperable. No point within the ER shall be closer than 6 M (20 ft) to power panels or equipment rated at greater than or equal to 480 V that may cause Electrical Interference or equipment which may cause RFI or EMI.

E. ENVIRONMENTAL PROVISIONING

1. The following environmental provisions are required in the Main Telecommunications Equipment Room:
CONSTRUCTION STANDARDS                                    Division 27 00 00 – COMMUNICATIONS
SECTION 27 11 00 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

a. Heating, ventilation, and air conditioning (HVAC) shall be provided on a 24 hours-per-day, 365 days-per-year basis. If the building system cannot assure continuous operation, a stand-alone unit shall be provided for the ER.

b. The temperature and humidity shall be controlled to provide a continuous operating range of 64°F to 75°F, with 30% to 55% relative humidity.

c. Lighting shall be a minimum of 50 foot candles, measured three (3) feet above the finished floor in the middle of all aisles between equipment racks and cabinets.

d. Minimum clear height in the ER shall be eight (8) feet without obstructions.

e. Dry chemical fire suppression systems are preferred in the ER.

F. ELECTRICAL PROVISIONING

1. The following electrical provisions are required for the Main Telecommunications Equipment Room (ER):

   a. A separate supply circuit serving the room shall be provided and terminated in its own electrical panel located in the ER. This power panel shall be designated as “ER Technical Power.” The ER Technical Power panel shall be used exclusively for supplying power to electronics equipment in the equipment room.

   b. If emergency generator power is available to the facility, the ER Technical Power panel must be linked to the emergency generator power supply.

   c. Sizing of electrical power is dependent upon the equipment types and equipment load, and must be calculated on a case by case basis, including sufficient spare capacity for future growth.

   d. Each equipment rack and all major freestanding equipment shall be provided with two dedicated 20-amp 110VAC electrical circuits from the ER Technical Power panel, each terminated in a quad (4-plex) outlet. Technical power shall be identified with orange colored electrical outlets. These outlets shall be used exclusively for electronics equipment. Do not use Technical Power outlets for general-purpose or utility devices such as electric drills, vacuum cleaners, or coffeepots.
e. Some IT equipment, such as large LAN switches and routers, are ordered with dual power supplies. The placement of equipment with dual power supplies shall be identified and the appropriate racks must have three, separate, dedicated 20-amp 110VAC electrical circuits from the ER Technical Power panel, each terminated in separate quad (4-plex) outlets, and be appropriately marked to identify the separate circuit breakers.

f. Some major pieces of telecommunications equipment, such as PBX remote equipment, may require 208 or 220 VAC power. These systems must be identified, and power requirements determined, well in advance of the ER architectural and electrical design.

g. The ER shall have 20-amp 110VAC general-purpose convenience electrical outlets placed at 6-foot intervals round the room. The general-purpose circuits must not originate from the ER Technical Power panel. The general purpose circuits shall be used for general purpose, utility devices such as power tools or vacuum cleaners. Do not use general purpose outlets for ER electronics equipment. White, gray, or beige colored outlets to match all other general purpose outlets in the building shall identify the general-purpose outlets.

h. The ER shall be equipped with a power disconnect switch. This switch shall be located near the main door of the ER. The switch shall disconnect power to all electronic equipment in the ER, and is to be used in the event of electrocution or fire in the ER. There shall also be a similar means to disconnect the power to all dedicated HVAC systems serving the ER and cause all required fire/smoke dampers to close. Refer to the National Electrical Code, NFPA 70, and Article 645-10.

G. TELECOMMUNICATIONS BACKBOARDS

1. All walls of the ER shall be covered with three-quarter inch A-C grade fire retardant plywood, painted with two coats of light colored, non-conductive fire retardant paint. The plywood shall extend from the floor to eight (8) feet above the finished floor, and shall be mounted with the “A” side exposed. Cutouts shall be provided around existing power and telecommunications outlets. In new construction, power and telecommunications outlets, and light switches in the ER shall be surface mounted on the plywood backboard.

H. EQUIPMENT RACKS AND CABINETS
1. Planning of the ER layout must make allowances for proprietary equipment and racks, and allow expansion room for future equipment. Texas State University has standardized on a general purpose open frame 19-inch wide EIA standard equipment rack with channels measuring 16.25”. (Please see appendix I Equipment Specifications for rack and components.). Floor standing equipment racks must always be securely bolted to the floor. Use cable ladders to interconnect multiple equipment racks, to brace equipment racks to the wall, and as a means of routing cables to and from the rack. Some IT equipment, such as large LAN switches, will require an equipment rack with both front and rear mounting rails. Provide 36” clear work space front, rear, and at one end of each equipment rack / cabinet line up for floor mounted racks / cabinets leaving sufficient front and rear rack / cabinet footprints for any equipment planned for installation. All cabinets must have a minimum of 20” from the front rail to the wall. All racks must have a minimum of 20” from the front rail to the rear isle workspace. All racks must be equipped with an appropriate number and type or horizontal and vertical wire management modules, both front and rear, with strain relief brackets to insure proper bend radius and strain relief is maintained for all UTP, fiber optic and power cables. In cases of multiply rack installations all fiber optic terminations must be housed in left rack and all UTP terminations housed in right rack. Collaborations between architects, consultants, contractors and Texas State University Telecommunications are necessary in planning and placement of all ER/ TC equipment and components.

I. GROUNDING, BONDING, AND ELECTRICAL PROTECTION

1. A #6 AWG insulated stranded copper cable shall be provided from the ER to the building main electrical service ground electrode. A Telecommunications Main Grounding Busbar (TMGB) shall be installed in the ER. All metallic conduits entering the ER, all equipment racks in the ER, and all exposed non-current carrying metal parts of telecommunications and information technology equipment in the ER must be bonded to the TMGB.

J. SEPARATION FROM POWER

1. OSP conduits and cabling shall be bonded to TMGB in a different location than all inside cabling and conduits.

2.01 TELECOMMUNICATIONS CLOSETS (TC)

A. The Telecommunications Closet(s) are located in each building, or each floor of a building, where backbone cables transition to horizontal distribution cables. These cables will be both fiber optic and copper, and will support voice, data, video, and other low voltage systems. The TC may also contain certain items of network
electronics equipment such as routers or switching equipment. A large building, with large floors, may have multiple TCs on a floor. To minimize both conduit and cable lengths, the TC shall be located as close as practical to the center of the building where it is housed on each floor of the area to be served. TCs should be “stacked” one above the other for multiple floors. Close attention must be given to the maximum length (90m) on LAN copper horizontal distribution cable.

B. TELECOMMUNICATIONS CLOSET PLANNING, LAYOUT, AND SIZING

1. ANSI/TIA/EIA-569-A provides sizing formula for a TC in normal office buildings. The sizing is based on the “usable floor space,” which is the space on a floor that can actually be used for office activities. TC shall be a minimum of 60 square feet. Spaces such as mechanical rooms, janitorial closets, and rest rooms cannot be used for office activities, and are not counted as usable floor space. The sizing formula assumes an average of 100 square feet of floor space for each person, or “work area.” Many Texas State University buildings are not traditional commercial or office buildings, and the sizing guidelines of ANSI/TIA/EIA-569-A must be adjusted to accommodate these buildings.

2. There shall be a minimum of one TC per building (may be ER). Additional TCs shall be added when the area to be served exceeds 10,000 square feet, or the cable length from the TC patch panel to the farthest work area outlet exceeds 90 meters (295 feet). Cable length is not calculated on a straight-line distance. The distance must include the rises, drops, and bends that the cable will follow from the TC to the work area.

C. TELECOMMUNICATIONS CLOSET LOCATION

1. The TC in each building is the transition point between backbone cabling and horizontal distribution cabling.

2. The TC must be able to contain telecommunications equipment, cable terminations, and associated cable interconnection apparatus.

3. The TC shall be dedicated to the telecommunications function.

4. The TC shall not be shared with electrical installations other than those necessary for telecommunications.

5. The TC shall be located as close as practical to the center of the area to be served, preferably in the core area of the building, to minimize the cable length. The maximum length of copper horizontal distribution cable is 90 meters (295 ft) from the work station outlet to the TC patch panel, no exceptions. Where this length would be exceeded the designer will add additional TCs as required.
6. Multiple TCs on a floor shall be interconnected by a minimum of three spare conduits. Additional conduits shall be installed as necessary based on the quantity of services supported.

7. All fiber optic backbone cables shall home-run from each individual TC to the main telecommunications Equipment Room, which should be the location of the data switching equipment. Requests for exceptions to this policy must follow the process described in section 27 01 00.

8. TCs shall not be located in or adjacent to areas containing sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc welding equipment, radio transmitting antennas, etc. This is a critical consideration, as EMI and RFI can render IT LAN networks totally inoperable.

9. No point within the TC shall be closer than 6 M (20 ft) to power panels or equipment rated at greater than or equal to 480 V, that may cause electrical interference or equipment which may cause RFI or EMI.

D. TELECOMMUNICATIONS CLOSET SIZING AND LOCATION IN EXISTING FACILITIES.

1. Existing facilities present a unique challenge for sizing and locating the TC. Many buildings were designed and constructed only to support telephones. When planning the size and location of TCs in existing buildings, every reasonable effort shall be made to meet the requirements for telecommunications closets identified above. In certain instances, the only viable alternative will be the use of one or several telecommunications cabinets in lieu of closets.

E. TELECOMMUNICATIONS CABINETS FOR SMALL BUILDINGS WITH LIMITED SERVICES

1. Certain small buildings may not justify a separate room as the telecommunications closet. In existing buildings, sufficient space may not be available for a telecommunications closet. In these instances, a wall or floor mounted telecommunications cabinet may be used as the transition point from backbone cables to horizontal distribution. However, the size of the cabinet and the conduits serving the building must always allow room for future growth, and must always allow room for computer network equipment such as switches or routers. Telecommunications cabinets must provide:

   a. Physical security to protect the contents and prevent unauthorized access. The cabinets shall be constructed of heavy gauge steel,
be lockable. Any removable panels must have tamper proof screws.

b. All power and telecommunications cables for equipment housed within the cabinet are to be contained within the cabinet. No exposed cables are allowed.

c. All power and telecommunications cables routed to or from the cabinet must be contained in conduit, surface mounted raceway, or routed within the adjacent wall.

d. The cabinet must contain a plywood backboard for mounting telecommunications hardware.

e. The cabinet must provide a means of mounting electronics equipment, including a LAN switch. Acceptable means are rails for rack mounting, or adequate space on the plywood backboard for electronics equipment wall mounting brackets.

f. The cabinet must have a minimum of one 20-amp 120 VAC quad (4-plex) electrical outlet installed inside the cabinet, on a dedicated circuit breaker from the electrical panel. The outlets shall be colored orange, and identified as Technical Power. An available general purpose power panel may be used to support the telecommunications cabinet power outlet. The power panel shall not be used to supply power to sources of electromagnetic interference such as large electric motors, arc welding, or industrial equipment. The power panel must be located in close proximity to the cabinet.

g. There shall be at least one 20-amp 110VAC general purpose convenience outlet located within 6 feet of the cabinet. White, gray, or beige colored outlets to match all other general-purpose outlets in the building shall identify the general-purpose outlet. The general purpose outlet shall not be used to power electronics equipment.

h. Any cabinet containing electronics equipment must have cooling fans installed in the cabinet.

i. The cabinet must have a telecommunications grounding busbar installed in accordance with the requirements listed in these guidelines.

j. The cabinet shall not be located in or adjacent to areas containing sources of electromagnetic interference (EMI) or radio frequency
interference (RFI) such as large electric motors, power transformers, arc welding equipment, radio transmitting antennas, etc. This is a critical consideration, as EMI and RFI can render IT WAN and LAN networks totally inoperable.

k. Standard EIA 19-inch open frame equipment racks as approved for use in the Main Telecommunications Equipment Room may be used in the TC (Please see appendix I Equipment Specifications for rack and components.). Floor standing racks must be securely bolted to the floor, and must be braced to the wall with cable ladder racking. Multiple racks in the same TC shall be interconnected with cable ladder racks.

l. Some IT equipment, such as large LAN switches, require an equipment rack with both front and rear mounting rails. Where space or equipment is limited, an open frame wall mounted equipment rack or enclosed equipment cabinet may be used. Wall mounted racks and cabinets must have two “swing-gates”: one for the front access panel and a second for rear access. Provide 36” clear work space front, rear, and at one end of each equipment rack / cabinet line up for floor mounted racks / cabinets leaving sufficient front and rear rack / cabinet footprints for any equipment planned for installation. All cabinets must have a minimum of 20” from the front rail to the wall; racks must have a minimum of 20” from the front rail to the rear isle workspace. All racks must be equipped with an appropriate number and type or horizontal and vertical wire management modules both front and rear with strain relief brackets to insure proper bend radius and that strain relief is maintained for all cables.

F. ENVIRONMENTAL PROVISIONING FOR TELE-COMMUNICATIONS CLOSETS

1. Walls and ceiling shall be treated and sealed to eliminate dust. Finishes shall be light in color to enhance room lighting. The floors in all low voltage equipment rooms will be; light colored, fire retardant, slip resistant, and provide protection from electrostatic discharge (ESD). In TCs that contain active electronics equipment (routers, switches, etc.), an HVAC system shall be provided on a 24 hours-per-day, 365 days-per-year basis. If the building system cannot assure continuous operation, a stand-alone unit shall be provided for the TC. The temperature and humidity shall be controlled to provide a continuous operating range of 64°F to 75°F, with 30% to 55% relative humidity. Lighting shall be a minimum of 50-foot candles measures 3 feet above the finished floor in the middle of all aisles between equipment racks and cabinets. Minimum clear height in the TC shall be 8 feet without obstructions. Fire suppression sprinklers
shall be equipped with wire cages under the sprinkler heads to prevent accidental discharge. Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room.

G. ELECTRICAL PROVISIONING FOR TELECOMMUNICATIONS CLOSETS

1. Each TC shall be equipped with a minimum of two 20-amp, 110VAC quad (4-plex) electrical outlets, each on its own dedicated circuit breaker. The outlets shall be colored orange, and identified as Technical Power. These outlets shall be used exclusively for electronics equipment. Do not use Technical Power outlets for general-purpose or utility devices such as electric drills, vacuum cleaners, or coffee pots.

2. The Technical Power circuits should originate from a dedicated power panel serving the TC. However, in small buildings where this may not be cost effective, an available general purpose power panel may be used. The power panel shall not be used to supply power to sources of electromagnetic interference such as large electric motors, arc welding, or industrial equipment. The power panel must be located in the TC, or in close proximity to the TC.

3. Some IT equipment, such as large LAN switches and routers, are ordered with dual power supplies. The placement of equipment with dual power supplies shall be identified and the appropriate racks must have three, separate, dedicated 20-amp 110VAC electrical circuits from the ER Technical Power panel, each terminated in separate quad (4-plex) outlets, and be appropriately marked to identify the separate circuit breakers.

4. The TC shall have 20-amp 110VAC convenience outlets placed at 6-foot intervals around the room. White, gray, or beige colored outlets to match all other general purpose outlets in the building shall identify general purpose outlets. These outlets shall not be used to power electronics equipment.

H. TELECOMMUNICATIONS BACKBOARDS

1. All walls of the TC shall be covered with three-quarter inch A-C grade fire retardant plywood, painted with two coats light colored, non conductive fire retardant paint prior to mounting anything on the backboard. The plywood shall extend from the floor to eight (8) feet above the finished floor, and shall be mounted with the “A” side exposed. Cutouts shall be provided around any existing power and telecommunications outlets. In new construction, power and telecommunications outlets, and light switches in the TC should be surface mounted on the plywood backboard.

I. EQUIPMENT RACKS AND CABINETS
1. Standard EIA 19-inch open frame equipment racks as approved for use in the Main Telecommunications Equipment Room shall be used in the TC. Floor standing racks must be securely bolted to the floor, and must be braced to the wall with cable ladder racking. Multiple racks in the same TC shall be interconnected with cable ladder racks. Some IT equipment, such as large LAN switches, require an equipment rack with both front and rear mounting rails. Where space or equipment is limited, an open frame wall mounted equipment rack or enclosed equipment cabinet may be used. Wall mounted racks and cabinets must have two “swing-gates”: one for the front access panel and a second for rear access. Provide 36” clear work space front, rear, and at one end of each equipment rack / cabinet line up for floor mounted racks / cabinets leaving sufficient front and rear rack / cabinet footprints for any equipment planned for installation. All cabinets must have a minimum of 20” from the front rail to the wall; racks must have a minimum of 20” from front rail to the rear isle workspace. All racks must be equipped with an appropriate number and type or horizontal and vertical wire management modules both front and rear with strain relief brackets to insure proper bend radius and that strain relief is maintained for all cables.

J. GROUNDING, BONDING, AND ELECTRICAL PROTECTION

1. A #6 AWG insulated stranded copper cable shall be provided from the ER to the building main electrical service ground electrode. A Telecommunications Main Grounding Busbar (TMGB) shall be installed in the ER. All metallic conduits entering the ER, all equipment racks in the ER, and all exposed non-current carrying metal parts of telecommunications and information technology equipment in the ER must be bonded to the TMGB.

3.01 TELECOMMUNICATIONS INFRASTRUCTURE

A. The telecommunications infrastructure is the cable and connecting hardware necessary to support the signaling between telecommunications devices. The infrastructure must be designed to support the known present, and reasonably certain future requirements of the telecommunications systems. ANSI/TIA/EIA-568-A provides the standards to be applied when designing and installing the telecommunications infrastructure. Texas State University utilizes the Ethernet LAN protocol at all facilities. Backbone Cabling cables are the major service cables that interconnect various buildings on a campus, connect equipment rooms to telecommunications closets within a building, or connect one telecommunications closet to another within the same building. Backbone cables are typically large capacity (high pair count) copper cables, or fiber optic cables. (Please see Appendix I Equipment Specifications for cable and connecting hardware.)
B. Modular Information Outlet Mounting Faceplates, Frames, and Boxes
   (Please see Appendix I Equipment Specification for appropriate faceplates, frames and boxes).

C. Eight-Position Jack Pin/Pair Assignments
   1. The preferred pin/pair assignment is the T568A configuration. In new construction at a new facility, the T568A pin/pair assignment shall be used.

4.01 CABLE SERVICE LOOPS

A. Horizontal distribution cables shall be installed with a service loop at one or both ends. The service loop shall have at least 10 feet of slack cable. Care must be exercised so that the service loop does not add excessive length to a cable run beyond the 295-foot distance limitation for horizontal distribution cable, or exceed the bending radius of the cable. The service loop shall be located in the most efficient location for future service depending on the type of cable raceway used. The necessary slack provided by a service loop can be achieved in several aesthetically pleasing methods, including but not limited to:

   1. Routing cables the long way around a backboard or equipment rack.
   2. Placing a service loop in the pull box of a closed conduit system.
   3. Placing the service loop above the false ceiling before dropping down to the outlet location.

5.01 TERMINATION HARDWARE TO SUPPORT OTHER LOW VOLTAGE SYSTEM

A. When other low voltage systems utilize the common structured cabling system, approved termination hardware shall be used for those systems. All fiber optic products shall fully comply with Texas State University standards. Copper cables shall fully comply in applications that can utilize Giga SPEED cable.
27 13 00 Communications Backbone Cabling

1.01 BACKBONE CABLING TO SUPPORT VOICE SYSTEMS

A. Voice (telephone) backbone cable shall originate at the location of the campus telephone system or remotes. The backbone cables will route to the various buildings on the campus, and/or the various floors of the building to distribute telephone service to the telecommunications closets. Voice backbone cables shall meet the following requirements:

1. Inter-building outside plant backbone cables shall be Category 3 UTP cables with an overall metallic shield. (Please see Appendix I Equipment Specification)

2. Voice backbone cables installed in underground conduits shall be jelly filled PIC cable to a termination point within the ER. The backbone cable shall then be tip spliced to an air core “tail” connecting the cable to the protected blocks. (Please see Appendix I Equipment Specification)

3. All splice cases used in the multi pair voice backbone will be waterproof. (Please see Appendix I Equipment Specification)

4. The shield of all inter-building backbone cables must be bonded to the ground lug on the primary protector panel. The protector panel must be bonded to the Telecommunications Main Grounding Busbar. The shield of all intra-building backbone cables must be bonded to the Telecommunications Main Grounding Busbar.

5. Voice backbone cable pair count shall be sized to support one (1) pair per voice station, plus 50% growth. When calculating size, voice stations shall also include fax machines and dial-up modems. (Please see Appendix I Equipment Specification)

6. Voice backbone cables shall have a minimum 10-foot service loop when terminated in the TC and ER, and at any splice points in telecommunications manholes.

2.01 BACKBONE CABLING TO SUPPORT DATA SYSTEMS

A. All intra-building TCs will be fed from the ER utilizing fiber optic and UTP backbones. Required cables are as follows:

1. 6 strand single mode fiber
2. 50 micron laser optimized multi-mode fiber optic cable
3. 4 each Category 6 UTP
B. Texas State University IT Department’ goal is to prepare facilities for migration of networks to Gigabit and higher backbone speeds. Singlemode fiber optic cable will be required to support most Gigabit and higher applications in the longer distances encountered in Texas State University networks. Note that cable distances listed in this section refer to the terminated cable length from the patch panel in each TC to the patch panel in the main ER. Specific Texas State University requirements for fiber optic backbones are:

1. All newly installed fiber optic cable and components for LAN use must be rated and installed to comply with the IEEE 802.3z 1000Base-X Ethernet Gigabit Standard.

2. All fiber optic backbone cables shall home-run through conduit from each individual TC to the Main Telecommunications Equipment Room (ER), which should be the location of the data switching equipment.

3. The standard inter-building fiber optic backbone shall be to install singlemode fiber optic cable to all buildings. All fiber optic cable with loose tube construction installed underground shall be gel filled or be constructed of appropriate waterproofing compounds. (Please see Appendix I Equipment Specification)

4. The standard cable size for inter-building fiber optic backbones is 24-strands of singlemode fiber optic cable. Strand count should be increased for specific buildings as required. All fiber optic backbones shall have a minimum of 20% spare capacity for all systems planned for use on the backbone. Where an Alternative Design has been approved to install fiber optic cable to small buildings such as utility buildings, no less than 6-strands singlemode fiber shall be installed.

5. All newly installed fiber optic cable shall be placed inside fiber optic inner duct. Where space is limited in existing conduit systems and only where an Alternative Design has been approved per 27 01 00, inner duct may be omitted. Inner duct shall be used to segregate and identify fiber optic cables in all telecommunications manholes and at all locations where fiber optic cable is exposed.

6. Fiber optic cables shall always have a minimum 20-foot service loop at the terminating ends and all approved splice points.

7. All strands of a fiber optic cable must be terminated with connectors and tested per previously sited standards.

8. Texas State University IT must design the interfaces on the LAN switch equipment based on the actual lengths of the backbone cable runs between
the telecommunications closets. Texas State University IT must be given the estimated cable length between the fiber patch panels of each TC and the main ER fiber patch panel in the design phase, and the actual cable length as soon as possible in the construction and installation phase.

9. There shall be no splices in fiber optic cable unless specifically allowed in the Texas State University project design and specifications. Designers wishing to include fiber optic cable splices must request written approval following the “Approval for Alternative Design Solutions” process described in section 27 00 00. All splices approved by Texas State University IT must be fusion splices, and there shall never be more than one splice per cable run between the ER and TC.

3.01 BACKBONE CABELING TO SUPPORT OTHER LOW VOLTAGE SYSTEMS

A. During planning for backbone cable installations, consideration shall be given to migrating other low voltage systems such as CATV, CCTV, fire alarm systems, EMS, emergency call boxes and facility control and monitoring systems to the common structured cabling system.

B. CATV specifics will be provided by current service provider. Necessary contacts will be arranged via Texas State University Office of Telecommunications Services.

END OF SECTION 27 13 00
27 15 00 Communications Horizontal Cabling

1.01 HORIZONTAL DISTRIBUTION CABLES

A. In all cases the Texas State University requires cable installed in the horizontal distribution cabling (HDC) environment to support low voltage systems including voice and data, and shall be interior rated cable. Exterior rated OSP waterproof cable will not be allowed in any HDC environment. Horizontal distribution cable is the cable that routes from the telecommunications closet to the work-area. The standard configuration for the Texas State University IT to route a minimum of one four (4)-pair cable for voice and one four (4)-pair cable for data to each office or work area. In all new installations, UTP cable (Please see Appendix I Equipment Specification) shall be used for both voice and data. Where additions are made to existing buildings, UTP cable shall be used for voice and data. Additional data cables must be placed to accommodate LAN-attached printers. Splitting cable pairs from one cable to two or more outlets to avoid adding an additional four (4)-pair cable is not allowed—no exceptions. The addition of spare Information Outlet jacks at any given work area, or the addition of spare Information Outlet locations on several walls of a room, is encouraged within the limitations of the project budget.

B. CABLE TO SUPPORT VOICE SYSTEMS IN NEW INSTALLATIONS

1. Horizontal distribution cable to support voice services in new installations or major renovations and remodeling shall be plenum 4-pair UTP cable. (Please see Appendix I Equipment Specification)

C. CABLE TO SUPPORT DATA SYSTEMS

1. All intra-building TCs will be fed from the ER utilizing fiber optic and UTP backbones. Required cables are as follows:
   a. 6 strand single mode fiber
   b. 50 micron laser optimized multi-mode fiber optic cable
   c. 4 each Category 6 UTP

2. All horizontal distribution copper cable and components for LAN use at new or refurbished Texas State University buildings, and Texas State University owned facilities, must be rated and installed to support the IEEE 802.3ab 1000Base-T Gigabit. (Please see Appendix I Equipment Specification) Additionally, the Texas State University IT staff may specify installation of copper cable and components to support Gigabit Ethernet at Texas State University buildings that currently do not have cable capable of supporting these data speeds.
3. Wherever data cables are used, they must be terminated to specified modular outlets and patch panels. (Please see Appendix I Equipment Specification)

D. CABLE TO SUPPORT OTHER LOW VOLTAGE SYSTEMS

1. During planning for horizontal cable installations, consideration shall be given to migrating other low voltage systems such as CATV, CCTV, fire alarm systems, EMS, emergency call boxes and building management systems to the common structured cabling system.

2.01 CABLE INTERCONNECTION AND TERMINATION HARDWARE

A. Cable interconnection and termination hardware used at Texas State University facilities shall meet the following specifications:

1. COPPER BACKBONE INTERCONNECTION HARDWARE
   a. All inter-building voice backbone cables shall be equipped with a primary protector panel. The protector panel must be equipped with Protector Units that provides sneak-current protection. (Please see Appendix I Equipment Specification)

2. FIBER OPTIC BACKBONE INTERCONNECTION HARDWARE
   a. All fiber optic cables shall be terminated in the Texas State University standard Fiber Optic Interconnection Unit patch panel. (Please see Appendix I Equipment Specification)
   b. In all locations where equipment racks are installed, the rack mountable Fiber Optic Interconnection Units shall be used. (Please see Appendix I Equipment Specification)
   c. All fiber optic patch cords shall be routed through cable management hardware to prevent the patch cords from becoming tangled or snagged.
   d. The standard fiber optic connector for Texas State University is the type 568SC. When fiber additions are made to existing facilities where type 568SC connectors are in use, 568SC connectors and new LC patch panels shall be used for the new fiber. (Please see Appendix I Equipment Specification)
   e. Where electronics equipment is used that has a different type of fiber optic connector, use fiber optic patch cords with the
appropriate connectors on each end, for example a LC to LC patch cord.

f. Care must be taken to maintain the minimum bend radius (10 times the cable diameter) of the fiber optic patch cord.

3. HORIZONTAL DISTRIBUTION VOICE COPPER CABLE TERMINATION HARDWARE

   a. In existing facilities with Category 3 cabling; Category 5e shall be used for additional installations. Category 5e horizontal distribution voice cables shall be terminated at the Telecommunications Closet on 110 Wiring Blocks. Category 5e horizontal distribution voice cables shall be terminated at the work area end into modular six (6)-position jack.

4. CATEGORY 5 DATA CABLE TERMINATION HARDWARE FOR EXISTING FACILITIES

   a. Where additions are made to existing Category 5e data cable installations, the following components shall be used:

   Category 6 horizontal distribution data cables shall be terminated at the Telecommunications Closet on a Category 6 Modular Jack Panel.
27 16 00  Communications Connecting Cords, Devices, and Adapters

1.01  COPPER PATCH CORDS FOR CATEGORY 6 LINES

A.  Telecommunications Contractor will be required to provide (2) Category 6 patch cords per Category 6 line installed.

1.  The specific number of provided patch cords will be determined by the number of completed drops in the project; this includes any change order. (Please see Appendix I Equipment Specification)

   a.  1 per installed drop- appropriate combination of cordage lengths to equal 1 per installed drop Category 6 patch cord (Blue). Combination of lengths should be relevant to the patch panel position and rack units used, as well as equipment location and rack placement.

   b.  1 per installed drop- 15’ Category 6 patch cord Blue

B.  Because UTP cable is protected from cross talk and immunity from EMI through the cables pair twist and lay configuration, care must be taken to maintain the minimum bend radius (4 times the cable diameter) of the copper patch cords. All furnished patch cords must be certified by the manufacturer to match the cable type used in the horizontal distribution. (Please see Appendix I Equipment Specification)

C.  Field terminated patch cords are not acceptable. It has been common practice to assemble patch cords in the field using leftover solid-conductor cable. Field assembled patch cables will not perform to Category 6 standards, frequently do not perform to Category 5 standards, and can not be tested for proper performance using currently available field testing equipment. Patch cables shall always be made from stranded copper wire to withstand the flexing associated with patch cords. Any existing field assembled patch cords shall be replaced with factory assembled Category 6 patch cords, before any Texas State University upgrades data speeds to 100 Mbps. Do not attempt to use Category 5 patch cords for Category 6 connections.

D.  Telecommunications Contractor will be required to provide (1) fiber optic patch cord per termination. The fiber optic patch cord will be consistent with termination type and fiber optic mode. (i.e. singlemode or multimode)
27 20 00  Data Communications

1.01  Texas State University Telecommunications will provide all equipment necessary for data communications. If this equipment is ordered through the contract it must be pre-approved by the Office of Telecommunications Services.
27 21 33  Data Communications Wireless Access Points

1.01  During any renovation or new construction appropriate amount of above ceiling Category 6 cabling shall be installed by communications contractor in order to provide full interior wireless coverage. Texas State University uses various Cisco wireless products. Please direct specific questions to Texas State University Network Operations.

END OF SECTION 27 21 33
27 30 00 Voice Communications

1.01 Texas State University Telecommunications will provide all equipment necessary for voice communications. If this equipment is ordered through the contract it must be pre-approved by the Office of Telecommunications Services.
**EQUIPMENT SPECIFICATIONS DATA AND VOICE**

1.01 Deviation from listed specifications or manufactures must be pre-approved by Texas State University Network Operations, as per section 27 01 00.

2.01 Not all of the following items will be applicable to all projects. Prior to order contractor must submit, for approval from Texas State University Network Operations, a complete list of materials for project.

3.01 Other items may be required for specific contract; if item is not on following list it must be pre-approved by Texas State University Network Operations.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MANUFACTURE</th>
<th>PART NUMBER</th>
<th>NOTE</th>
</tr>
</thead>
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<tr>
<td>24 port Clarity Cat6 High Density Patch Panel</td>
<td>Ortronics</td>
<td>OR-PHD68424</td>
<td>T568A wiring</td>
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<td>48 port Clarity Cat6 High Density Patch Panel</td>
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<td>OR-PHD68448</td>
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<td>Mighty Mo 6 (16.25”channels)</td>
<td>Ortronics</td>
<td>OR-MM6716</td>
<td>for use in- ER ONLY</td>
</tr>
<tr>
<td>Mighty Mo 6 (10.5”channels)</td>
<td>Ortronics</td>
<td>OR-MM6710</td>
<td>general purpose</td>
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<tr>
<td>Wall Mount Relay Rack</td>
<td>Ortronics</td>
<td>OR-604045450</td>
<td>for use in- TC ONLY</td>
</tr>
<tr>
<td>Series II Faceplates (Fog White)</td>
<td>Ortronics</td>
<td>OR-40300158</td>
<td>Outlets dedicated to internal networks teaching labs, should be black.</td>
</tr>
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<td>Series II 1 unit module, Clarity Category 6</td>
<td>Ortronics</td>
<td>OR-S21600</td>
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<td>Series II 1 unit module, Clarity Category 6</td>
<td>Ortronics</td>
<td>OR-S22600</td>
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<td>Series II Blank Module</td>
<td>Ortronics</td>
<td>OR-40300191</td>
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<td>Ortronics</td>
<td>OR-S215E00</td>
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<td>Series II 1 unit module, Clarity Category 5e</td>
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<td>OR-S225E00</td>
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<tr>
<td>Clarity Category 6</td>
<td>Ortronics</td>
<td>OR-MC605-06</td>
<td>May use 3’-9’</td>
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</table>
### Modular Patch Cord
- **5' (blue)**
  - Ortronics OR-MC615-09
  - Work Station

### Clarity Category 6 Modular Patch Cord
- **15' Blue**
  - Ortronics OR-30200145

### 110 Wiring Block with Legs
- Ortronics OR-30200109
- For UTP

### 110C Connecting Blocks
- **4 pair 110C4**
  - Ortronics OR-30200110
  - For Distribution

### Single Channel Trough (300 Pair)
- Ortronics OR-806003194

### Dual Channel Trough (300 Pair)
- Ortronics OR-806003197

### Horizontal Cable Management
- Ortronics OR-60400020

### 110 Protected Circumference
- Circa 1880ENAI/NSC-100G

### 24 Port Fiber Housing
- Corning CCH-02U
- L panels only

### 48-72 Port Fiber Housing
- Corning CCH-04U
- LC

### 144 Port Fiber Housing
- Corning CPH-04U
- Data Center Installations

### Preformed Splice Closure
- **9.5”x28”**
  - Preformed 8000630

### Preformed Splice Closure
- **12.5”x28”**
  - Preformed 80006219

### Preformed Splice Closure
- **12.5”x38”**
  - Preformed 80006252
  - For Restoration Purposes Only

### MS^2 Slicing Module 25pr gel
- 3M 4000-GT/TR

### Category 6 UTP (blue)
- Any manufacture Certified to Comply with Ortronics Category 6 warranty is acceptable. Berk-Tek is preferred.

### ATTENTION ELECTRICIANS, TELECOMMUNICATIONS AND FURNITURE CONTRACTORS

**Tombstones**
- Careful consideration must be taken when purchasing these items.

**Polk-Through**
- Not all bezels are compatible with Ortronics Series II modular jacks. Do not install incompatible fixtures where Telecommunications outlets are required.

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**END OF SECTION 27 36 00**

**Revised Jan-15**

**Date and Voice Equipment – 27 36 00–2**
SECTION 27 41 16.51 – INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR CLASSROOMS

27 41 16.51  Integrated Audio-Video Systems and Equipment for Classrooms

1.01  MINIMUM TECHNOLOGY ENHANCED CLASSROOM DESIGN STANDARDS

THIS CLASSROOM STANDARD IS FOR USE IN THE DESIGN OF FACILITIES FOR TEXAS STATE UNIVERSITY – SAN MARCOS. CONSULTANTS SHALL ENSURE COMPLIANCE WITH ALL APPLICABLE REGULATING CODES. ANY DEVIATIONS FROM THESE GUIDELINES REQUIRE INSTRUCTIONAL TECHNOLOGIES SUPPORT (ITS) APPROVAL. A DETAILED EXPLANATION OF THIS STANDARD CAN BE COORDINATED THROUGH THE CONSTRUCTION OFFICE.

These installations and purchases do not preclude, but compliment, existing construction standards. None of these installations will take the place of standard requirements and locations. For example, if standard wiring practices require three power outlets in a wall, and this document requires one outlet, then there will be four outlets in that wall. The end user may have additional requirements that must be coordinated with ITS.

1.02  Basic Technology Enhanced Classroom

Classroom Design Standards

A.  ALL classrooms will be designed and engineered from the classroom needs standpoint, not by forcing any classroom into a specific shape formed by the building. Precedence is given to enhance human interaction in the audio and the visual aspects of the learning environments.

B.  ALL students and audience members shall be able to easily see and hear all presenters and program materials, and ALL Faculty and presenters shall be able to easily see and hear all students and audience members.

C.  ALL entrances/exits must be at the opposite end of room from the staging/teaching area, thereby eliminating unnecessary interruption of student in-flow. If more than one door is required, it is preferred to be in back of room, if configuration allows. If not, the second door shall be set back greater than 8’ from the instructional wall.

D.  All student seats to be within 90-degree side-to-side cone established from center of screen. No greater than 45-degree horizontal angle to centerlines on screen, and no greater than a 35-degree vertical angle defined from the eyes of the closest student viewer to the top of any screen; horizontal line parallel to the floor that extending through the eyes.
SECTION 27 41 16.51 – INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR CLASSROOMS

E. Closest seats to projected image are 1.5x the width of projection screen.

F. Farthest seats to projected image are 5 x the height of projection screen.

G. Finished ceiling no less than 9’-6” AFF for small rooms (less than 20 students); clear height at instructional end of room, not dropped ceiling.
   1. Up to 75 students – 11’ minimum clear height AFF
   2. 75 to 150 students – greater than 13’ AFF
   3. 150 & over students – greater than 15’ AFF

H. Room layout should be relatively rectangular, ratio not exceeding 1.5 to 1. Staging area shall be on the narrow wall.

1.03 Projection Screens, Basic Technology Enhanced Classroom

A. ITS will always specify screen. Contractor will install ceiling recessed screens.

B. Where ceilings do not exceed 10’, ITS currently specifies: Ceiling recessed Draper Access Series M with Auto Return (16:10 GREEN GUARD matt white XT1000E), manually operated. Screen should be installed flush with ceiling with no more than 6” of drop material at top of screen when lowered.

Access/Series M by Draper

Case Dimensions

Revised Jan-15
C. Where ceilings exceed 10', ITS currently specifies: Ceiling recessed Draper Signature/Series V (16:10 GREEN GUARD, matt white XT1000E, Quiet Motor Option, Serial Communication Option, and 24 Volt 3-Button Control Switch), Electrically Operated with no more than a 12” drop material at top of screen when lowered.

D. Optimal distance between the first row of seating and the projector screen is 1.5 x the width of the specified screen. Optimal distance to farthest is 5-x screen height.

E. If electrical screens are used in larger rooms, wall-mounted raise/lower switches would be required adjacent to lighting controls, centralized at location of instructor’s station. These switches would need to be clearly marked with text “Screen Control,” “Raise,” and “Lower.”

F. Provide space for whiteboard on side(s) of screen

G. The bottom of the screen should be a minimum of 4 feet above the audience floor, allowing those seated toward the rear of the audience to see the screen.
1.04 Ceiling Mounted Data Projector Mounting, Basic Technology Enhanced Classroom

A. Based on configuration of room and ceiling height, ITS will determine the exact placement for the projector. ITS will specify, order, and install the projector.

B. ITS currently specifies the Chief CMS-445, 2’ x 2’ Tile Replacement Projector Mounting Kit. Contractor will furnish and install per manufacture’s specification with anchors to concrete deck in the location specified by ITS, and provide one (1) 120 VAC I.G. quad electrical outlet and one (1) network drop installed directly into the Chief CMS-445. Power should be supplied through a 15’ flexible whip that will allow the mount to be repositioned later to another location, as the projector model requires.

C. In general, the projector is ceiling mounted approximately 12’- 16’ from screen to front of projector lens in a room with standard 9’6” or 10’ height ceiling. Distance from screen to front of projector lens varies with size of screen, which is determined by height of ceiling and depth of room, and projector model/type.

D. The projector ceiling kit is aligned to be centered on the projector screen—center row of ceiling grid should be clear between 0’ – 20’ (from projection screen) of all A/C vents, smoke detectors, ceiling fans, lighting, etc. to allow for future repositioning of projector infrastructure.

E. HVAC intake/exhaust ducts should not be located any closer than 6’ to the projector location; this will eliminate circulation competition with the projector’s own fan and cooling unit.
SECTION 27 41 16.51 – INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR-classrooms

1.05 Audio, Basic Technology Enhanced Classroom

A. Assistive listening systems (ALS) shall be installed in all rooms with audio-amplification systems which accommodate at least 50 persons (See Americans with Disabilities Act Accessibility Guideline ADAAG 4.1.3., 19, 4.33). ITS will specify ALS technology and contractor will purchase and install, test, and coordinate integration into Classroom media cabinets with ITS.

B. Noise level is to be no higher than NC = 30 in general and NC = 20 at grills or registers. ANSI/ASA S12.60-2002 sets 35 decibels for maximum background noise for unoccupied school classrooms. Separate classrooms should not share same plenum area, as sound will carry over into adjacent rooms. Walls or sound-attenuation barriers must be used to insure each classroom’s audio environment is isolated from each other.

C. Currently ITS specifies a monaural system using the JBL Model Control 24CT where each speaker should be spaced based on a minimum 130° conical coverage at a 10” ceiling, and the JBL Model Control 26C where each speaker should be spaced based on a minimum 110° conical coverage for ceiling heights greater than 10’. Speaker placement should be coordinated and approved by ITS.

D. ITS will install speakers in all Suspended Acoustic Tile (SAT) ceilings, not exceeding 11’ AFF, unless otherwise coordinated. Contractor is to install speakers in non-SAT ceiling materials, regardless of ceiling height.

1.06 Multimedia and Video, Basic Technology Enhanced Classroom

A. ITS media cabinets will be designed and purchased by ITS. Funds for these purchases will be included in the construction budget. Estimates will be provided by ITS to the university’s construction director.

B. Classroom media cabinets typically contain rack-mounted computers, monitors, visual presenters, media players, sound amplification, signal routing-switchers, power conditioners, control systems, and cabling to connect to wall outlets. The media cabinets range in size from 36” wide x 26” deep, to 48” wide x 30” deep relative to classroom size and instructional requirements. While these cabinets are mobile, they are typically tethered to wall connections with a large umbilical up to 10’. The wall connections for the components in the lectern/instructor workstation will also be installed by ITS. Conduit with pull strings in walls are to be installed by contractor.

1.07 Networking and Communications, Basic Technology Enhanced Classroom

A. Four (4) Category 6 or better network connections direct from the MDF/Switch shall be wall mounted adjacent to the 120VAC I.G. quad electrical outlet at the side wall of the classroom 5’ from the front projection wall and on the side of the room opposite the main entry. The lines will have a ten-foot service loop AFC.
B. Contractor will provide one (1) three-gang 90 cu.in. metal electrical outlet box (8-5/8”L x 4-1/2”W x 3-1/2”D) fed by two (2) 1-1/2” rigid conduit running from top of box to AFC with 90 degree sweep terminating into plenum area towards location of projector for control and signal cables. The three-gang 90 cu.in. metal electrical outlet box will be mounted adjacent to the data connections and quad power outlet. Contractor to provide metal wall plate with 2” centered opening and nylon bushing. Contractor to provide nylon bushings on both ends of AV cable conduits or pipe. Special wall plates with AV connections to be installed by ITS as required. These conduits will accommodate all A/V cabling between the projector and the media cabinet.
C. In case of floor box/poke-through device, all conduit sizes remain required unless otherwise coordinated by ITS; two (2) 1-1/2” conduits for A/V cabling, two (2) 1” conduits for network and electrical.

1.08 Power, Typical Classroom, Basic Technology Enhanced Classroom

A. Provide isolated ground (I.G.) and neutral power circuits that are clean of ambient and stray signals for the lectern/tech projector circuit(s). No other powered items are to be tied into circuits supporting instructional technology. All equipment is to be on the same phase.

B. Provide a 120 VAC I.G. quad electrical outlet on the sidewall of the classroom, approximately 5’ from the front wall at standard height. It will be on the sidewall of the room opposite the main entry.

C. Provide a 120 VAC I.G. quad outlet, installed in the ITS specified Projector Mounting Kit (see 1.04), approximately 12 to 16 feet from the screen location. Conduit will be installed to a point four feet above and centered over the projector.
SECTION 27 41 16.51 – INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR CLASSROOMS

mounting location. Outlet will be connected to the conduit by a fifteen-foot flex cable. This outlet will provide power for the data projector at the front of the classroom. Exact location for Projector Mounting Kit to be determined by ITS.

D. Floor penetrations for the conduits into the instructional tech lectern are to be centered under the ITS media cabinet and located so that the minimum 4’ behind and 2’ to each side are maintained for both access and cooling/air flow of equipment.

1.09 Lighting, Basic Technology Enhanced Classroom

A. Do not place any ceiling light fixtures within 7’ of any projection screens, unless reflectors restrict lights directly downward to not spill or reflect onto screens. The front panel of lights reflecting onto the screen will be independently controlled.

B. Plan for the instructor to adjust all the lighting levels for his needs from near the teaching position. All lights will be controlled from a minimum of two points; near entry/exit to room, and near location of instructor/media cabinet. Besides being able to completely shut off the front panel of lights near the projection screen, the other lights in the room should be able to be dimmed by switching off either half the fluorescent bulbs in each fixture, or either one or two bulbs in each fixture should they only contain three bulbs.

D. First switch panel above the sidewall quad power outlet positioned so the instructor can easily adjust lights while standing behind lectern or media cabinet (approximately two feet from front wall on side wall opposite the main entry.) All light controls must be clearly marked with engraved switch plate with 1/8” high lettering. (See picture below for control placement relative to A/V cabling and electrical.)
D. Fire-alarm strobes are not to be placed behind projection screens, which when in the down position would block the light from the strobes.

E. Classrooms and lecture halls need the ability to be made totally dark, therefore, all lighting, including night lights and emergency lights should be de-energized with localized switching in the room. Emergency Lights will be re-energized at building power loss or activation of the fire alarm system.

F. Whiteboards may be lighted via a single tube fluorescent fixture with a directional reflector and must be independently switched. Use a separate on/off, circuited and wall mounted light strip above the instructor’s whiteboard. Provide proper clearances to the fully extended projection screen. Whiteboard lighting should not be supplied with ceiling mounted hanging fixtures that interfere between projector and projector screen sight lines.

G. Automatic lighting systems must have manual overrides.
SECTION 27 41 16.51 – INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR CLASSROOMS

H. Fixtures shall be full spectrum fluorescent type. Generally, the fixtures should be 2’x 4’ parabolic fluorescent. Light levels will be 50-70 foot candles via recessed fluorescent fixtures, and lighting shall be glare free, with the appropriate colored lamps that do not flicker or provide uneven light.

1.10 Storage, Basic Technology Enhanced Classroom

A. Provide at least one lockable closet per building, minimum 36 square feet (6’W x 6’D x 10’H). Support and storage closets will be accessible from hallways and will NOT be inside the classrooms, with 36” wide entrance, electrical power and lighting for Instructional Technologies Support storage of emergency support ladder and replacement equipment to prevent loss of class time.

1.11 Windows, Basic Technology Enhanced Classroom

A. Action must be taken to eliminate outside light.

B. Windowless rooms are preferred (subject to user group input).

C. Windows will be located on the side of the rooms, not the ends. Windows to have two coverings; one layer is to allow some light entry into room; the second layer is to cut all light entry into room. Provide enough recessed pocket space at ceiling system or window recess to allow proper placement of the dual layer shade system.

D. Venetian blinds or drapes are not desired. All windows must have blackout shades. Dual roller blinds, with translucent layer opening density adjusted for light exposure for particular building elevation most desired, such as “MechoShades.”

E. No windows on the same wall or near projection screens.

1.12 Ceiling Material and Heights, Basic Technology Enhanced Classroom

A. Use regular 2’ x 2’ lay-in acoustical tile in exposed metal suspension system tiles (not narrow designs or metal edged tiles). Use non-sagging (humidity resistant) lay-in acoustical tile for most classroom ceiling areas to allow easy overhead access.

B. Ceiling heights should be: (minimum clear height AFF at both projector and screen location.)

1. 10 – 25 students – 9’6” – 10’6”
2. 30 – 50 students – 10’6” - 11’6”
3. 50 to 75 students – 11’6” - 12’6”
4. 75 to 150 students – greater than 13’ AFF
5. 151 & over students – greater than 15’ AFF

Revised Jan-15
C. If ceilings are higher than 12’ high, the contractor will coordinate with ITS for an alternative projector and screen mounting plan.

1.13 Entrances, Basic Technology Enhanced Classroom

A. Entry/exit should be at back of room. Doors shall be located opposite the designated instructor station or the far corner of the adjacent wall.

B. Doors shall be a minimum of 36” wide and contain a small window, have quiet operational and closing characteristics. Minimize noise transmission into classroom from corridors – no door transfer grills.

C. Doors shall have automatic door bottoms and edge sound treatment where high noise levels may occur outside of the door (some classes run two periods so should not be disturbed by class changes). Consideration for them to also have bumpers, gaskets, sound strips, nylon bushings, silencers or sound strips on the strike jambs and hardware to minimize closing and impact noises and noises outside the door.

1.14 Floors, Basic Technology Enhanced Classroom

A. Floor and other elements surrounding classrooms to have an Impact Isolation Class (IIC) that prevents sound transmission into room from floors or equipment surrounding the classrooms. Refer to ANSI/ASA S12.60 for minimal requirements.

B. The needs of ADA access and pathways must be addressed. Only seating tiers are allowed in classrooms with 100 or more student seats, as long as accessible positions are located at the front, back and middle of the room and visual sight lines are maintained between student positions, instructor and screens.

C. Sight lines relative to floors with differing elevations – consideration must be given to sight lines between instructors and students so that eye contact is possible between instructor and all students in all situations – for instructors as tall as 6’-8” or as short as 4’-10”, as well as those in wheel chairs.
SECTION 27 41 16.51 – INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR CLASSROOMS

1.15 Multimedia and Other Hardware, Basic Technology Enhanced Classroom

A. Technology hardware, unless specified elsewhere, will be installed by ITS, in most cases. The cost of these items will be estimated by ITS, included in the construction budget, purchased by ITS, and installed by ITS, or under their supervision. ITS will provide a spreadsheet of items and cost estimates as required. Based on time lapse between initial cost estimate and selection of items and actual time of construction, ITS may alter equipment selection based on costs or features, or both.

1.16 Chalk Boards/Whiteboards/Tack boards, Basic Technology Enhanced Instructional Space/Classroom

A. All Whiteboards 4’ high w/ flat porcelain on steel surfaces, with aluminum trim, tray and end caps, concealed spline connections. Set trays at 36” AFF, and provide 25-year warranty against surface defects, shadowing after erasing, etc.

B. Do not place whiteboards behind technology lectern areas where lectern will block view of whiteboard from student seating positions.

C. ITS does not recommend traditional chalkboards in rooms with electronics which rely on intake/exhaust fans or filter mediums for cooling. Chalk silica has a proven damaging effect on open electronics and reduces the life expectancy of projectors, and computers. It is also very difficult to clean from monitor screens and keyboards.

END OF SECTION 27 41 16.51
SECTION 27 41 16.61 Integrated Audio-Video Systems and Equipment for Video Conferencing Classrooms [Refer To Video Conferencing Classrooms as ITV Classrooms]

THE STANDARDS FOR Minimum Technology Enhanced Classroom Design WILL APPLY TO ITV CLASSROOMS WITH THE FOLLOWING ADDITIONS.

1.01 Basic ITV Technology Enhanced Classroom, ITV Additions

A. ITV Video Conferencing is a simulation of face-to-face delivery of education using video conferencing technology. The environment is highly customized with technology and environmental features which maximize this simulation.

B. Each student seat will be supplied with a permanent wired microphone for interaction with the instructor and recording of class experience.

C. Each student seat will have both power and data for laptop connectivity to receive digital instructional materials and virtualized content.

D. Ceiling height must be no less than 10’ AFF, and no greater than 11’ AFF.

E. No windows are allowed in this type of room.

F. No Whiteboards or Chalkboards are allowed in this type of room.

F. Room layout should be relatively square, or if rectangular, at a ratio not exceeding 1.5 to 1. Staging area shall be on the narrow wall.

1.02 Projections Screens, Front and Back Wall of the Classroom, ITV Additions

A. ITS will always specify screen. Contractor will install ceiling recessed screens if/when specified.

B. Where ceilings do not exceed 10', ITS currently specifies a fixed wall mounted screen: #252212V Draper Clarion projection screen, 137", 16:10, CH1900V Pearl White w/Veltex [72-1/2" x 116" x 137"] Top of screen should be installed flush with the finished ceiling.

C. Where ceilings exceed 10', ITS currently specifies: Ceiling recessed Draper Access Series V Custom Size (16:10 GREEN GUARD matt white XT1000E), Electrically Operated with no more than a 6” drop material at top of screen when lowered.

Revised Jan-15
D. Optimal distance between the first row of seating and the projector screen is 1.5 x the width of the specified screen. Optimal distance for ITV to farthest is 4-x screen height.

E. If electrical screens are used in larger rooms, wall-mounted raise/lower switches would be required adjacent to lighting controls, centralized at location of instructor’s lectern. These switches would need to be clearly marked with text “Screen Control,” “Raise,” and “Lower.”

F. The bottom of the screen should be a minimum of 4 feet above the audience floor, allowing those seated toward the rear of the audience to see the full screen.

G. For ITV simulation: All student seats to be within 70-degree side-to-side cone established from center of screen. No greater than 30-degree horizontal angle to centerlines on screen, and no greater than a 30-degree vertical angle defined from the eyes of the closest student viewer to the top of any screen; horizontal line parallel to the floor that extending through the eyes.

### 1.03 Data Projector Mounting, Front and Rear of Classroom, ITV Additions

A. ITS will specify, order, and install projector, determine exact placement based on configuration of room and ceiling height.

B. In general, the projector is ceiling mounted approximately 12’- 16’ from screen to front of projector lens in a room with standard 9’6” or 10’ height ceiling. Distance from screen to front of projector lens varies with size of screen, which is determined by height of ceiling and depth of room, and projector model/type.

C. The projector ceiling mounting kit is aligned to be centered on the projector screen—center row of ceiling grid should be clear between 0’ – 20’ (from projection screen) of all A/C vents, smoke detectors, ceiling fans, lighting, etc. to allow for future repositioning of projector infrastructure.

D. HVAC intake/exhaust ducts should not be located any closer than 6’ to the projector location; this will eliminate circulation competition with the projector’s own fan and cooling unit.

E. ITS currently specifies the Chief CMS-445, 2’ x 2’ Tile Replacement Projector Kit. Contractor will install per manufactures specification with anchors to concrete deck in the location specified by ITS, and provide one (1) 120VAC I.G. quad electrical outlet and one (1) network drop installed directly into the Chief CMS-445. Power should be supplied through a 15’ flexible whip that will allow the mount to be repositioned later to another location, as the projector model requires.
1.04 Multimedia and Video, ITV Additions

A. Control/support cabinet and equipment rack may be located at front side – a support workstation may also be positioned at the front side of the classroom. It could occupy the corner of the room adjacent to the instructor media lectern; it will be on the opposite wall from and directly across the room from the doorway. There would be additional monitors, mixers and multimedia equipment at this station.

B. Wall mounted cameras will be installed adjacent to front and rear projection screens. Provide double gang mud ring 2’ below AFC (Above Finished Ceiling) for low voltage lines, with one (1) 1-1/2” conduit run AFC.

1.05 Networking and Communications, ITV Additions

A. Six (6) total Category 6 or better network connections direct from the MDF/Switch, wall mounted adjacent to the 120VAC I.G. quad electrical outlet at the side wall of the classroom 5’ from the front projection wall and on the side of the room opposite the main entry. The lines will have a ten-foot service loop AFC. The connections are for the control cabinet.

B. A single data connection on the ceiling will be installed adjacent to the ceiling outlet for BOTH projectors; front and rear facing. (See 1.03-E).

C. A second double gang outlet, for other low voltage lines, with two 1-1/2” conduits will be run above ceiling line. The box will be mounted adjacent to the data box and the quad power outlet at the front wall of the classroom on the same side of the classroom as the podium. The box will be approximately 5’ from the teaching wall, on the sidewall.

D. A single analog telecommunications line will be installed in a second data faceplate as the six data lines above. The line will have a ten-foot service loop above ceiling line.

E. A single gang outlet with one 1-1/2” conduit will be installed in the wall, 2’ below the ceiling and stubbed out to above the ceiling line, for low voltage lines/wall mounted camera. The box will be in the front corner of the classroom opposite the instructor media lectern.

F. Each student seat location must be provided a single Category 6 or better network connection direct from the MDF/Switch into either fixed furniture, or accessible floor box. ITS will specify furniture, contractor will purchase and install, coordinated with ITS.
1.06 Power, ITV Additions

A. Provide isolated ground (I.G.) and neutral power circuits that are clean of ambient and stray signals for the lectern/tech projector circuit(s). No other powered items are to be tied into circuits supporting instructional technology. All equipment is to be on the same phase.

B. A quad outlet (120 VAC I.G.) will be installed on the front wall of the classroom on the same side of the classroom as the media cabinet, approximately 5’ from the front corner, at standard height. It will be on the same side of the classroom as the media support station. The instructor media lectern is located in front corner of the room on the wall opposite the doorway.

C. A quad outlet (120 VAC I.G.) will be installed in the ceiling approximately 12’ from the front screen for the front projector and the ceiling mounted camera. Conduit will be installed to a point four feet above and centered over the projector mounting location. Outlet will be connected to the conduit by a fifteen-foot flex cable. (See 1.03-E)

D. A quad outlet (120 VAC I.G.) will be installed in the ceiling, approximately 12’ from the rear screen, centered on the wall, for the rear mounted projector. Conduit will be installed to a point four feet above and centered over the projector mounting location. Outlet will be connected to the conduit by a fifteen-foot flex cable. (See 1.03-E)

E. A duplex outlet will be installed in the wall, 2’ below the ceiling adjacent to the duplex low voltage box. The box will be in the front corner of the classroom opposite the instructor media lectern. The outlet will support a wall mounted camera.

F. Instructional Furniture requires 4’ of clearance behind, for access, and 2’ of clearance, on each side, for cooling/air flow of equipment. Floor penetrations for instructional furniture are to be located to provide the above clearances.

G. Each student seat location must be provided a single 120VAC I.G. electrical outlet into either fixed furniture, or accessible floor box. ITS will specify furniture, contractor will purchase and install, coordinated with ITS.

1.07 Floors, ITV Additions

A. Floor and other elements surrounding classrooms to have an Impact Isolation Class (IIC) that prevents sound transmission into room from floors or equipment.
surrounding the classrooms. Refer to ANSI/ASA S12.60 for minimal requirements.

B. Use carpet tiles in classrooms, equal or greater than 10 stitches per inch; Antron 6.6 fiber nylon, yarn weight of 20 to 30 ounces; multi-dark colors to not show spills; stain, moisture & wear resistant; impervious and thick Unibond type backing material not affected by moisture; edge curl resistant with no edge ravel; glue resistant to wet cleaning, anti-static, UL Class A.

C. All penetrations and wall elements to be sealed and designed to minimize noise entry into room.

D. The needs of ADA access and pathways must be addressed. Only seating tiers are allowed in classrooms with 100 or more student seats, as long as accessible positions are located at the front, back and middle of the room and visual sight lines are maintained between student positions, instructor and screens.

1.08 Ceiling, ITV Additions

A. Use regular 2' x 2' lay-in acoustical tile in exposed metal suspension system tiles (not narrow designs or metal edged tiles). Use non-sagging (humidity resistant) lay-in acoustical tile for most classroom ceiling areas to allow easy overhead access. Should result in a Noise Reduction Coefficient of .90.

1.09 Walls, ITV Additions

A. Acoustical treatment of the wall which will result in a Noise Reduction Coefficient of .90. Acoustical panels mounted on interior walls are preferable.

B. Should not be located near high occupancy areas such as libraries, computer rooms, common areas, and departmental offices. Nor should classrooms be near mechanical rooms, toilet rooms, lobbies, or elevator shafts.

C. All penetrations and wall elements to be sealed and designed to minimize noise entry into room.

D. Noise level is to be no higher than NC = 30 in general and NC = 20 at grills or registers. ANSI/ASA S12.60-2002 sets 35 decibels for maximum background noise for unoccupied school classrooms. Separate classrooms should not share same plenum area as sound will carry over into adjacent rooms. Walls or sound-attenuation barriers must be used to insure each classroom's audio environment is isolated from each other.
1.10 Entrances, ITV Additions

A. Entry/exit should be at back of room. Doors shall be located opposite the
designated instructor station or the far corner of the adjacent wall.

B. Doors shall be a minimum of 36” wide and contain a small window, have quiet
operational and closing characteristics. Minimize noise transmission into
classroom from corridors – no door transfer grills.

C. Doors shall have drop sill plates and edge sound treatment where high noise
levels may occur outside of the door (some classes run two periods so should not
be disturbed by class changes). Consideration for them to also have bumpers,
gaskets, sound strips, nylon bushings, silencers or sound strips on the strike jambs
and hardware to minimize closing and impact noises and noises outside the door.

1.11 Lighting, ITV Additions

A. Do not place any ceiling light fixtures within 7’ of any projection screens, unless
reflectors restrict lights directly downward to not spill or reflect onto screens. The
front panel of lights reflecting onto the screen will be independently controlled.

B. Plan for the instructor to adjust all the lighting levels for his needs from near the
teaching position. All lights will be controlled from a minimum of two points;
near entry/exit to room, and near location of instructor/media cabinet. Besides
being able to completely shut off the front panel of lights near the projection
screen, the other lights in the room should be able to be dimmed by switching off
either half the fluorescent bulbs in each fixture, or either one or two bulbs in each
fixture should they only contain three bulbs.

C. First switch panel above the sidewall quad power outlet positioned so the
instructor can easily adjust lighting while standing behind lectern or media

D. Fixtures shall be full spectrum fluorescent type. Generally, the fixtures should be
2’x 4’ parabolic fluorescent. Light levels will be 50-70 foot candles via recessed
fluorescent fixtures, and lighting shall be glare free, with the appropriate colored
lamps that do not flicker or provide uneven light.

E. Fire-alarm strobes are not to be placed behind projection screens, which when in
the down position would block the light from the strobes.
1.12 Multimedia and Other Hardware, ITV Additions

A. Technology hardware will be installed by ITS, in most cases. The cost of these items will be estimated by ITS, included in the construction budget, purchased under state contract by ITS, and installed by ITS, or under their supervision. ITS will provide a spreadsheet of items and cost estimates as required. Based on time lapse between initial cost estimate and selection of items and actual time of construction, ITS may alter equipment selection based on costs or features, or both.
CONSTRUCTION STANDARDS

SECTION 27 41 16.62 – INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR AUDITORIUMS

SECTION 27 41 16.62 – Integrated Audio-Video Systems and Equipment for Auditoriums

THE STANDARDS FOR Minimum Technology Enhanced Classroom Design WILL APPLY TO LECTURE HALL CLASSROOMS WITH THE FOLLOWING ADDITIONS.

1.01 Projection Screens, Large Lecture Halls Addition

A. There may be a requirement for two projection screens or a larger single screen in large classrooms. ITS and the end user will determine this need.

B. The distance from the screen to the projector will be determined by the size of the screen and the model of projector. The placement of quad electrical outlets and the data lines for the projector(s) will be determined after the screen size and placement has been established.

C. The goal is to make the screen large enough so those in the back row can read the subject matter easily, but not so large as to overwhelm the closest viewer. Evaluate any barriers, and try to make sure that the lower part of the screen will be visible from all seats. Extra drop may be required to position the screen at a comfortable viewing level in a room with a high ceiling.

D. Width of viewing area: maximum 30 degrees each side of screen vertical center (60 degree max). No seats more than 45 degrees off axis from center(s) of screen(s).

1.02 Image Aspect Ratios

A. ITS recommends Widescreen, 16:9, thereby screen height should equal or exceed 1/3 the distance from the screen to the optimum seat for watching video.

B. For charts and data, as in a conference or lecture room, use ¼ the distance.

C. For complex graphics, use ½ the distance.

Width—Screen width is generally determined by the height of the screen and the projection formats to be used.

1.03 Audio, Large Lecture Halls Addition

A. Combination of point-source cabinet speakers on stereo amplifier and distributed ceiling speakers on monaural amplifier. Obtain minimum specifications from ITS, before design.

B. Distributed speakers: Currently ITS specifies a monaural system using the JBL Model Control 24CT where each speaker should be spaced based on a minimum 130° conical coverage at a 10” ceiling, and the JBL Model Control 26C where each

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speaker should be spaced based on a minimum 110° conical coverage for ceiling heights greater than 10’. Speaker placement should be coordinated and approved by ITS. (Quantity and type are dependent on room dimensions and layout, audio equipment & speaker manufacturer specifications).

C. Program audio: Stereo w/2-3 point source speakers, program audio bussed to distributed speakers.

D. Separate amplification, control & EQ for voice support audio & program audio.

E. Point source cabinet speakers might be needed in large lecture halls. The contractor and architect should work with ITS to make provisions for the installation of these additional speakers in the front wall of these rooms.

1.04 Multimedia and Other Hardware, Large Lecture Halls Addition

A. Technology hardware will be installed by ITS. However, the cost of these items will be estimated by ITS, included in the construction budget, purchased under state contract, and installed by ITS or under their supervision. ITS will provide a spreadsheet of items and cost estimates as required. Based on time lapse between initial cost estimate and selection of items and actual time of construction, ITS may alter equipment selection based on costs or features, or both.

1.05 Lighting and control, Large Lecture Halls Addition

A. All control systems and lighting control systems will be coordinated with ITS.

1.06 Attendance Tracking Card Readers

A. Attendance Tracking Card Readers will be coordinated with Access Services. A minimum of 5 scanners and 1 keypad will be installed at each entrance and exit to the auditorium.

1.07 Network and Power Drops

A. A total of 3 network drops with a quad power outlet will be installed at the AV workstation.

B. A total of 2 network drops with a quad power outlet will be installed near the center aisle or center area of auditorium (Exact location to be determined by ITS).

C. A quad power outlet will be installed at lectern area (Exact location to be determined by ITS).
1.08 University Cable TV Channel

A. Coax cable will be installed in the auditorium to provide cable channel and University cable TV access. Installation to be coordinated with the Production Studios and the local cable TV provider.
DIVISION 28: ELECTRONIC SAFETY & SECURITY

28 13 00 Access Control System
28 23 00 Video Surveillance System
28 31 00 Fire Detection and alarm
SECTION 28 13 00– Access Control Systems

PART 1:   GENERAL

1.01    Summary
A.    Section Includes:
  1.    Access control.
  2.    Stranded power and control cable.
  3.    Cable connecting hardware, patch panels, and cross-connects.
  4.    Cable management system.
  5.    Cabling identification products.
  6.    Grounding
  7.    Pathways
B.    Related Specifications:
  1.    Communications Specification Standards – 27 00 00
  2.    Building Hardware Specification Standards – 08 71 00
C.    System Requirements:
  1.    Install and integrate Access Control, CCTV and related security hardware.
  2.    Configure local access panels in various telecommunication room (TR) and the Server’s computer system to communicate with one another.
  3.    Enter security system databases hardware configuration.
  4.    Test security system communication and operation in accordance with the specifications.
  5.    Train operators and the system managers.
D.    Bidding Requirements:
  1.    Submit complete detailed proposals with line item cost representation for components and associated installation labor. Lump sum bids will not be accepted.
  2.    Include as part of the bid response the following item:
         a.    Installation schedule with proposed manpower assignments,
         b.    Resumes for project manager and lead engineer for this project.
  3.    Review associated “E” and “TA” Series electrical, low voltage infrastructure drawings to verify that necessary conduit and floor boxes will be provided by others. The Owner will provide no additional infrastructure to support the Access Control System. Any discrepancies
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with the identified infrastructure to support these systems should be questioned in the form of a request for information (RFI) during the bidding process. Be responsible for any additional infrastructure requirements after receipt of contract for this project.

4. Unspecified Equipment and Material: Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide complete and functional Access Control systems shall be provided in a level of quality consistent with other specified items.

1.02 References

A. The Codes and Regulations listed below from a part of this specification to the extent referenced. Work shall be performed in accordance with the applicable international, federal, state, and local codes or standards current at the commencement of installation. The following list summarizes applicable standards:

1. UL 294, UL 1076, ULC
2. CE
3. FCC-Part 15, Part 68
4. NFPA 70, NEC
5. IEEE, RS 170 variable standard
6. RoHS

B. Where more than one code or regulations is applicable, the more stringent shall apply.

C. Cable and equipment installation, identification and termination shall be performed in accordance to the applicable codes above.

1.03 System Description

A. Complete engineering, installation and operation of the ACS.

1.04 Definitions

A. ACS – Access Control System – Cbord CS Gold/CS Access

1.05 ACS Description

A. Texas State University currently uses the CS Gold/CS Access system by the Cbord Group, Inc. 61 Brown Road, Ithaca, New York, 14850 607.257.2410 www.cbord.com

B. All building and room access control systems shall be systems, equipment, and accessories compatible with the current ACS. All auxiliary accessories or
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supporting devices shall be fully compatible with and able to integrate with existing campus system.

C. The ACS System outlined in this section and detailed in Part 2 of this document is the key central component for managing physical security and the bridge between physical and logical security for this project. The system shall provide a variety of integral functions including the ability to regulate access and egress; provide identification credentials; monitor, track and interface alarms; and view, record and store digital surveillance video linked to ACS events.

D. Upgrades or expansion of the ACS to a larger size system in scale shall not require installation of a different and or new ACS application or require the administrator/operator to learn a different and or new interface from the previous version.

1.06 Performance Requirements

A. All programming of all system’s hardware is by the Access Services. A one year full parts and labor warranty is specified. Note that the full one year parts and labor warranty is unconditional and covers all portions of this system from failure, except for acts of God or misuse by the owner. During this one-year period, the security contractor must meet the following performance requirements.

1. Respond Onsite Within Two to Four Hours

2. Advanced Loaners

3. Computerized Dispatch

4. Service technicians certified on system components and products.

5. Available 7 days a week, 24 hours a day.

1.07 Submittals

A. Comply with requirements of submittal procedures by A/E specifications.

B. Informational Submittal: Submit a detailed bill-of materials listing all part numbers and quantities for this project.

C. Qualification data:

1. List all technical personnel

2. List of all technical personnel, that are certified on factory components
SECTION 28 13 00– Access Control Systems

3. Identification in both quantity and dollars of the amount of service inventory maintained locally on both services vehicles and your warehouse.

4. Resume of key project manager, and lead technician.

5. Three (3) references from universities using complex access control systems (more than 50 card readers).

D. Pre-Qualification Certificate as part of this proposal: Submit a letter of approval from the manufactures indicating on compliance with qualifications requirements. Training certificates for design, engineering and installation of the proposed products shall be submitted with the proposal.

E. Service Dispatch: Submit as part of this proposal an outline containing the type of service program used for dispatching and tracking service calls.

F. Shop Drawings: Required before work can begin. Shop drawings will clearly indicate how work will be performed.

G. Product Literature Sheets: Provide a manufacturer’s product cut sheet for each component of the system including each data gathering panel, computer, computer peripheral, alarm contacts, UPS, power supply, electronic locking device, delay locking device, or other device on the device schedule.

H. Detail Drawings. Provide a detail drawing for each type of door. This should also include device location on floor plans, wiring diagrams and point-to-point charts, riser diagrams for each major subsystem, etc. Show each input and output terminal on each panel and identity its use. If it is a spare, indicate this accordingly. Include on shop drawings the reader locations and show the reader controller to which they are assigned. Show the devices they work with such as electric locks, local audible alarms, door contacts, etc.

I. Project Directory. Provide a job directory of your company engineering and installation team including phone, fax, email or mail to each manager, engineer, sales rep, or installer involved in this project.

J. Block Diagrams. Submit block diagrams for each system indicating connections of equipment and indicating equipment types and model numbers.

K. Riser Diagram. Provide riser diagrams of the access control systems and any other system specified herein.

L. Field Devices. Submit details on items such as alarm detectors and contacts and card readers including their appearance and performance, specifications, and
SECTION 28 13 00– Access Control Systems

exact locations. Include on shop drawings the reader locations and show the reader controller to which they are assigned. Show the devices they work with such as electric locks, local audible alarms, door contacts, etc.

M. Manuals: Final copies of the manuals shall be delivered within fourteen (14) days after completing the installation test. Each manual’s contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following available from the manufacturing:

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included.

2. Hardware Manual: The manual shall describe all equipment furnished including:
   a. General description and specifications
   b. Installation and checkout procedures
   c. Equipment layout and electrical schematics to the component level
   d. System layout drawings and schematics
   e. Alignment and calibration procedures
   f. Manufacturers repair parts list indicating sources of supply

3. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operations. The manual shall include:
   a. Definition of terms and functions
   b. System use and application software
   c. Initialization, startup, and shut down
   d. Reports generations
   e. Details on forms customization and field parameters

4. Operators Manual: The operators manual shall fully explain all procedures and instructions for the operation of the system including:
   a. Computers and peripherals
   b. System’s startup and shut down procedures
SECTION 28 13 00– Access Control Systems

c. Use of system, command, and applications software
d. Recovery and restart procedures
e. Graphic alarm presentation
f. Use of report generator and generation of reports
g. Data entry
h. Operator commands
i. Alarm messages and reprinting formats
j. System permissions functions and requirements

5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

6. Manuals shall be delivered on CD/DVD in an organized fashion based on manufacturer and product.

N. As-Built Drawings: During system installation, maintain a separate hard copy of drawings, elementary diagrams, and wiring diagrams of the ACS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the ACS. Copies of the final as-built drawings shall be provided to the end user in DXF format.

1.08 Quality Assurance

A. Installing company must be on a pre-approved list furnished by the owner for installation services for this project.

B. Providers of manufactured components, installation, wiring and testing shall be the responsibility of a single contractor who is an authorized dealer for the product supplied and who has been continuously in business for a period of not less than five (5) years and is licensed as required by the jurisdictions where the work will occur to perform the work specified. The security contractor shall meet the following performance requirements:

1. The security firm shall be licensed by the State of Texas and in good standing.

2. Technician Certification:

a. Technical personnel shall be certified by the factory for the installation and service of all components.

3. Security License Requirements: The security contractor and “all” personnel at the company (including technical and administrative staff)
SECTION 28 13 00– Access Control Systems

shall be licensed by the State of Texas for a security license with the appropriate background checks.

C. Service Support: Provide post-sales service support for all components in the system design that meets requirements:

1. Availability: 7 days a week, 24 hours a day.

2. Response Time: Two to four hours on-site.

3. Advance Replacement:
   a. Contractor shall provide advance replacements for any component whenever it is required.
   b. The contractor shall be able to provide advance loaners.

1.09 Contractor Performance Requirements

A. Technical Personnel: The contractor shall have adequate technical staff located within sixty (60) miles of the university.

B. Working Hours Response: During normal working hours, all telephone calls placed to the contractor shall be answered by a live person, not an auto-attendant.

C. Service Dispatch: The contractor shall use a computerized service dispatch system that is a commercial off-the-shelf product used for dispatching service companies. At the end of every week, the contractor will be required to email Texas State University a list of all service calls and their status on an automatic basis. Excel spreadsheets are not acceptable for a service dispatch program.

D. The contractor shall have a dedicated position specifically for managing and dispatching service call for their clients. This position shall perform no other functions except service-related dispatch functions and service.

E. Engineering: The contractor must have field-trained engineers on staff that are 100% conversant in AutoCAD and are able to provide the necessary electronic drawings and submittals required for a project of this size.

F. Contractor must meet all security clearance requirements to meet NBHPP CHEMPAK standards.
SECTION 28 13 00– Access Control Systems

1.10 Substitutions and Quality

A. Where products are specified by name, provide and install that product. Substitutions will not be accepted for the access control system or their subsystem.

1.11 Delivery, Storage, and Handling

Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating manufacturer and materials.

1.12 Project Conditions

A. Environmental Limitations: Do not deliver or install cables, equipment, and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.13 Coordination

A. Coordinate layout and installation of ACS equipment with Owner’s security representative.

1. Meet jointly with FPDC and Access Services to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute them to other participants.

B. Coordinate layout and installation of the ACS cable pathways with telecommunications contractor.

1.14 Warranty

A. During the first year, provide a full service warranty program that guarantees a two to four hour on-site response, include all parts and labor, and provides advance replacements for any defective components. The installation contractor must qualify as the service organization and provide the on-site warranty service. The contractor recognizes that in emergent situations, Texas State University-Access Services personnel may have to respond before the contractor. In the event that Texas State University-Access Services initially responds, the contractor accepts the work and agrees that the Warranty is still in full force and effect. The contractor will reimburse Texas State University for all expenses.
SECTION 28 13 00– Access Control Systems

B. The system components shall be guaranteed against all defective materials, design and workmanship for a period of one-year from the date of acceptance by the client after final testing. New replacement parts shall be furnished promptly and defects in design and workmanship shall be corrected, without cost to the Owner, promptly upon receipt of notice from the Owner of failure of any part of the system during the guarantee period. This is a one year full parts and labor warranty and no alternative will be acceptable.

C. Personnel: Service personnel shall be factory certified in the maintenance and repair of the equipment installed under this section of the specification. The owner shall be advised in writing of the name of the designated service representative, and of any change in personnel.

D. Schedule of Work: This work shall be performed during regular working hours (8-5), Monday through Friday, excluding federal holidays.

1. Inspections: The Contractor shall perform two minor inspections at six (6) month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.

2. Minor Inspections: These inspections shall include:
   
a. Visual checks and operational tests of all console equipment, peripheral equipment, field hardware, sensors, and electrical and mechanical controls.
   b. Mechanical adjustments if required on any mechanical or electromechanical devices.

3. Major inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
   
a. Clean all ACS equipment, including interior and exterior surfaces.
   b. Perform diagnostics on all equipment
   c. Check, physically test, and if required by the manufacturer’s maintenance procedures, calibrate each sensor.
   d. Run all system software diagnostics and correct all diagnosed problem.

E. Operations: Performance of scheduled adjustments and repair shall verify operation of the ACS as demonstrated by the applicable tests of the performance verification test.

F. Emergency Service: The owner will initiate service calls when the ACS is not functioning properly and hinders critical operation of the facility. Qualified personnel shall be available to provide repairs to the ACS. The owner shall be
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furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at site within four (4) hours after receiving a request for service. The ACS shall be restored to proper operating condition within eight (8) hours after service personnel arrive on site.

Records and Logs: Keep records and logs of each task, and organize cumulative records for each component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial settings. Complete logs shall be kept and shall be available for inspection on site, demonstrating that planned systematic repairs have been accomplished for the ACS.

G. Work Requests: Separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, name of services personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. Deliver a record of the work performed within five (5) days after work is accomplished.

H. System Modifications: Make any recommendations for system modification in writing to the Owner. No system modifications shall be made without prior written approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

I. Software: Provide all software updates during the period of the warranty and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with ACS operators, shall include training for the new changes/features enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.

1.15 Commissioning and Startup

A. Provide Access Services with programming sheets in excel format showing equipment locations, model numbers, cabling, controller panel MAC addresses, physical addressing for and cable termination points on controller panels, door interface, input, and output panels.

B. Conduct formal inspection of ACS with Access Services and Network Operations staff. Demonstrate every device location is providing proper signals and indicators showing door functions (open/closed, forced/rex, propped, card read, and manual unlock).

PART 2: PRODUCTS

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Access Control Systems – 28 13 00-10
SECTION 28 13 00– Access Control Systems

2.01 Access Control Cable

A. Yellow Plenum overall jacket, components listed below:

1. SHLD 18 awg-4/c (printed: lock power) plenum jacket
   a. Larger gauge wire may be required to compensate for voltage drop over longer distances.
2. SHLD 22 awg-3/PR (card reader) plenum jacket
3. SHLD 22 awg-2/c (door contact) plenum jacket
4. SHLD 22awg-4/c (rex/spare) plenum jacket
5. Door monitor cable-SHLD 22awg-2/c Plenum (door contact) plenum jacket

B. ADA/Spare Cable

1. 22awg-4/c plenum jacket

C. Von Duprin Latch Retraction/ Delayed Egress

1. 12 awg-2/c plenum jacket up to 200ft

D. Delayed Egress Monitoring Cable

1. 22awg -8/c plenum jacket

2.02 Readers

A. Exterior Door

1. HID Corp (www.hidcorp.com) R40 I-Class card reader (Wiegand) (R40 is preferred default card reader).
2. HID Corp R10 I-Class card reader (requires Access Services approval).
3. HID Corp. RK40 I-Class card reader with keypad (requires Access Services approval).
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4. HID Corp. ER40 I-Class card reader and single door controller (requires Access Services approval).

5. HID Corp. ER40K I-Class card reader with keypad and single door controller (requires Access Services approval).

6. HID Corp. R90 I-Class long range card reader for Handicap equipped entrances (Wiegand).

7. 

B. Interior Door

1. HID Corp. R40 I-Class card reader (Wiegand).

C. Disable/Handicap Enabled Doors

1. HID Corp. R90 I-Class long range card reader for Handicap equipped entrances (Wiegand).

D. Parking Vehicle Entrances

1. HID Corp. R90 I-Class long range card reader (Wiegand).

E. Elevators

1. HID Corp. R40 I-Class card reader (Wiegand).

F. Biometric

1. Schlage Handkey II Biometric Reader

2. All other readers must be compatible and supported by CS Access system software. (www.cbord.com)

G. Wireless

1. Schlage Wireless I-Class. (requires prior written approval by Access Services).

2.03 Power Supplies

A. Altronix Corp. Maximal 75 power supplies shall be used for all controllers, card readers, locks, and sensors unless otherwise specified by these university construction standards or Access Services.
SECTION 28 13 00– Access Control Systems

1. Maximum of sixteen (16) card readers per Maximal 75 power supply.
2. Altronix Corp PD8 distribution board to be used for card reader and control panel power distribution.
3. Altronix Corp. ACM8 distribution board(s) to be used for lock power distribution.
4. Each Maximal 75 power supply will be equipped with four (4) 12 amp/hour back-up batteries.
5. Monitor power supply AC power fail and battery fail outputs using ACS.

B. Von Duprin PS 914-BB power supplies, when required by electric latch retraction and/or delayed egress devices, shall be mounted in a way to be accessible from the ground (preference is for Von Duprin power supplies to be centrally mounted with the access equipment being optimal).

1. Each PS914-BB power supply to be equipped with appropriate option board(s).
2. Each PS914-BB power supply will be equipped with two (2) 12 amp/hour back-up batteries.
3. Monitor power supply AC power fail and battery fail outputs using ACS.

2.04 Access controller Devices

A. Cbord V1000 Squadron Control Panel. (www.cbord.com)
B. Chord V100 door controller.
C. Cbord V200 Input controller
D. Cbord V300 Output controller
E. Cbord V2000 two door Squadron controller
F. Cbord Panel Interface Module (PIM)

2.05 Attic / Spare Stock

A. Equal to five percent (5%) of each type of card reader (1 each type minimum but not to exceed 10 readers per project).
B. Equal to five percent (5%) of each type of power supply transformer board (1 each type minimum but not to exceed 5 per project).
C. Equal to five percent (5%) of each type of Cbord controller panels (1 each type minimum but not to exceed 5 per project)
SECTION 28 13 00– Access Control Systems

2.06 Delayed Egress Monitoring

A. Monitor delay egress door hardware for the following functions:

1. Device power supply status.
2. Fire alarm relay status.
3. Device activation/arm status.
4. Device alarm status.
5. Door position status.

B. Devices

1. Von Duprin-Chexit-98-Delayed Egress
2. GE Type 1076DPDT Door Position Switch.
3. Minimum two (2) Altronix 24volt SPDT relay for monitoring with ACS.

C. Cable

1. 22awg / 8c from panic device to access control panel
2.

2.07 Data/Network

A. One (1) accessible data port/connection shall be provided for each Cbord V1000 Squadron controller panel installed.

PART 3: EXECUTION

3.01 General Design Standards

A. ACS shall be designed and installed to not interfere with egress requirements for life safety nor interfere with intrusion or fire alarm systems.

B. All access controlled handicap entrances shall be fully integrated into the building ACS ensuring that while providing access to the disabled, that proper access control is maintained in both the unsecured and secured modes. ACS shall be installed to comply with Americans with Disabilities Act, Texas Accessibility Standards, and Texas State University-San Marcos policies.

C. All access control installations shall use housings and mountings which maintain or minimize disruption to architectural sensibilities or themes of the buildings and campus.

D. All access control installations shall use housings and mounting designed to provide sufficient protection against tampering and vandalism. Torx center pin security fasteners shall be in used on all devices installed in public areas.
SECTION 28 13 00– Access Control Systems

E.   All equipment and components to support ACS shall be installed to manufacture’s specifications. Installation of components and hardware shall be in place prior to connection to the access control system.

F.   Installations of ACS equipment hardware shall comply with requirements found in Texas State University-San Marcos Construction Standards.

G.   All ACS shall be configured to provide a Fail Secure with mechanical manual egress from the secure side in the event of a loss of power, loss of network communications, or system failure.

H.   All access control equipped doors locking hardware shall include keyed locking mechanisms accessible from the unsecured side to allow keyed manual operation of the door.

I.   All access control equipped doors shall be equipped with door position monitors and request to exit devices to allow for configuration of door condition alarms.

J.   All ACS equipment, including controllers and power supplies, shall be located in accessible and secure rooms; with Telecommunications/IDF rooms being preferred.

K.   Electric power supplies and power converters for the ACS equipment and hardware shall be connected in the Telecommunications/IDF room. Power supplies located at the access equipped door should be avoided.

L.   Electrical service to ACS power supplies shall be on dedicated circuits. Where practicable, electric power for the access system should be provided through the building emergency power supply.

M.   All ACS equipment power supplies shall be equipped with battery back up to allow operation if electrical service and emergency generated power is lost.

N.   As a minimum, provide conduit from all access devices, hardware, and equipment to ceiling location to allow for convenient access to raceway for cabling.

O.   All new construction installation of ACS shall be hardwired. In renovation or retrofit installations hardwired installations are preferred; wireless systems may be considered with the approval of Access Services, and Project Manager, and building owner.

P.   Wiring Connection Requirements: All low voltage control, monitor, power, and other cables shall be connected using sealed crimp type lugs, no wire nuts will be allowed.
SECTION 28 13 00– Access Control Systems

Q. Monitor Contacts: Door monitoring contacts, wiring, and conduits there to, shall be concealed and invisible when the door is closed. Externally applied door monitoring contacts, externally applied conduit or wire mold, and wire without conduit must be approved by Access Services, Project Manager, and building owner.

R. Request to Exit Switches: Request to exit (RX) switches should be mechanical or magnetic hardware based devices. Passive infrared (PIR) or sonic detectors require prior approval of Access Services.

S. All door position, request to exit, tamper, battery failure, and AC power failure switches shall be wired using GRI 2.2k resistor packs allowing for supervised monitoring by the Cbord CS Gold/CS Access system.

T. Doorways or entrances having multiple doors or leafs shall be equipped with door position switches and request to exit devices on each leaf or door.

U. All delayed egress equipped doors will be monitored by the ACS for device power supply status, fire alarm relay status, device arm/disarm status, device alarm status, and door position.

3.02 Conductors, Wire, Cables

A. Data

1. All ACS data wiring, cables, jumpers, and connectors will comply with requirements of Division 27 Construction Standards.

B. Low Voltage Electrical

1. All ACS low voltage electrical wiring, cables, and connectors will comply with the requirements of Division 27 Construction Standards.

2. All ACS low voltage electrical wire shall be rated and adequate to supply the intended doors full functionality including but not limited to lock mechanisms, readers, and monitoring points without exceeding seventy-five percent (75%) of the wire’s rated capacity.

3. Distance from power supply to door lock should be examined to determine manufacturer’s recommended wire gauge to support expected voltage drop over distance.

3.03 Controllers

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Access Control Systems – 28 13 00-16
SECTION 28 13 00 – Access Control Systems
A. Squadrons/Controllers

1. All access control system squadrons and/or controllers should be located in secure location with Telecommunication/IDF closets being preferred.

2. All access control system controllers and interface devices shall be housed in a metal case. Metal enclosure should provide surplus room to accommodate 20% expansion of the devices in the enclosure.

3. All access control system squadron and/or controller installations shall comply with requirements of Division 27 Construction Standards.

B. Wireless Controllers and Transceivers.

1. Prior to installation of wireless devices, testing of wireless transmissions and performance will be performed. A written report of the testing results will be provided to Access Services for approval.

2. All access control system wireless transceivers/PIM shall be mounted out of the public view with mounting in a secured room being preferred.

3. All access control system wireless transceivers/PIMs shall be housed in a case capable of being locked.

4. All access control system wireless transceivers/PINs installations shall comply with requirements of Division 27 Construction Standards. Attention should be given to avoid interference with other wireless devices.

3.04 Electrical Power Needs

A. All ACS power supplies should be located in secure location with Telecommunication/IDF closets being preferred.

B. Preferably, ACS power cables shall not be installed to be within the public view. However, if power cables cannot be properly concealed and must be in the public view, they shall be placed in conduit to prevent damage or tampering.

C. All ACS power supplies shall be rated and adequate to supply all controllers, door locks, card readers, and monitor devices without exceeding seventy-five percent (75%) power supply. In selection of power supply output, special attention should be paid to expected distance from power supply to door installation and resulting voltage drop over distance. All power supply distribution terminations shall be individually fused.
SECTION 28 13 00– Access Control Systems

D. ACS power supplies should be equipped with battery back up to insure operation in the event of power failure regardless of building emergency power supply.

E. ACS power supplies should be connected to the building emergency power system to insure service in the event of AC power failure or battery failure.

F. ACS power supplies shall be equipped to allow ACS to detect and report building electrical power feed failure.

G. ACS power supplies shall provide a device or method to terminate building electrical power feed at the power supply by switch or plug.

H. A four gang electrical outlet connected to dedicated 20 amp power supply shall be provided at each controller/power supply installation location.

3.05 Equipment Cabinets

A. All ACS controllers and power supplies shall be housed in metal cabinets capable of being locked using a key. The cabinet shall be secured to the wall of the telecommunication /IDF closet in accordance with the requirements listed in Division 27 Construction Standards. The final mounting location in telecommunication closet/IDF closet requires prior approval by the Office of Technology Resources.

B. All ACS controller and power supplies cabinets shall be equipped with monitors to allow remote determination of cabinet cover door status (open vs. closed). All access control system controller and power supply cabinets shall be equipped with keyed locks to secure cabinet.

C. Conduit wire pathways shall be installed to house wiring passing from the power supply cabinets and the squadron/controller enclosures.

3.06 Electronic Access Control

A. Administration of the electronic ACS infrastructure includes documentation of devices, cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, and telecommunications closets. All Texas State facilities shall apply and maintain a system for documenting and administering the electronic ACS infrastructure.

B. In order to create a consistent environment, Texas State maintains a campus wide numbering scheme for electronic access control. (Building name abbreviations published in Texas State Master List of Buildings [link](http://www.maps.txstae.edu/masterlist.html/), Parking Lot numbers published in
SECTION 28 13 00– Access Control Systems

Parking Services Parking Regulations and Map
http://www.parking.txstate.edu/AllColor.htm).

1. All cables and components used on electronic access control equipped doors and controllers shall be clearly marked using permanent means. Equipped door and controllers shall use the following system of numbering:

   a. Exterior Doors: Abbreviated building name + EXT + room number of door + decimal designator + abbreviated compass direction of door relative to the center of the building. Example: JCK EXT 27.1 NW.
   
   b. Interior Doors: Abbreviated building name + INT + room number + decimal door number + decimal door number determination if more than one doorway to the room is present. Example: JCK INT 101.1.
   
   c. Controllers: Abbreviated building name + room number of telecommunications room installed in + device model + decimal designation. Example JCK 202 1000.1.
   
   d. Power Supply: PWR + Abbreviated building name + room number of telecommunications rooms installed in + decimal designation. Example PWR JCK 202.1

   e. Door/Controller Terminator: Controllers shall be labeled with exterior or interior door numbering scheme indicating the doorway(s) attached to each controller.

3.07 Records

   A. A record is a collection of information about or related to a specific element of the ACS. Records must be maintained in a computer printable spreadsheet, or in a computer database. Submit proposed record format to Access Control for approval. Paper records are encouraged, but are optional. A device and cable record is prepared for each device/door installation. The record will show the device/door name, and must describe the components from origin point and destination point. The device and cable record will record what services and/or connections are assigned to each installed location based on Equipped Door Number. An equipment record is prepared for services distributed from a certain piece of equipment, such as an encoder, controller, or a system.

3.08 Drawings

   A. Drawings are used to illustrate different stages of ACS installation planning, installation and administration.
SECTION 28 13 00– Access Control Systems

B. Installation or Construction Drawings.

1. Installation or construction drawings are the plans that show the installer how the infrastructure and devices are to be installed. The quality of the installation can be directly impacted by the level of details in the installation drawings and written specifications. Installation drawings for Texas State projects shall, at a minimum, show device installation, show pathway locations and routing, show configuration of ACS including door hardware installation, device installation, infrastructure, backboard and equipment rack configurations, and wiring details including identifier assignments.

C. As-Built Drawings

1. The as-built drawings graphically document the installed ACS infrastructure through floor plan, elevation, and detail drawings. In many cases, these drawings will differ from the installation drawings because of changes made during construction and specific site conditions. In the as-built drawings, the identifiers for major infrastructure components must be recorded. The pathways, spaces, and wiring portions of the infrastructure each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings. As-built drawings are a vital component of the administration system, and must be kept current as adds, moves and changes take place. Texas State University requires the installer to provide a complete and accurate set of as-built drawings.

3.09 Labeling and Color Coding

A. It is important that both labeling and color coding be applied to all ACS devices, wiring, and infrastructure components. Labeling with the unique identifier will identify a particular component. Proper color coding will quickly identify how that component is used in the overall systems infrastructure of the facility.

B. Labeling

1. Labels shall be applied to the wiring terminations and corresponding devices. Wiring and cable labels shall be applied at the doorway end and controller device side of cable and wiring runs.

2. Labels are generally of either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion.

3. Outside Plant labels shall be totally waterproof, even when submerged.
SECTION 28 13 00– Access Control Systems

4. All labels shall be machine printed.

5. Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.

6. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used, and must be used in the manner intended by the manufacture.

C. Color Coding – Cable Termination Fields

1. Color coding shall be applied to all cables and cable termination fields in Telecommunications Closets, Equipment Rooms, and Entrance Facilities. Color coding may also be used to identify specific cables in a pathway, or the function of specific equipment racks or equipment. The same color is always applied to both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the plywood backboard behind the termination block, may be the color of a plastic cover on a termination block, or may be the actual color of the insert label on a termination block or patch panel. See Division 27 05 28 1.01A Construction Standards.

2. The following color code shall be used in all Texas State facilities relative to the access control systems:

   a. Yellow-Electronic Door Access.

END OF SECTION 28 13 00
SECTION 28 23 00– Video Surveillance System

PART 1: GENERAL

1.01 Summary

A. Section Includes:
   1. CCTV
   2. Stranded power and control cable.
   3. Cable connecting hardware, patch panels, and cross-connects.
   4. Cable management system.
   5. Cabling identification products.
   6. Grounding
   7. Pathways

B. Related Specifications:
   1. Communications Specification Standards – 27 00 00

C. System Requirements:
   1. Install CCTV and related security hardware.
   2. Provide DVRs, cameras, power supplies for cameras, and other CCTV equipment.
   3. Provide all required software licenses for primary and redundant recording on DVTel recording system.

D. Bidding Requirements:
   1. Bidder shall submit complete detailed proposals with line item cost representation for components and associated installation labor. Lump sum bids will not be accepted.
   2. Include as part of the bid response the following item:
      a. Installation schedule with proposed manpower assignments,
      b. Resumes for project manager and lead engineer for this project.
   3. Review associated electrical, low voltage infrastructure drawings to verify that necessary conduit and floor boxes will be provided by others. The Owner will provide no additional infrastructure to support the video surveillance system. Any discrepancies with the identified infrastructure to support these systems should be questioned in the form of a request for information (RFI) during the bidding process. Be responsible for any additional infrastructure requirements after receipt of contract for this project.

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Video Surveillance – 28 23 00-1
SECTION 28 23 00– Video Surveillance System

4. Unspecified Equipment and Material: Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide complete and functional video surveillance systems shall be provided in a level of quality consistent with other specified items.

1.02 References
A. The Codes and Regulations listed below from a part of this specification to the extent referenced. Work shall be performed in accordance with the applicable international, federal, state, and local codes or standards current at the commencement of installation. The following list summarizes applicable standards:
   1. UL 294, UL 1076, ULC
   2. CE
   3. FCC-Part 15, Part 68
   4. NFPA 70, NEC
   5. IEEE, RS 170 variable standard
B. Where more than one code or regulations is applicable, the more stringent shall apply.
C. Cable and equipment installation, identification and termination shall be performed in accordance to the applicable codes above.

1.03 System Description
A. Complete Engineering, installation, and maintenance CCTV (DVtel), system.
B. Texas State University currently uses the DVtel video surveillance system (www.dvtel.com).
C. All video surveillance or documentation systems shall be recorded and stored using the current DVtel video documentation system and administered by the University Police Department’s Access Services.
D. All video camera system’s equipment and accessories shall be fully compatible, integrated, and licensed with the current DVtel video surveillance system.
E. All additional accessories or supporting hardware shall be fully compatible with and able to integrate with existing campus systems.
F. Video surveillance systems shall be installed to and in compliance with Federal Law, State Law, and Texas State University policies.
G. All video surveillance installations shall provide adequate housings and environmental controls to insure proper operation of camera determined by environmental conditions and building usage. Provide protection from accidental and intentional damage or tampering. Torx with center pin security fasteners shall be used for devices in public areas.
SECTION 28 23 00– Video Surveillance System

H. All video surveillance installations shall be overt using housing and mountings which maintain or minimize disruption to architectural sensibilities or themes of the buildings and campus. No hidden or covert video surveillance systems shall be installed without prior written permission and approval of Access Services and the Director of University Police Department.

I. IP addressable digital video cameras are preferred over systems using coaxial cabling for image transmission. Installations relying on coaxial image transmission must be encoded into a digital format for transmission over network data infrastructure. Installations requiring coaxial installations require approval by Access Services, Project Manager, and facilities owner.

J. Cameras using optical/mechanical pan, tilt, and zoom systems are preferred to digital pan, tilt, and zoom systems. Digital pan, tilt, zoom systems require the approval of building owner and Access Services.

K. Buildings that have exterior entrances and/or interior doors, interior areas, parking lots of external areas equipped with a video surveillance system shall be equipped with signage displayed on doors or entrances announcing the use of video surveillance equipment.

L. Signs reading, “Video Recording in Use” shall be prominently displayed on all public entrances of buildings equipped with video surveillance systems.

M. Signs reading, “Video and Sound Recording in Use” shall be prominently displayed in areas where video and audio recordings are being made.

N. Signs reading, “Video Recording In Use” shall be prominently displayed on the sign designating the color zone of the parking lot equipped with video surveillance systems.

O. Signs reading “Video Surveillance System In Use” shall be prominently displayed at all vehicles and pedestrian entrances to parking garages.

P. All equipment and components to support video surveillance system shall be installed to manufacturer’s specifications. Installation of components and hardware shall be in place prior to connection to the video surveillance system.

Q. Where practical the electric power for the video surveillance system equipment and hardware shall be connected through the building emergency power system or provided with appropriate battery backup systems.

R. Exterior mounted cameras should be appropriately protected from lightning strikes.

S. The final building video surveillance system shall be approved by the Supervisor, Access Services.
SECTION 28 23 00– Video Surveillance System

1.04 Performance Requirements:

A. Provide, as shown on drawings, quantity of DVtel cameras, encoders, mounts, and controls.

B. Also, provide and install equipment vertical racks as required to hold encoders and other equipment.

C. All programming of all systems’ hardware is by the security contractor. A one year full parts and labor warranty is specified. Note that the full one year parts and labor warranty is unconditional and covers all portions of this system form failure, except for acts of God or misuse by the owner. During this one-year period, the security contractor must meet the following performance requirements.

1. Respond Onsite Within Two to Four Hours
2. Advanced Loaners
3. Computerized Dispatch
4. Service technicians certified on DVTel systems and products.
5. Available 7 days a week, 24 hours a day.

1.05 Submittals

A. Comply with requirements of Submittal Procedures by A/E specifications.

B. Informational Submittal: Submit a detailed bill-of-materials listing all part numbers and quantities for this project.

C. Qualification data:

1. List all technical personnel
2. List of all technical personnel factory-certified DVtel.
3. Resume of key project manager, and lead technician.
4. Three (3) references from universities using complex video surveillance systems (more than 50 cameras) (prefer at least one reference from university or higher education entity).

D. Pre-Qualification Certificate as part of this proposal: Submit a letter of approval from the manufactures indicating compliance with qualifications’ requirements.
SECTION 28 23 00–Video Surveillance System

Training certificates for design, engineering and installation of the proposed products shall be submitted with the proposal.

E. Service Dispatch: Submit as part of this proposal an outline containing the type of service program used for dispatching and tracking service calls.

F. Shop Drawings: Required before work can begin. Shop drawings will clearly indicate how work will be performed.

G. Product Literature Sheets: Provide a manufacturer’s product cut sheet for each component of the system including each data gathering panel, computer, computer peripheral, alarm contacts, UPS, power supply, camera, camera mount, camera enclosure, camera pole, PTZ motor or drive, lens, monitor, recorder, or other devices to be utilized.

H. Detail Drawings: Provide a detail drawing for each type of camera and device installation. This should also include device location on floor plans, wiring diagrams and point-to-point charts, and riser diagram.

I. Project Directory: Provide a job directory of your company engineering and installation team including phone, fax, email or mail to each manager, engineer, sales rep, or installer involved in this project.

J. Block Diagrams: Submit block diagrams for CCTV system indicating connections of equipment and indicating equipment types and model numbers.

K. Programming Sheets – Submit programming sheets in Excel format showing hardware components location, equipment type, model number, serial number, MAC address, and default IP address.

L. Manuals: Final copies of the manuals shall be delivered within fourteen (14) days after completing the installation test. Each manual’s contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following available from the manufacturing:

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included.
SECTION 28 23 00– Video Surveillance System

2. Hardware Manual: The manual shall describe all equipment furnished including:
   a. General description and specifications
   b. Installation and check out procedures
   c. Equipment layout and electrical schematics to the component level
   d. System layout drawings and schematics
   e. Alignment and calibration procedures
   f. Manufacturers repair parts list indicating sources of supply

3. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operations. The manual shall include.
   a. Definition of terms and functions
   b. System use and application software
   c. Initialization, startup, and shut down
   d. Reports generations
   e. Details on forms customization and field parameters

4. Operators Manual: The operators manual shall fully explain all procedures and instructions for the operation of the system including:
   a. Computers and peripherals
   b. Systems startup and shut down procedures
   c. Use of system, command, and applications software
   d. Recovery and restart procedures
   e. Graphic alarm presentation
   f. Use of report generator and generation of reports
   g. Data entry
   h. Operator commands
   i. Alarm messages and reprinting formats
   j. System permissions functions and requirements

5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

6. Manuals shall be delivered on CD/DVD in an organized fashion based on manufacturer and product.

M. As-Built Drawings: During system installation, maintain a separate hard copy of drawings, elementary diagrams, and wiring diagrams of the CCTV to be used for
SECTION 28 23 00– Video Surveillance System

record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the CCTV system. The final as-built drawings shall be provided to the end user in DXF format.

1.06 Quality Assurance

A. Installing company must be on a pre-approved list furnished by the owner for installation services for this project.

B. Providers of manufactured components, installation, wiring and testing shall be the responsibility of a single contractor who is an authorized dealer for the product supplied and who has been continuously in business for a period of not less than five (5) years and is licensed as required by the jurisdictions where the work will occur to perform the work specified.

C. Service Support: Provide post-sales service support for all components in the system design that meets requirements:

1. Availability: 7 days a week, 24 hours a day.

2. Response Time: Two to four hours on-site.

3. Advance Replacement:
   a. Contractor shall provide advance replacements for any component whenever it is required.
   b. The contractor shall be able to provide advance loaners.

1.07 Contractor Performance Requirements

A. Working Hours Response: During normal working hours, all telephone calls placed to the contractor shall be answered by a live person, not an auto-attendant.

B. The contractor shall use a computerized service dispatch system that is a commercial off-the-shelf product used for dispatching service companies. At the end of every week, the contractor will be required to email Texas State University a list of all service calls and their status on an automatic basis. Excel spreadsheets are not acceptable for a service dispatch program.

C. The contractor shall have a dedicated position specifically for managing and dispatching service call for their clients. This position shall perform no other functions except service-related dispatch functions and service.
SECTION 28 23 00– Video Surveillance System

D. Engineering: The contractor must have field-trained engineers on staff that are 100% conversant in AutoCAD and are able to provide the necessary electronic drawings and submittals required for a project of this size.

E. The Contractor must be a certified dealer of all products utilized in the CCTV system.

1.08 Substitutions and Quality:

A. Where products are specified by name, provide and install that product. Substitutions will not be accepted for the access control system or their sub-system.

1.09 Delivery, Storage, and Handling

A. Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating manufacturer and materials.

1.10 Project Conditions

A. Environmental Limitations: Do not deliver or install cables, equipment, and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the reminder of the construction period.

1.11 Coordination

A. Coordinate layout and installation of video surveillance system’s equipment with Access Services.

1. Meet jointly with Access Services to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute them to other participants.

B. Coordinate layout and installation of the video surveillance systems cable pathways with telecommunications contractor.

1.12 Warranty

A. During the first year, provide a full service warranty program that guarantees a two to four hour on-site response, include all parts and labor, and provides advance replacements for any defective components. The installation contractor must qualify as the service organization and provide the on-site warranty service.
SECTION 28 23 00– Video Surveillance System

The contractor recognizes that in emergent situations, Texas State University Access Services personnel may have to respond before the contractor. In the event that Texas State University Access Services initially responds, the contractor accepts the work performed and agrees that the Warranty is still in full force and effect. The contractor will reimburse Texas State University for all expenses.

B. The system components shall be guaranteed against all defective materials, design and workmanship for a period of one-year from the date of acceptance by the client after final testing. New replacement parts shall be furnished promptly and defects in design and workmanship shall be corrected, without cost to the Owner, promptly upon receipt of notice from the Owner of failure of any part of the system during the guarantee period. This is a one year full parts and labor warranty and no alternative will be acceptable.

C. Any item failing before the one year guarantee period expires shall be replaced and the guarantee extended for that item for twelve months from the replacement date of the item.

D. The warranty period for any part which has a warranty by the manufacturer of longer than 12 months shall be for the longer period. Provide a copy of the manufacturer’s warranty period statement for all major CCTV components.

PART 2: PRODUCTS

2.01 Wiring and Cabling

A. Data transmission cable.

1. All video surveillance system data wiring, cables, jumpers, and connectors will comply with requirements of Division 27 Construction Standards.

B. Low Voltage Electrical Wiring.

1. All video surveillance low voltage electrical wiring, cables, and connectors will comply with the requirements of Division 27 Construction Standards.

   a. CAT 6E.
   b. 18awg/2 conductor

2. All video surveillance system low voltage electrical wire shall be rated and adequate to supply the intended cameras full functionality including but not limited to camera operations, audio equipment, mechanical movement, and environmental housing without exceeding seventy-five percent (75%) of the wire’s rated capacity.
SECTION 28 23 00– Video Surveillance System

3. Sufficient cabling shall be provided to each camera to use all audio, dry contact input and output capabilities of the camera.

2.02 Electrical Power Needs

A. Video surveillance power supplies should be located in Telecommunication/IDF closets.

B. Preferably, video surveillance system power cables shall not be installed to be within the public view. However, if power cables cannot be properly concealed and must be in the public view, they shall be placed in conduit to prevent damage or tampering.

C. Video surveillance power supplies shall be connected to the building’s emergency power system to insure service in the event of a power failure.

D. Power Over Ethernet (POE) or centralized power supply distribution to video cameras shall be utilized for all applicable camera locations.

2.03 Mounting Equipment

A. All video surveillance camera housings and mounts must provide protection against accidental and intentional damage or tampering. Torx center pin security fasteners shall be used on devices in public areas.

B. All video surveillance camera housings and mounts shall have adequate housings and environmental controls to insure proper operation of camera as determined by environmental conditions and building usage.

C. All video surveillance installations shall be overt using housing and mountings which maintain or minimize disruption to architectural sensibilities and themes of the building and campus.

2.04 Data Transmission Resources Needs

A. Contractors shall work closely with the Texas State University-San Marcos Office of Technology Resources via the Office of Facilities Planning Design and Construction to insure adequate computer network resources are available for intended additions to the Texas State University video surveillance systems.

B. Data cable runs shall be limited to no more than 290 ft. from the camera device and switch. During design and installation close attention should be paid to the distance of cabling runs for video surveillance.
SECTION 28 23 00– Video Surveillance System

C. Camera installations requiring cable runs longer than 290 ft may use the following methods to transmit data to the telecommunications/IDF closet with prior approval by Access Services and Network Operations.

1. Single or Multi-mode fiber with required conversion devices. (See Division 27 Construction Standards).
2. Coaxial cable with required digital encoders and power supplies.

D. All data transmissions between cameras and recording servers or devices shall be encrypted or made on secure network pathways to ensure data cannot be intercepted or manipulated.

2.05 Camera Requirements & Products

A. All cameras shall provide a minimum resolution, dynamic range, and field of view to provide clear and crisp images to the Owners satisfaction.

B. Networkable IP passed cameras are preferred. Analog cameras must interface with and be fully compatible and functional with DVTel system currently in use. Analog camera video signals will be encoded using a DVTel EA-201 digital encoder (or most current revision). Analog cameras shall be used only in elevators for this project.

C. Corner mount Exterior PTZ camera shall be DVtel model number: CP2101-361N (or most current revision) with corner mount and camera arm along with DVTel CX-RRWR-241 power supply.

D. Interior fixed ceiling tile mount with bracket shall be DVtel model number: DVTel CM-3211-11 (or most current revision) with DVTel CM-RSCD-0 recessed mounting kit.

E. Interior elevator camera shall be Video Alarm model number: WS6S-50NF-X2 (or most current revision). Video signal may be via RG59 or Shielded Twisted Pair (STP). Unshielded Twisted Pair (UTP) for 4video shall not be acceptable. With DVTel EA-201 digital encoder (or most current revision).

2.06 Attic / Repair Stock

A. Provide equal to 5% of each type of camera installed (1 minimum each camera type not to exceed 3 per project).
3.01 Examination

A. The contractor shall examine areas and conditions under which the equipment is to be installed and shall notify the general contractor in writing of conditions detrimental to proper and timely completion of work.

3.02 Video Surveillance Administration

A. Administration of the video surveillance infrastructure includes documentation of devices, cables, termination hardware, patching and cross-connection facilities, conduits, or other cable pathways, and telecommunications closet.

B. In order to create a consistent environment, Texas State University maintains a campus wide numbering scheme for video surveillance devices. (Building name abbreviations published in the Texas State University Master List of Buildings [http://www.maps.txstate.edu/masterlist.html](http://www.maps.txstate.edu/masterlist.html)/ Parking Lot numbers published in Parking Services Parking Regulations and Map [http://www.parking.txstate.edu/AllColor.htm](http://www.parking.txstate.edu/AllColor.htm)).

C. All video surveillance cameras, devices, and cables shall be clearly marked using permanent means. Video cameras shall use the following system of numbering:

1. Exterior Cameras Mounted Viewing Building Entrance: Abbreviated building name + EXT + number of door+ abbreviated compass direction of door relative to the center of the building. Example: JCK EXT 27 NW (if more than one camera at entrance for the same purpose includes decimal designator to number of door).

2. Exterior Camera Mounted to Building Viewing Parking Lot: Abbreviated building name + LOT + number of parking lot + abbreviated compass direction of door relative to the center of the parking lot. Example: JCK LOT R10 S.

3. Exterior Camera Mounted to Parking Garage Viewing Garage: Abbreviated building name + EXT + GAR + floor + abbreviated compass direction of door relative to the center of the garage. Example: SPCK EXT GAR 1st N.

4. Exterior Camera Mounted to Building Viewing Area Around Building: Abbreviated building name + EXT + abbreviated name of area covered + abbreviated compass direction of area viewed relative to the center of area viewed. Example JCK EXT 27 NW (if more than one camera at entrance
**SECTION 28 23 00– Video Surveillance System**

for the same purpose includes decimal designator to name of area covered).

5. **Exterior Camera Mounted to Light Pole Viewing Parking Lot:** Abbreviated name of area viewed + EXT + abbreviated building name of nearest building + abbreviated compass direction of area viewed relative to the center of area viewed. Example: Ponds EXT JCK E.

6. **Exterior Camera Mounted to Light Pole Viewing Parking Lot:** LOT + number of parking lot + abbreviated compass direction of area viewed relative to the center of the parking lot. Example: Lot R5 SW.

7. **Interior Camera Mounted Viewing Building Entrance:** Abbreviated building name + INT + floor + number of door + abbreviated compass direction of door relative to the center of the building. Example: JCK INT 1st 27 NW (if more than one camera at entrance for the same purpose included decimal designator).

8. **Interior Camera Mounted Viewing Interior Room:** Abbreviated building name + INT + number of room. Example JCK INT 202 (if more than one camera at entrance for the same purpose includes a decimal designation at end of sequence. Example: JCK INT 202.1).

9. **Interior Camera Mounted Viewing Interior Area:** Abbreviated building name + INT + Floor + abbreviated name of area viewed. Example JCK INT 1st Lobby (if more than one camera used for the same area include a decimal designator. Example: JC INT 10th Hallway.1.)

10. **Interior Camera Mounted Viewing Building Elevator Cab:** Abbreviated building name + INT + Elev + Elevator number. Example: JCK INT Elev 1 (if more than one camera used for the same area includes a decimal designator).

11. **Interior Camera Mounted Viewing Garage Elevator Cab:** Abbreviated building name + INT + GAR + Elev + Elevator number. Example: JCK INT Elev 1 (if more than one camera used for the same area includes a decimal designator).

12. **Special Use Cameras:** Abbreviated building name + Number of room + abbreviation of department name + decimal designation. Example: JCK 202 Chem-1).

13. **Video Encoders:** END + abbreviated building name + number of room installed + decimal designator. Example: End JCK 202.1
SECTION 28 23 00– Video Surveillance System


3.03 Records

A. A record is a collection of information about or related to a specific element of the video surveillance system. Records must be maintained in a computer spreadsheet, or in a computer database. Submit proposed record format to Access Control for approval. Paper records are encouraged, but are optional. A device and cable record is prepared for each camera/device/door installation. The record will show the camera/device/door name, and must describe the components from origin point and destination point. The device and cable record will record what services and/or connections are assigned to each installed location based on Camera number. An equipment record is prepared for services distributed from a certain piece of equipment, such as an encoder, controller, or a system.

3.04 Drawings

A. Drawings are used to illustrate different stages of video surveillance system installation planning, installation, and administration.

B. Installation or Construction Drawings

1. Installation or construction drawings are the plans that show the installer how the infrastructure and devices are to be installed. The quality of the installation can be directly impacted by the level of detail in the installation drawings and written specifications. Installation drawings for Texas State projects shall, at a minimum, device installation, show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and wiring details including identifier assignments.

C. As-built Drawings

1. The as-built drawings graphically document the installed video surveillance devices and infrastructure through floor plan, elevation, and details drawings. In many cases, these drawings will differ from the installation drawings because of changes made during construction and specific site conditions. In the as-built drawings, the identifiers for major infrastructure components must be recorded. The pathways, spaces, and wiring portions of the infrastructure each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings. As-built drawings are a vital component of the administration system, and must be kept current as adds, moves, and changes take place.
SECTION 28 23 00– Video Surveillance System

Texas State University requires the installer to provide a complete and accurate set of as-built drawings.

3.05 Labeling and Color Coding

A. It is important that both labeling and color coding be applied to all video infrastructure components. Labeling with the unique identifier will identify a particular component. Proper color coding will quickly identify how that component is used in the overall systems infrastructure of the facility.

B. Labeling

1. Labels are generally of either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.

2. Outside plant labels shall be totally waterproof, even when submerged.

3. All labels shall be machine printed.

4. Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.

5. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used, and must be used in the manner intended by the manufacture.

C. Color Coding – Cable Termination Fields

1. Color coding shall be applied to all cable termination fields in Telecommunications Closets, Equipment Rooms, and Entrance Facilities. Color coding may also be used to identify specific cables in a pathway, or the function of specific equipment racks or equipment. The same color is always applied to both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the plywood backboard behind the termination block, may be the color of a plastic cover on a termination block, or may be the actual color of the insert label on a termination block or patch panel. See Communications 27 00 00 Construction Standards of the Texas State University.

D. The following color code shall be used in all Texas State facilities relative to the video surveillance system:

1. Neon-Green – Video Surveillance
SECTION 28 23 00– Video Surveillance System

END OF SECTION 28 23 00
SECTION 28 31 00 – FIRE DETECTION AND ALARM

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Fire Detection and Alarm.

B. The design guidelines contained herein include the requirements for systems and materials for fire protection systems at Texas State University. It is the intention of this document to provide a minimum standard for fire protection systems at Texas State University so as to provide the highest level of fire safety possible; it is not intended to be a guide specification.

C. SPECIAL NOTE: Texas State University requires all buildings with monitored fire alarm systems to be programmed for General Alarms and full evacuation.

1.02 Reference Standards

A. This is to be used in the development of all fire alarm and signaling system designs for buildings and structures on Texas State University campuses.

B. This standard is to apply to all fire alarm and signaling system components and equipment installed at Texas State University campuses during new construction, or as part of any improvement project.

C. The work addressed in this section consists of a fire protection system, which may include, and at least will be coordinated with, all of the following building systems or components:

1. Fire Suppression Systems.
2. HVAC, fire, smoke, and combination fire/smoke dampers.
3. Emergency power systems.

PART 1: GENERAL

5. Central Control and Monitoring System.

D. Referenced Publications: The documents or portions that are listed in this section shall be considered part of the requirements of this document. (Utilize most recent editions)

1. NFPA 1, Uniform Fire Code
2. NFPA 13, Standard for the Installation of Sprinkler Systems
3. NFPA 14, Standard for the Installation of Standpipe and Hose Systems
SECTION 28 31 00 – FIRE DETECTION AND ALARM

4. NFPA 17, Standard for Dry Chemical Extinguishing Systems
5. NFPA 17A, Standard for Wet Chemical Extinguishing Systems
6. NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection
7. NFPA 70, National Electrical Code
8. NFPA 72, National Fire Alarm and Signaling Code
9. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
10. NFPA 92, Standard for Smoke-Control Systems
14. IBC-International Building Code
15. IFC-International Fire Code
16. UL Standard 268, Smoke Detectors for Fire Protective Signaling Systems
17. UL Standard 268A, Smoke Detectors for Duct Application
18. UL Standard 346, Water flow Indicators for Fire Protective Signaling Systems
20. UL Standard 864, Control Units for Fire Protective Signaling Systems
21. UL Standard 1424, Cables for Power—Limited Fire Protective Signaling Systems
22. UL Standard 1480, Speakers for Fire Protective Signaling Systems
23. UL Standard 1481, Power Supplies for Fire Protective Signaling Systems
24. UL Standard 1711, Amplifiers for Fire Protective Signaling Systems
25. UL Standard 1971, Signaling Devices for the Hearing Impaired
26. UL Standard 2572, Control and Communication Units for Mass Notification Systems
27. ADA-Americans with Disabilities Act
28. TAS-Texas Accessibility Standards
29. American Society of Mechanical Engineers (ASME)/American National Standards Institute (ANSI)
30. ANSI A17.1, Elevator Code, latest edition
32. ANSI A117.1, Accessibility Code, latest edition

1.03 General Conditions and Special Conditions:

A. The Contractor:

1. The Contractor shall furnish all equipment, materials, tools, labor, engineering, drawings, etc. Necessary for a complete fire alarm system, with said system Being made ready for operation in accordance with the requirements of the authority having jurisdiction (AHJ), as follows.

2. The purpose of the contract documents is to convey to the Contractor the scope of work required, all of which the Contractor is responsible to furnish, install, adjust, and make operable.

Revised June 2016
3. The omission by the contract documents of any necessary system component(s) as required by the Authority Having Jurisdiction (AHJ) or applicable codes shall not relieve the Contractor of the responsibility for providing such necessity, without additional cost to the Owner.

4. The Contractor shall visit the site before submitting his bid and shall examine all existing physical conditions, which may be material to the submission of the bid or performance of his work.

5. No extra payments will be allowed to the Contractor as a result of extra work made necessary by his failure to adequately assess the physical conditions of the job site.

6. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Owner and/or Engineer for clarification prior to the bid due date.

1.04 Performance Guidelines:

A. Provide labor, materials, and equipment for a complete and functional fire alarm and supervisory signaling system as outlined. The Contractor shall be responsible for compliance with the entire project specifications as well as the following guidelines:

1. Point addressable multiplex fire alarm control equipment, multiplex transponders, alarm signal initiating devices, notification appliances, annunciators, switches, relays, software and accessories.

2. Monitoring of all fire alarm systems installed on Texas State University campuses shall be monitored by the EST FireWorks campus monitoring system for fire protection. This monitoring shall utilize the campus Ethernet IP configuration. All IP addresses needed for this installation will be issued by Technical Services to reside on their VLAN.

3. When remodeling an existing building or space, maintain the existing fire alarm systems in operational condition during the project.

4. Core drilling and fire stopping.

5. Cutting, patching and painting.

6. Detailed shop drawings.

7. Coordination of the work with other trades for this project and coordination with any other Owner projects ongoing at the time of Fire Alarm Contractor’s work.

8. On-site project supervision.
SECTION 28 31 00 – FIRE DETECTION AND ALARM

9. Permits, fees, and other charges required for the work.

10. Record documents.

11. Operating and maintenance instructions.

12. Training of Owner’s personnel.

13. System testing, to include third party acceptance and 100% pre-testing prior to acceptance testing with the designated inspector from the office of Environmental Health, Safety, and Risk Management.

14. Warranty of equipment and labor.

15. Conducting weekly job progress meetings and issuing weekly written job progress reports to the Project Representative.

16. During the construction, it is the responsibility of the Contractor to assure that there is no disruption of the University’s normal functions, such as studying, testing, classes, research or administration.

1.05 System Abbreviations and Definitions:

A. ADAAG: Americans with Disabilities Act Accessibility Guidelines.

B. AFF: Above Finished Floor.

C. AHU: Air-handling unit.

D. AHJ: Authority Having Jurisdiction Texas State University EHS/RM (512-245-3616)

E. Approved: Unless otherwise stated, materials, equipment or submittals approved by the Owner, Engineer, or AHJ.

F. Circuit: Wire path from a group of devices or appliances to a control panel or transponder.

G. Concealed: Where used in connection with installation of piping or conduit and accessories, shall mean “hidden from sight” as in shafts, furred spaces, in soffits, or above suspended ceilings.

H. Contractor: The company awarded the prime contract for this work and any of its subcontractors, vendors, suppliers, or fabricators.

I. CPU: The central computer of a multiplex fire alarm control system.

J. Engineer: Professional Engineer or NICET III

K. Exposed: Where used in connection with installation of conduit and accessories, shall mean “visible” or “not concealed”.

L. FACP: Fire Alarm Control Panel.

M. FM: Factory Mutual.

N. Furnish: Supply materials.

O. HVAC: Heating Ventilating and Air Conditioning.

P. IDC: Initiating Device Circuit.
SECTION 28 31 00 – FIRE DETECTION AND ALARM

Q. Install: Install materials, mount, and connect equipment or assemblies.
R. LED: Light Emitting Diode.
S. Listed: Materials or equipment included in a list published by a nationally recognized laboratory that maintains periodic inspection of production of listed equipment and materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.
T. LCD: Liquid Crystal Display.
V. NAC: Notification Appliance Circuit.
X. Owner: Texas State University
   601 University Drive San Marcos, Texas 78666-4609
Z. RTP: Remote Transponder Panel. AA.
   SLC: Signaling Line Circuit.
BB. Style 4: As defined by NFPA 72, 2010 edition. CC.
   Style 7 As defined by NFPA 72, 2010 edition.
DD. Supervisory: Signal indicating the need of action in connection with the supervision of fire suppression systems or equipment or with the maintenance of related systems.
EE. Transponder: Single or multiple zone/point data collection panel used within a multiplex system.
FF. Trouble: Signal initiated by the fire alarm system, indicative of a fault in a monitored circuit or component.
GG. UL Listed: Materials or equipment listed by Underwriters Laboratories, Inc. (UL) and included in the most recent edition of the UL Fire Protection Equipment Directory.
HH. Zone: Combination of one or more circuits or devices in a defined building area, i.e. 3 speaker circuits on a floor combined to form a single zone.

1.06 Objectives

A. This standard is intended to achieve consistently high levels of fire detection/alarm system performance by:

1. Allowing designers to incorporate required or desired features as early in the design development process as possible.

2. Assuring all systems are designed to meet all applicable codes, ordinances, laws, and sound engineering practices.

3. Providing a basis for a general understanding among all parties involved in the design of systems.
SECTION 28 31 00 – FIRE DETECTION AND ALARM

1.07 Concepts

A. All systems are to be compliant with applicable paragraphs of NFPA 101 "Life Safety Code".

B. All systems are to be compliant with the requirements of NFPA 72 "National Fire Alarm and Signaling Code".

C. All systems are to be compliant with approved types, styles, and equipment as approved by Facilities/Tech Services and Environment Health, Safety, and Risk Management.

1.08 System Features

A. All system product lines shall be comprised of components capable of providing the following features when appropriate and specified by the project documents or the University:

1. General alarm notification.
2. Positive alarm sequence.
3. Voice alarm notification.
4. Fireman's communications, with an Annunciator Panel, having remote microphone capability.
5. Elevator capture/recall.
6. Elevator power shunt trip.
7. Smoke control/fan shutdown.
8. Door release.
9. Release locks on normally locked egress doors.
10. Release and monitoring of clean agent and/or pre-action sprinkler systems.
11. Alarm Verification.
12. Monitor non-water based fire suppression systems.

B. Provide audible notification throughout the building in accordance with NFPA 72. Provide an individually silence-able 10 inch, 24 VDC general alarm bell on the building exterior. Provide remote microphone capability.

C. Visual notification to ADA levels and TAS requirements shall be provided throughout the building.

D. Smoke detectors shall be provided at all elevator lobbies, elevator equipment rooms and elevator hoist ways to perform capture/recall functions; excepting elevator pits, where heat detectors shall be utilized in place of smoke detectors.

E. All systems shall be designed to provide manual means of alarm initiation at every exit from every level. Elevators are not to be considered an exit or means of egress.
F. Duct detectors for damper control shall be located within 5 feet of the damper. Install per IBC methods of coverage.

1.09 System Operation:

A. The point addressable fire alarm and supervisory signaling system shall perform the following functions:

1. Continuous monitoring of the status of all fire alarm and supervisory signal initiating devices.

2. Visible point annunciation of all fire alarm point trouble conditions at FACP.

3. Continuous monitoring of all fire alarm transponders.

4. Operation of indicated control functions.

5. Notify the campus fire alarm monitoring system and be associated to the building graphics.

B. Change in status of any initiating device on the system shall:

1. Activate audible and visible status change indicators and display the system point number, point description, status and message associated with the point.

2. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log.

3. Notify the campus fire alarm monitoring system and be associated to the building graphics.

C. Activation of any manual station, smoke detector, heat detector, or other initiating device shall cause the following functions to occur:

1. Manual station operation shall:

   a. Activate audible and visible status change indicators, display the system point number, point description, and message associated with the point on the system’s operator terminal.

   b. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log.

   c. Activate the audible and visible notification appliances throughout the building.
d. Notify the campus fire alarm monitoring system and be associated to the building graphics.

2. Spot type heat detector or spot smoke detector operation shall:
   a. Activate audible and visible status change indicators; display the system point number, point description, status and message associated with the point on the system’s operator terminal.
   b. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log.
   c. Activate the audible and visible notification appliances throughout the building.
   d. Notify the campus fire alarm monitoring system and be associated to the building graphics.
   e. Notify the campus fire alarm monitoring system and be associated to the building graphics.

3. Duct smoke detector activation shall:
   a. Activate audible and visible status change indicators and display the system point number, point description, status and message associated with the point on the system’s operator terminal. Duct detector shall report a supervisory and shut down its associated unit.
   b. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log as a supervisory.
   c. Shut down the fan unit associated with the duct detector or activate the appropriate smoke exhaust function.
   d. Notify the campus fire alarm monitoring system and be associated to the building graphics.

4. Elevator lobby or elevator machine room smoke or heat detector operation shall:
   a. Activate audible and visual status change indicators and display the system point number, point description, and message associated with the point on the system’s operator terminal.
   b. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log.
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c. Immediately recall the affected elevators to the lobby level. If the alarm is on this level, recall the elevators to the alternate level. When appropriate with the sequence of operation, heat detectors in the elevator machine room and/or elevator hoist way shall shunt the elevator. All machine room detectors and hoist way detectors shall activate a flashing fire hat in the elevator cab.

d. Activate the audible and visible notification appliances throughout the building.

e. Activate the campus fire alarm monitoring system.

f. Upon alarm silence activation, audible and visible notification appliances in the affected area shall be silenced and shut off.

g. Notify the campus fire alarm monitoring system and be associated to the building graphics.

D. Removal of any device, wiring disarrangement, or system component failure shall display on the fire alarm system operator’s terminal, the change of status, time, date, point description and the message associated with the point.

1.10 Applicable Standards:

The following standards and guides (of the issue indicated) are hereby made a part of this work by reference thereto:

A. National Fire Protection Association (NFPA):

1. NFPA 1, Uniform Fire Code
2. NFPA 13, Standard for Installation of Sprinkler Systems
3. NFPA 14, Standard for Installation of Standpipe and Hose Systems
10. IBC- International Building Code
SECTION 28 31 00 – FIRE DETECTION AND ALARM

11. IFC- International Fire Code

B. Underwriters Laboratories, Inc. (UL):

4. UL Standard 346, Water flow Indicators for Fire Protection Signaling Systems
9. UL Standards 1480, Speakers for Fire Protective Signaling Systems
11. UL 1711, Amplifiers for Fire Protective Signaling Systems


D. TAS- Texas Accessibility Standards

E. American Society of Mechanical Engineers (ASME)/American National Standards Institute (ANSI):


1.11 Submittals:
SECTION 28 31 00 – FIRE DETECTION AND ALARM

A. Prior to installation, the following documents shall be provided to Texas State University for reference and or approval:

1. Shop Drawings: Shall be prepared using latest AutoCAD. Shop drawings shall be drawn to scale: \( \frac{1}{8} " = 1' - 0" \) for floor plans and \( \frac{1}{4} " = 1' - 0" \) for details. Drawings shall not be reproduced or copied in contractor’s preparation of shop drawings. Include manufacturer’s name, model numbers, ratings, power requirements, equipment layout, conduits, device arrangement, and complete point to point wiring diagrams along with other required information including but not limited to:

   a. General Drawing Notes.

   b. Complete panel layout showing location of all modules, power supplies and batteries.

   c. Complete panel layout showing all field terminations.

   d. Main panel elevations.

   e. Complete system riser diagrams.

   f. Electrical back box requirements.

   g. Control Equipment Schedules.

   h. Panel Schematics showing all connections, between modules within the panels, to all modules from field wiring with zones identified.

   i. Scale floor plans with layout of all devices with point numbers for initiating and notification devices, wiring connections, zones, wire size, and routing.

   j. Detailed Legend

   k. Fire Safety and related symbols shown on drawings and diagrams shall comply with NFPA70.

   l. Detailed Input/ Output Matrix.

   m. The contractor shall provide a signed "fire alarm and emergency communication system inspection and testing form for each system, consisting of completed copies of the appropriate pages from NFPA 72, at the final acceptance test. The fire alarm contractor shall attach the appropriate fire alarm tags to the panel as required by the State of Texas.
SECTION 28 31 00 – FIRE DETECTION AND ALARM

B. Product Data: Provide electrical characteristics, connections’ requirements, and compatibility listings showing that components are compatible with each other, including but not limited to:

1. Manufacturer’s data sheets with equipment to be used highlighted,
   a. Fire Alarm Control Panel
   b. Wiring
   c. Batteries
   d. Detectors
   e. Manual Pull Stations
   f. Audible Signaling Devices
   g. Visual Signaling Devices
   h. Control Devices
   i. Annunciator Panel
   j. Remote Microphone

2. Wiring diagrams of all equipment,

3. Installation instructions for all equipment,

4. Equipment testing procedures,

5. Equipment maintenance manuals

6. Wire data sheets

C. Software and Database Information:

1. Proposed point numbers,

2. Labels of all addressable devices,

3. Complete sequence of operation with input/output matrix for all points

4. English action messages.

D. System Calculations:

1. Complete calculations shall be provided which show the electrical load on the following system components:
   a. Each system power supply, including standalone booster supplies.
   b. Standby Battery Calculations plus a 20 percent de-rating factor.
SECTION 28 31 00 – FIRE DETECTION AND ALARM

c. Voltage drop calculations for each type of circuit (identify all mathematical formulas, variables, and constants).

d. dB loss calculations for speaker circuits.

e. Speaker circuit loading and amplifier loading.

f. Strobe circuit loading with 20% available capacity and the 4th circuit left for future use.

f. Provide 10amp power supplies.

g. Calculations for sounder base power shall include all base's being activated simultaneously on each auxiliary control circuit that draws power from any system power supply.

E. Submittal packages shall be signed by NICET III or signed and sealed by a Professional Engineer (P.E.) registered in the State of Texas.

F. Prior to start of construction, submit the information outlined in A, B, C, D, and E above to the following:

1. Three complete submittal packages to the Project Representative for review by the Owner and Engineer.

G. Costs incurred by the Owner for the Engineer or the Project Representative to review additional submittals resulting from an initial rejection shall be the responsibility of the submitting contractor.

H. PARTIAL SUBMITTALS ARE NOT ACCEPTABLE.

1.12 Unit Prices:

A. The Contractor shall provide with his bid unit prices for the following list. The unit prices shall include the device, installation, conduit, wire, programming, testing and any other required installation for additions and or modifications (change orders).

1. Point Addressable smoke detector.

2. Point Addressable duct smoke detector.

3. Point Addressable heat detector.

4. Point addressable manual station.
SECTION 28 31 00 – FIRE DETECTION AND ALARM

5. Point addressable monitor module.
6. Point addressable control module.
8. Ceiling Multi-Cd Strobe
9. Ceiling Multi-Cd Speaker Strobe

1.13 Delivery, Storage and Handling of Materials:

A. The Project Representative will designate an area for storage of all materials. At the end of each working day, all materials shall be returned to the designated area. Material, equipment, tools, etc. will not be left outside the storage area without the consent of the Project Representative.

B. The cost of all material handling, delivery and freight is the Contractor’s responsibility. The Owner or his representatives will not be responsible for materials delivered to the site.

C. Maintain premises free from accumulation of waste materials or rubbish caused by this work. At the completion of the work, remove all surplus materials, tools, etc., and leave the premises clean to the Owner’s satisfaction.

1.14 Quality Assurance:

A. The company specializing in installing the products specified in this section must demonstrate a minimum of five years’ experience. The company shall also employ NICET certified personnel in the Sub-field of Fire Alarm Systems, for the engineering and technical installation and supervision of the system. This certification shall be Level III for engineering and Level II for technical installation and supervision. Proof of certification shall be provided, along with a complete list of project personnel. All work shall be performed by skilled technicians, under the supervision and direction of the designated NICET Engineering Technician, all of whom shall be properly trained and qualified for this work.

B. The installing Fire Alarm Contractor shall hold a current license, issued by the State of Texas Commission on Fire Safety, to design, install, and service fire detection and alarm equipment.

C. The Fire Alarm Contractor shall maintain a fully staffed branch office including application engineers, drafters and technical service personnel.
SECTION 28 31 00 – FIRE DETECTION AND ALARM

D. All supplied equipment shall be standard products of the manufacturer and regularly stocked within the manufacturer’s branch office.

E. All technical service personnel shall be regularly employed by the fire alarm system contractor.

F. All electrical installation of the fire alarm system, including wire installation and terminations, shall be performed by electricians in the employ of the Fire Alarm Contractor.

G. Any subcontractors used to install portions of the system shall be approved by the Project Representative prior to commencement of the installation.

PART 2: PRODUCTS

2.01 Fire Alarm Control Panel (FACP):

A. Provide a UL listed point addressable fire alarm control system. **Acceptable supplier EST** or preapproved equivalent.

B. Products shall be of the latest version. Models acceptable are EST-3 or preapproved equivalent. Obsolete or discontinued models are not acceptable.

1. Acceptable model for Round Rock Campus is EST-3 or preapproved equivalent

C. All fire alarm control panels must be intelligent, addressable Central Processing Units (CPU) based and meets the latest edition of UL 864

D. All FACPs must be capable of providing circuit integrity monitoring for all Signaling Line Circuits at a level of Class A, Style 6, as defined in NFPA 72

E. All fire alarm initiating devices and notification appliances in finished areas shall be white.

F. All FACPs must be capable of providing circuit integrity monitoring of Initiating Device Circuits (IDC's) at a level of Class B as defined in NFPA 72.

G. Manufactured terminal boxes labeled “FIRE ALARM TERMINAL BOX” Space Age TC2 series or equal.

H. With each installed field device affix a label to indicate the device’s full address on its signaling line circuit.
SECTION 28 31 00 – FIRE DETECTION AND ALARM

I. Mark each cable or wire to designated terminal with labeling tool in all junction boxes, terminal cans, riser cans, ins and outs of devices in the field, and at the FACP.

J. All FACPs must provide twenty percent (20%) excess power supply, input circuit, and output circuit capacity at final acceptance to allow for future expansion by the owner on the Signal Line Circuit (slc).

K. Zone labeling must be textual by alpha-numeric display at the FACP and remote annunciator to allow “first response” by persons not trained in fire alarm technology.

L. Textual (alpha-numeric) language must be conventional, concise, clear and accurate to facilitate rapid response.

M. All FACPs must provide a control to silence the Public Alarm to allow for maintenance and testing, and to reduce disruption to include sounder bases, visual notification, and audible notification.

N. All FACPs must provide a control to override for door holder release, smoke control/fan shutdown feature, sounder base, water flow, strobes, speakers and damper activation to allow for maintenance and testing. Program panel to allow functions to be disabled by floor or by group as required by Texas State University.

O. All FACPs must be connected to a Primary and Secondary Power source. The secondary power supply must be sized to provide 15 minutes of operation in alarm conditions after 24 hours of system operation in standby power. Where voice evacuation systems are utilized, 15 minutes of alarm shall be provided.

P. All FACPs must provide a separate digital address for each initiating device to facilitate rapid response and maintenance and testing.

Q. All FACPs must provide a separate digital address for each individual flow switch and tamper switch.

R. All programming must be permanent and non-volatile to reduce outage time due to failure.

S. All FACPs must be listed and approved and the smoke detector sensitivity test level set to reduce maintenance costs.

T. All FACPs must be capable of providing drift compensation. Drift compensation is considered equal to adjustability at the detector.
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U. All FACP's must be field programmable, using internal or connected components, for all changes, alterations, modifications, additions, deletions and hardware and software upgrades.

V. All voice evacuation messages shall be in a female voice.

W. All FACPs shall be capable, using internal or connected components, of generating comprehensive reports for sensitivity, verification counts, address registers.

X. A fault isolation device shall be provided electrically between each building level and building wing. This device shall be capable of automatically isolating wire-to-wire faults on each SLC to the building level or wing involved. The device shall be powered by the SLC loop. The device shall provide visual indication at the device of a short circuit (isolate) condition. The device shall reset to the normal mode upon elimination of the wire-to-wire short. All fault isolation devices shall be physically located within the terminal box for that floor.

Y. All nodes to have 120VAC surge protection and dedicated 120vac. Acceptable models: Eaton model AGPH12005 or preapproved equivalent provided by the fire alarm contractor and installed by the electrical contractor.

2.02 Point Addressable Multiplex Equipment:

A. The FACP shall be wall mounted and installed where shown on the drawings. The FACP shall be equipped with locked enclosures having removable access panels for servicing of electronic components. All controls and displays shall be mounted at heights allowing easy access by operating personnel. The FACP shall include, but not be limited to, the following major components, some of which may be physically separate from the main cabinet:

   1. Central processing equipment.
   2. Normal AC power supplies.
   3. Data transmission equipment.
   4. Mass data storage (if required).
   5. Emergency power supplies.

B. The central processing unit (CPU) shall be a “mini” or “micro” computer, listed in accordance with UL 864. The main memory system shall be adequately sized to provide display, print out and control of 150 percent of the actual alarm and command points as described herein and indicated on the drawings. All basic alarm and control software shall be included and be at the latest edition of SDU. The CPU shall be completely field programmable and all data entered shall reside in the system memory.
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C. The CPU shall be equipped with a nonvolatile main memory system of EPROM, battery protected RAM, or EEPROM memory system. The mass storage system shall be equipped with all necessary control hardware and software.

D. Normal operating power for the FACP shall be 120 volt AC supplied from dedicated circuits (of the emergency power panel, if provided). All circuits shall be protected by circuit breakers of proper size. In addition, the CPU shall be provided with an emergency battery standby power system, which shall operate the system for 24 hours in the standby mode and 15 minutes in full alarm condition. Remotely powered Audio/visual alarms must also function in a power outage.

E. The system operating terminal shall be the liquid crystal display type (LCD). The LCD shall include, at a minimum, control function keys, digital display window, programming keys and key-operated lock-out capability. Programmable bypass switch Control Display Module of 12 LEDs and switches. Programmed per owner’s instructions.

F. The time shall be permanently displayed on the LCD and shall be visible at all times. The LCD shall allow the operator to perform the following minimum tasks:

1. Inquire point status.
2. Start or stop equipment manually.
3. Test and reset equipment manually.
4. Initiate control by event sequences.
5. Bypass control zones and points during manual system tests.
6. Push button bypasses shall be installed to bypass all outputs.
7. Manually request “logs” of system status.
8. Acknowledge status changes.
10. Monitor and control smoke detector sensitivity.

2.03 Expansion / Transponder Panels:

A. Remote multiplex input/output (RTP) panels shall be provided as required. The cabinets shall be surface mounted with a locking door or cover.
B. The RTP panels shall accommodate all specified alarm input points, supervisory input points, command points and shall allow a 20 percent expansion of connected points. All assemblies within the RTP panels shall be modular to allow for expansion and servicing of equipment. All power supplies, standby power, motherboards and terminal strips shall be included to accommodate specified future expansion so that expansion can be accomplished by simple installation of circuit boards and wiring to remote devices.

C. Normal system power shall be provided by the dedicated circuits. A standby power supply shall be provided at each RTP cabinet location, which shall operate the system for 24 hours upon loss of normal AC power and 15 minutes in full alarm mode. Emergency power circuit shall recharge the unit to normal capacity within 48 hours of restoration of normal power. One emergency power supply unit may power more than one RTP cabinet if all such cabinets are at one location. The loss of AC or DC power at any RTP shall cause a distinct power failure signal.

D. Batteries for emergency standby power shall be sealed lead-acid or gel cell of sufficient quantity to provide 24-hour standby with 15 minutes in full alarm. Batteries shall be mounted in a separate vented enclosure.

E. The RTP cabinets shall accept input/output (alarm and/or command) modules for the specified points and/or zones plus spares. The type of input/output modules shall include, but not be limited to the following:

1. Equipment command control modules shall provide the functions of start/stop, on/off, bypass/normal and test/reset as required for the equipment to be controlled.

2. Addressable device data transmission, supervision, control, and power.

F. The RTP panels shall accommodate all specified speaker circuits and strobe notification circuits and shall allow a 25 percent expansion of connected points. All assemblies within the RTP panels shall be modular to allow for expansion and servicing of equipment. All power supplies, standby power, motherboards, amplifiers and terminal strips shall be included to accommodate specified future expansion so that expansion can be accomplished by simple installation of circuit boards and wiring to remote devices.

G. Each remote transponder panel shall be capable of degraded mode operation. In this mode, the system shall receive an alarm from any analog or conventional initiating device and activate all indicating appliances served from the panel.

H. One backup amplifier shall be installed per panel. Backup amplifier shall be sized based on the largest amplifier in the associated cabinet.

I. Remote Strobe Power Supplies shall include:
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1. A minimum of four notification appliance circuit monitoring and control modules. The modules shall be designed to meet Style Y NAC wiring.

2. Power supply with battery charger and standby batteries. Batteries shall be sized for 24 hours in standby condition and 15 minutes in full alarm condition.

3. Provision to be supervised and activated by the main fire alarm system.

4. All remote strobe power supplies shall allow for 25% expansion and use.

5. All remote power supplies (NAC panels) shall leave the 4th circuit available for future expansion.

6. All remote strobe power supplies shall be independently activated by an addressable control module and use that control module for monitoring the power supply.

7. ALL Remote Booster Power Supplies shall be EST BPS10A or preapproved equivalent.

2.04 Point Addressable System Software:

A. As part of the initial system installation, provide all executive system software including, but not limited to, the following:

1. Basic alarm processing programs.

2. Control by event programs.

3. System point scanning routines.

4. Password control routines.

5. Emergency file display routines.


7. Provide all hardware, software, programming tools, access codes, access keys, documentation, and training necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
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8. If the system access code is either a hardware key or software key, the Contractor/Vendor shall provide the proper key to meet the above requirements.

B. Provide as part of the system all preparation and installation of data files including, but not limited to, the following:

1. Point descriptions.
2. Control by event sequences.
3. Emergency file statements.
4. Print statements.
5. Password installation.

C. Systems which rely on EPROM shall be factory reprogrammed at no additional cost to the Owner as many times as required until the system is accepted by the Owner.

D. Point/zone descriptions shall consist of English language statements which adequately define the point or zone. The use of abbreviations shall be limited to commonly used fire alarm system abbreviations.

E. System emergency file statements shall be assigned to individual points/zones to assist operator response to an emergency condition. The emergency file shall consist of English language statements which adequately define the desired action. The use of look-up tables is expressly forbidden.

2.05 Alarm Initiating Devices:

A. Manual Pull Stations

1. Provide point addressable manual stations where indicated. The manual stations shall be double-action key reset type, red with white lettering, and shall be mounted in the existing locations unless otherwise noted:
2. Surface mounted stations shall mount on a UL listed, red, smooth sided back box provided by the manufacturer. Semi-flush mounted stations shall mount on a standard electrical box.
3. Operation of a manual station shall cause its contacts to manually lock-in until manually reset and visibly indicate that the station was activated.
4. Manual stations mounted exposed to the environment shall be in weather resistant enclosures.
5. Manual pull stations shall be EST model SIGA-278 or preapproved equivalent

B. Photoelectric Smoke Detectors
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1. Point addressable analog photoelectric type smoke detectors shall be provided where indicated. The smoke detectors shall be provided with integral LEDs to indicate detectors in alarm. The detectors shall operate from the two-wire alarm initiating circuit (SLC) and be listed under UL Standard 268, latest edition.

2. Sounder base installation in ALL residence rooms. These circuits shall have power failure monitoring at the end of the circuit.

3. All residence rooms shall comply with the 520 Hz rule in NFPA 72.

4. Photoelectric smoke detectors shall be EST model SIGA2-PS with SIGA-SB4 bases in standard locations and SIGA-AB4G-LF in all sleeping rooms or preapproved equivalent

C. Duct Mounted Smoke Detectors

1. Point addressable analog photoelectric type duct mounted smoke detectors shall be provided where indicated. The duct detectors shall be provided with integral LEDs to indicate detectors in alarm. The detectors shall operate from the two-wire alarm initiating circuit (SLC). The smoke detectors listed under UL Standard 268A, latest edition, shall be provided with approved duct housings mounted on the exterior of the duct, and shall have perforated sampling tubes extending across the width of the duct. Provide an auxiliary DPDT load relay for fan shutdown control where required by the points list.

2. Each duct detector above ceiling or ceiling height 7ft shall have installed a remote test switch. Test switches shall be EST model SD-TRK or preapproved equivalent.

3. Duct detectors above ceiling grid shall have a 1” label installed on the grid or at the access to the duct detector White background red letters.

4. Duct detectors shall be EST model SIGA-SD with a sampling tube to extend the full length of the duct.

5. PRESSURE DIFFERENTIAL READINGS FOR DUCT DETECTOR SAMPLE AIR FLOW WILL BE LABELED ON THE FRONT OF THE DETECTOR.

D. Heat Detectors

1. Point addressable heat detectors listed under UL Standard 521, latest edition, shall be provided where indicated. The heat detectors shall be rate compensated type or analog type. Intelligent heat detectors shall be EST model SIGA2-HRS with SIGA-SB4 bases or preapproved equivalent.

2. Conventional rate of rise heat detectors listed under UL Standard 521, latest edition, EST model 302-ET or preapproved equivalent, shall be provided where indicated. Temperature ratings of the heat detectors shall be appropriate for the area protected.
3. Addressable point monitoring interface modules shall be used to monitor the conventional heat detectors. The interface modules shall provide Style B electrical supervision of monitored devices.

4. Conventional heat detectors listed under UL Standard 521, latest edition, EST model 302-ET or preapproved equivalent shall be installed in all outside elevator lobbies, or specified areas by Tech Services.

5. Addressable point monitoring interface modules shall be used to monitor the conventional heat detector and be installed in weatherproof enclosures. The interface module shall provide Style B electrical supervision of the monitored device.

E. Project-Beam Detector

1. All projected-beam detectors must operate on the infrared principle.

2. All projected-beam detectors must have automatic gain control circuits to compensate for deterioration of signal strength due to environmental factor such as dirt accumulation, component aging and temperature fluctuations.

3. Transmitting and receiving units of projected-beam detectors must be protected from physical damage.

4. All projected-beam detectors must have circuits to prevent “false” alarms due to sudden and complete obscuration.

5. All projected-beam detectors shall be installed in a safe and accessible manner.

F. Air Sampling Smoke Detection

1. Provide air sampling smoke detection if required by the project.

2. Locate air sampling smoke detection ports in accordance with NFPA 72 and manufacture’s requirements.

3. Maintain a maximum transport time of 120 seconds, or the transport time specified by the manufacturer, from the farthest sampling point, whichever is less.

4. Utilize CPVC piping that is listed for use in air sampling systems. Label piping as required per NFPA 72.

5. Air sampling system shall be VESDA or preapproved equivalent

G. Water Flow Switches
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1. Fire detection / alarm systems must be interconnected to the fire alarm sprinkler systems by water flow switches and must be set for a 60 second delay prior to “ALARM”.

2. Each water flow switch shall be monitored by an addressable module on the SLC.

3. It is the responsibility of the Sprinkler Contractor to locate the water flow switches to assure indication of water flow within the building and at each level of the building.

4. Water flow switches shall be monitored by a SIGA-CT1, SIGA-CT1HT, SIGA-CT2, or SIGA-MCT2 or preapproved equivalent. Contractor shall not use the SIGA-WTM module.

H. Supervisory (Tamper) Switches

1. Connect tamper switches installed on all sprinkler, PIV, or standpipe valves to the fire alarm system to indicate closing or opening of the valves.

2. Each tamper switch shall be monitored by an addressable module on the SLC.

3. It is the responsibility of the Sprinkler Contractor to locate the tamper switches to assure indication of the valve position within the building and at each level.

4. Tamper switches shall be monitored by a SIGA-CT1, SIGA-CT1HT, SIGA-CT2, or SIGA-MCT2 or preapproved equivalent. Contractor shall not use the SIGA-WTM module.

2.06 Alarm Notification Appliances:

A. Fire alarm system audible notification is required to be provided by speakers in all buildings. The fire alarm signal generated must be the distinctive three-pulse temporal pattern described by NFPA and ANSI codes.

B. Provide audible systems with voice intelligibility measured in accordance with the guidelines in Annex A of IEC 60849, Sound Systems for Emergency Purposes. When tested in accordance with Annex B, Clause B1, of IEC 60849, the system shall exceed the equivalent of the common intelligible scale (CIS) score of 0.70.

1. Voice Alarm Notification

   a. Provide speakers for announcement of voice messages. Signals generated shall be Distinctive Evacuation Signal (three pulse temporal pattern) alternated with the custom massage.
b. Audible Message--- “Attention, please! Attention, please! An emergency situation has been detected in the building. Please evacuate immediately in accordance with safety and security regulations. Use stairwells; do NOT use the elevators. Repeat: use stairwell; do NOT use elevators. Go to your assigned area outside the building or follow the instructions of the staff or emergency personnel. Do not re-enter the building until instructed to do so by emergency personnel. Please evacuate the building immediately.”

c. Digitized audible evacuation messages shall sound once and shall be preceded by a minimum of two cycles of the three pulse temporal pattern emergency evacuation signal.

d. Provide Annunciator Panel with Remote Microphone capability.

C. Strobe units, listed to UL Standard 1971, shall be provided where indicated. Whenever possible, units shall be ceiling mounted. Wall mounted units, if necessary due to installation environment shall be semi-flush type. The units shall operate on 24 volt DC polarized power to allow for supervision. The strobe minimum effective intensity shall be 15 candelas and have a flash rate of 1 to 3 Hertz as defined by UL 1971. All strobes shall be ceiling mounted.

D. All notification devices shall be white in color and without the word “FIRE” on the device. Switch to blank for Mass Notification.

E. Strobes may be combined with speakers where shown on the drawing.

F. All visual notification appliances must be xenon strobe, compliant with the current requirements of ADA and TAS.

G. All visual notification devices within a room or adjacent space within field of view must be synchronized as required per NFPA 72.

H. Ceiling mounted strobes and speaker/strobes shall be used where installation location meet manufactures and NFPA 72 guidelines.

I. Speakers shall be provided where indicated. Sound pressure level shall be 15 dB above ambient or 5dB over maximum having of over 60 seconds whichever is greater per the latest edition of NFPA 72 throughout the building. 520Hz speakers to be installed in all sleeping rooms.

1. Average Ambient Sound Level According to Location. The following sound levels shall be used for design purposes.

   a. Business occupancies 55 dB
   b. Educational occupancies 45 dB
   c. Industrial occupancies 80 dB
   d. Institutional occupancies 50 dB
   e. Mercantile occupancies 40 dB
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f. Mechanical rooms 85 dB

g. Places of assembly 55 dB

h. Residential occupancies 35 dB

i. Storage occupancies 30 dB

J. Sounder Base notification shall be used in all dormitory residence rooms.

2.07 Monitoring:

A. Monitoring of all fire alarm systems installed on Texas State University campuses shall be monitored by the EST FireWorks campus monitoring system for fire protection. This monitoring shall utilize the campus Ethernet IP configuration. All IP addresses needed for this installation will be issued by Technical Services to reside on their VLAN.

B. Monitoring shall consist of graphics for all-addressable points in the fire alarm system. Point associations shall be completed between the point and the graphics.

2.08 Control Devices:

A. Provide addressable control module and isolation relays (MR101 style) for all interconnections to other systems for controls. (control module shall be a siga cc1s or mcc1s) or preapproved equivalent 24VDC control voltage for the isolation relays shall come from the fire system 24VDC power and will be monitored for integrity. Control devices as such but not limited to:

1. HVAC Control - Provide relays/contacts for fan shutdown and smoke control sequence where indicated. The control relays/contacts shall be 24 volts DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty. (MR101 style) or preapproved equivalent

2. Elevator Controls Provide control relays/contacts for elevator recall where indicated. The control relays/contacts shall be MR101 style or preapproved equivalent, 24volt DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty. (MR101 style) or preapproved equivalent

3. Security Controls Provide control relays/contacts for security tie in where indicated. The control relays/contacts shall be MR101 style or preapproved equivalent, 24volt DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty.

4. Fire Damper Control Provide control relays/contacts for fire dampers where indicated. The control relays/contacts shall be MR101 style or preapproved equivalent, 24volt DC low voltage type, each with number of contacts as required.
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and housed in metal enclosure. The contacts shall be rated as required for continuous duty.

a. Duct detectors for damper control shall be located within 5 feet of the damper. Install per IBC methods of coverage.

5. Stairwell Fan Control Provide control relays/contacts for stair well pressurization fans where indicated. The control relays/contacts shall be MR101 style or preapproved equivalent, 24volt DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty.

6. Smoke Evac Control Provide control relays/contacts for smoke evacuation control where indicated. The control relays/contacts shall be MR101 style, 24volt DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty.

7. Control devices shall be MR 101 style and labeled at the location of what it controls.

8. Automatic Door Control Provide control relays to release Smoke control doors that are normally open electrically. These doors shall close on any “ALARM” condition. All door control will be 24 vdc provided by fire alarm power supply. Releasing will be by a MR101 style relay or preapproved equivalent.

9. Access Control Doors Provide control relays to release normally electrically locked security access doors. These doors shall unlock on any “ALARM”. Releasing will be provided by a MR101 style relay or preapproved equivalent.

10. All control devices are to be installed within 3 feet of the controlled power origination or controlled device.

2.09 Bypass Functions

A. Bypass switches shall be installed at the FACP to bypass the following controlled outputs that pertain to the project:

1. NACs by Floor
2. AHU Shut-down
3. Elevator Recall
4. Door Release / Fire Curtains
5. Security Override / Access Control
6. Fire smoke Dampers
7. Stairwell Pressurization Fans
8. Smoke Evacuation Control
9. Water flow Switches
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10. Sounder Bases

B. A minimum of 10 extra bypass buttons shall be installed for future use.

2.10 Documentation:

A. Storage shall be provided adjacent to (within five feet of) the FACP. This storage shall be capable of storing and securing all documents required for the fire alarm system maintenance and response. Storage shall be for fire alarm documents only. Storage shall include but not limited to:

1. 18” x 24” set of laminated fire alarm drawings
2. Installation Certificate.
3. Panel points list
4. Copy of the most resent program shall be installed into the storage container USB drive
5. STORAGE CONTAINER PREFERRED IS AS FOLLOWS: Manufacturer: Space Age Electronics Manufacturer Part#:SSU00685 or preapproved equivalent

PART 3: EXECUTION OF INSTALLATION

3.01 Installation Contractor:

A. The Fire Alarm System Supplier shall furnish on-the-job supervision for the proper installation of his devices in cooperation with, or as may be required by, other trades. This supervision shall include, but not be limited to, the following:

1. Provide specific on-site instructions to others on mounting and installation of each type of device by physically observing the mounting of one or more of each type of device, as required, to assure that the installer is properly instructed in the work.
2. Provide other supervision as required by the trades to properly perform alarm installation work.
3. Perform a complete test of the system, certifying that all devices have been activated and that the devices and systems perform in accordance with the requirements of these specifications.
4. Install, test, trouble-shoot and correct all system software provided under these specifications. This includes, but is not limited to, actual keyboard entry,
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reprogramming required to meet these specifications and any other task associated with the system software. Contractor shall provide 10% testing after every program change.

5. Provide layout drawings and detailed wiring diagrams to the Authority Having Jurisdiction as required by the Submittal section of these specifications and current NFPA 101 requirements.

B. The Fire Alarm Contractor shall furnish all material and labor to provide a complete and functional system, which operates in accordance with the requirements of these specifications, Texas State University Construction Standards and Texas State University Technical Standard on the Construction Documents CD or on the Facilities Planning Design and Construction website.

3.02 Installation, Interconnection and Operation

A. Conduit, raceway and wiring systems as indicated herein.

1. Exposed areas shall have wiring installed in steel conduit with steel connectors conduit or approved raceway, parallel to existing building structure.

2. Exposed conduit or wire mold will require painting to blend with architecture.

3. All riser-wiring and wiring between floors shall be installed in conduit.

4. In any areas where hard ceilings are use, a conduit raceway shall be provide from hallway to device/s in room. (i.e. Initiating and notification devices)

5. FMC runs shall not exceed six feet.

6. Concealed wiring may be plenum cable (see NFPA 70, NEC per application) and bundled and secured in a proper manner.

7. All wire installed for this project shall be new and be UL listed for use in fire alarm systems.

8. Strap or bundle all cables and wires inside equipment enclosures and terminal cabinets, parallel to the enclosure sides.

9. All plenum wiring will be supported by J-hooks or D-rings. One hole cable straps are not acceptable.

10. IF DUCT DETECTOR IS INSTALLED IN COLD DECK, INSTALL WITH SEALTIGHT FLEX CONDUIT or preapproved equivalent
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11. THE INSULATION SHALL BE Sized SO That THERE IS A 3 INCH GAP around detector.

B. Wiring Requirements

1. Wire: Basic wiring materials and installation must comply with NFPA 70, conductor sizes must be sized in accordance with NFPA 72 and NFPA 70 to provide the minimum required voltage drop

2. Wire used for 120 VAC power circuits shall be a minimum of 12 AWG standard copper conductors, with THHN insulation.
   a. Surge protection shall be installed in accordance with NFPA 70 and 72. 120VAC Power Filters shall be installed on all fire alarm panels. (Eaton power line filter ADPV12005) or preapproved equivalent

3. Wire used for 24 VDC power circuits shall be a minimum of 14 AWG solid copper conductors with outer jacket “Black”.
   a. Surge protection shall be installed in accordance with NFPA 70 and 72. (Ditek DTK-2MH-LP36B) or preapproved equivalent

4. Wire used for strobe circuits shall be a minimum of 14 AWG solid copper conductors with outer jacket “Yellow”.
   a. Surge protection shall be installed in accordance with NFPA 70 and 72.

5. Wire used for point addressable, signaling circuits, network transmission systems shall be a minimum of 18 AWG solid copper conductor with outer jacket “Red”.
   a. Surge protection shall be installed in accordance with NFPA 70 and 72.

6. Wire shall be UL listed for use in fire alarm speaker systems or as required by NFPA 70, article 760. All wire shall be solid conductors of copper, minimum 16 AWG with outer jackets “Blue”.
   a. Surge protection shall be installed in accordance with NFPA 70 and 72.
   b. All networking cabling shall be at a level of class A between all CPU’s.

7. All SLC riser-wiring shall be monitored at a level of Class A.
   a. Isolation Modules shall be installed per floor and per wing with floors with more than one wing.
b. Surge protection shall be installed in accordance with NFPA 70 and 72.

8. All Field Initiating Device Circuits (SLC) shall be monitored at a level of Class B.

9. All Notification Appliance Circuits shall be monitored at a level of Class B
   a. Surge protection shall be installed in accordance with NFPA 70 and 72.

10. Elevator interface wiring must meet NEC 620. Colors for control wiring:
    a. Main Floor Recall—Red
    b. Alternate Floor Recall—Blue
    c. Fire Hat Signal—Yellow
    d. Supply Power—Black

11. 120 VAC dedicated circuit primary power from the nearest emergency lighting panel shall be connected to each fire alarm control panel, remote transponder panel and strobe power supply panel.

12. Dedicated lockable breakers for the fire alarm system circuits shall be provided for the fire alarm system.

13. No dedicated fire alarm system 120 VAC primary power circuit shall be loaded beyond 80 percent of the circuit’s rated capacity.

14. Conduit:
    a. Conduit shall be EMT type except where otherwise required by local code or these specifications.
    b. Conduit fills per NFPA 70, NEC with 3/4-inch minimum conduit size.
    c. Exterior fittings shall be steel compression type, interior steel screw type.
    d. All conduit fittings and connections shall be painted red.
    e. Crimp fittings are prohibited.
    f. All box fittings shall have installed plastic inserts.

15. 
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16. Junction Boxes: Sectional boxes shall not be used.
   a. Each box shall be large enough to accommodate required splices and conduit in accordance with the NFPA 70.
   b. All box covers shall be painted red and labeled Fire Alarm.

17. Field Terminal Cabinets (FTC):
   a. FTC shall be UL listed for use in electrical wiring systems.
   b. SPACE AGE ELECTRONICS FIRE ALARM TERMINAL CABINETS WITH A MINIMUM OF 10% SPARE TERMINALS AVAILABLE FOR FUTURE USE. or preapproved equivalent
   c. FTC shall be painted red with label “Fire Alarm Equipment” stenciled on cover.
   d. UL listed terminal strips shall be provided for all wiring splices in terminal boxes. All terminals shall be permanently labeled. Wire nuts are not acceptable.

17. Patch all walls, floors and ceilings which are penetrated or damaged during construction; match existing adjacent surfaces.

18. All slab penetrations shall be completely sealed and made watertight.

19. Restore all firewalls to rated conditions.

20. Repair and patch surfaces to match existing finish.

21. X-ray floor areas prior to core drilling.

B. Mounting:

1. Manual stations in finished areas shall be mounted flush boxes unless otherwise noted. Stations located in unfinished areas shall be surface mounted on back- boxes provided by the station manufacturer. All stations shall be mounted at 48 inches AFF as measured from the pull lever.

2. Strobes and speaker/strobes shall be ceiling mounted unless approved by Technical Service, where wall mounted devices are acceptable, devices shall be mounted such that the entire lens is not less than 80 in and not greater than 96 in. all the finished floor or 6 inches below the ceiling, whichever is lower in cases where ceiling mounted is not an option.
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3. Speaker only devices shall be ceiling mounted where applicable, wall mounted at 80 inches AFF or 6 inches below the ceiling, whichever is lower in cases where ceiling mounted is not an option.

4. All alarm devices, speakers, and strobes shall be mounted in accordance with the manufacturer’s installation instructions and utilize the manufacturer’s suggested mounting box.

5. All surface mounted speaker and strobes boxes shall be smooth sided, without knock-outs. Use of standard electrical boxes for surface mounted equipment is prohibited.

6. Point addressable monitor modules and control modules shall be securely mounted in back-boxes or mounted on rails within a larger enclosure.

7. All flush and semi-flush devices or panels shall be installed with trim rings or cover plates.

8. All panels visible to the public or noted on the drawings shall be finished as directed by the Owner.

C. Repairing and patching surfaces to match existing finish.

D. X-raying of floor areas prior to core drilling.

E. All coring and sleeve required.

F. All fire alarm system data transmission shall be enclosed in 2-hour fire rated construction or other method acceptable to the Authority Having Jurisdiction.

G. Connecting to Existing Systems

1. Operations of and connections to existing fire alarm systems must be supervised and/or coordinated by Texas State University’s Technical Services Shop.

2. Existing systems must remain operational during modifications or additions to the existing system throughout the duration of the project unless approved by the AHJ.

3. Where part or all the fire alarm system is required to be demolished, remove the existing fire alarm components only after the new system installation is completed and accepted by the Third Party Inspection.

4. Existing equipment that is required to be salvaged shall be stored in a secure area designated by Texas State University.
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5. All modifications need to be reflected on the graphics.

3.03 Record Drawings Shall Include The Following:

A. Two (2) sets of prints and a set of CDs of “as-built” drawings and wiring diagrams in AutoCAD.

B. Two (2) sets of customized “as-built” operating manuals.

C. Two (2) complete sets of “as-built” data sheets for all system-connected equipment.

D. Two (2) sets of the complete “as-built” software listing of all data files, event programs, print statements, and passwords, etc.

E. The USB drive of the final panel program in .sdu format.

F. The spreadsheet file of devices and locations in .xls format.

G. The completed test form which complies with NFPA 72, signed and dated by the fire alarm system manufacturer or his agent.

H. The NFPA 72 completion certificate, signed by the Authority having Jurisdiction.

All items of this section shall be provided to the owner prior to final payment request.

3.04 Spare Parts:

A. All spare parts shall be directly interchangeable with the corresponding components of the installed systems.

B. The Fire Alarm Contractor shall furnish a listing, in duplicate, of all spare parts and accessories which the manufacturer recommends to be stocked for proper maintenance of system.

C. The Fire Alarm Contractor shall furnish 10 of each new field device installed or 3% of the total type of devices installed, whichever is greater on the fire system as spare parts for TSU. Devices: any detector, pull stations, any module used, isolation and monitoring relays, door holders, and audio and visual devices.

D. Contractor shall provide a Signature Map Fault Tool (SIGA-MFT) or preapproved equivalent

Part 4: Tests/Field Quality Control and Commissioning:

4.01 General

Revised June 2016
A. Upon completion of the system, perform a complete and comprehensive test of the entire system in accordance with the provisions of NFPA 72. Contractor shall document testing electronically using logging software commonly available.

B. AHJ shall witness 100% pretest prior to third party commissioning.

4.02 Specific Tests/ Inspections

A. An acceptance will be conducted at the completion of each project. The test will be the responsibility of the Fire Alarm Contractor and shall be performed in strict compliance with the provisions of NFPA 72.

B. In addition to the provisions of NFPA 72 and/or the paragraph above, it is the responsibility of the Contractor to provide all of the following on a set of clean red line prints prior to the acceptance testing:

1. Smoke detector sensitivity report. Smoke detector percent dirty shall not exceed 10% at the time of acceptance.

2. Contractor shall provide a Signature Map Fault Tool report or preapproved equivalent.

3. Pressure differential readings for duct detector sample airflow.

4. Closed loop resistance and EOL resistance readings for all field wiring.

5. Audible decibel readings for the entire building documented on a clean set of fire alarm prints for the building.

6. The fire alarm contractor shall provide the Texas Insurance Code Fire Alarm System Installation Inspection Form to Texas State University Technical Services Department at the following intervals for installation approval:

   a. At the completion of the device back-box installation but prior to the start of the cable installation;

   b. At the completion of cable installation but prior to the start of device installation;

   c. At the completion of device installation but prior to activating the fire alarm system.

C. Third Party Testing:

1. Third Party testing shall be conducted by an independent third party, who shall be independent of the Professional Service Provider or design team companies,
reporting to and approved by the Owner. Third Party testing shall include repeating all the tests described in “Fire Alarm Contractors Test” above.

2. Detailed listing of any deficiencies found during these tests shall be forwarded to the Fire Alarm Contractor and Texas State University’s office of Environmental Health, Safety and Risk Management and shall serve as a punch list for the system.

3. All witness testing shall be performed by the State of Texas Fire Alarm Planning Superintendent (NICET Level III in Fire Alarm Systems) or by a Professional Engineer (P.E.) registered in Fire Protection in the State of Texas.

4. The Campus may at its sole option witness and/or participate in any and all tests.

5. If, at any point during their tests, the Third Party finds significant deficiencies they are to report those to the Owner who will then determine an appropriate course of action. If the Owner determines that the number of and/or severity of the deficiencies so justify , they may stop the Third Party Testing and instruct the Fire Alarm Contractor to correct the deficiencies and re-certify the system. Such retesting shall include Supervision testing of 100% of the Initiating Device Circuits, Notification Appliance Circuits, and Signaling Circuits.

6. If retesting by the Third Party is required due to significant deficiencies in the work of the Contractor, the Contractor shall reimburse the Owner for the cost of the Third Party Tests conducted to that point.

D. Deficiencies Repairs:

1. A copy of the formatted check list shall be transmitted to the contractor to serve as punch list for the correction of the noted deficiencies. The Contractor shall notify the verifying party, in writing, that the deficiencies have been corrected along with a copy of the punch out list with the corrected deficiencies initialed by the Contractor to indicate the corrections.

2. The Fire Alarm Contractor shall provide updated certification forms as set forth in Section

E. Third Party Retest:

1. Each deficient item shall be retested. Retesting of the system shall be conducted in accordance with NFPA 72, Table 14.4.2.2, test Methods. If any software changes are made to the system, updated site-specific software and print out with changes highlighted will be submitted to the verifying party prior to the start of the retest.

F. Third Party Certification:
1. The Third Party shall then retest each portion of the system affected by the corrections. If no additional deficiencies are found, the Third Party shall issue a “Third Party Certification” stating that they have tested the system and certify that it complies with the appropriate sections of NFPA72. Such certification shall not contain any disclaimers or similar comments.

G. Campus Test and Acceptance:

1. Upon receipt of all documents from the final “Fire Alarm Contractor’s Certification” and the “Third Party Certification”, the Campus will conduct any tests it determines to be necessary, consistent with the specified survivability style and performance requirements for the system. If no additional deficiencies are found, they will accept the system. If additional deficiencies are found, the Contractor will be required to correct the deficiencies, re-test and re-certify the system. Such re-testing shall include Supervision testing 100% of the Initiating Device Circuits, Notification Appliance Circuits, and Signal Line circuits. The Third Party shall then re-test each portion of the system affected by the corrections; if no additional deficiencies are found, the Third Party shall re-issue a “Third Party Certification” as set forth in Section “F” Third Party Certification of this document.

Part 5 Warranty and Training

5.01 Warranty:

A. The contractor shall provide a two-year written warranty against defects in material and workmanship furnished under this Contract. The costs of such warranty shall be part of the purchase price. The warranty commences when the system and installation are accepted by the Owner.

B. The warranty or any part of the warranty shall not be made void by any required operation or annual inspections of the system after acceptance during the warranty period.

C. The warranty shall include all necessary material, travel, labor, and parts to replace defective components or materials at the job site. This Contractor shall commence repair of any “in warranty” defects within 8 hours of notification of such defects.

D. The warranty shall include all necessary factory and field software required to perform the specified tasks. This item does include software installed prior to system acceptance. Software updates, equipment revisions, releases updated by the manufacture are to be included in this warranty.

E. The Contractor shall include, as part of the two-year warranty, a test and inspection of the entire fire alarm system one year after the date of completion. The
SECTION 28 31 00 – FIRE DETECTION AND ALARM

Contractor shall provide a written report of any deficiencies and repair any of the deficiencies. The test and report shall conform to the certification as described in NFPA 72 and as required by the Owner.

5.02 Training:

A. Operator Training

1. Provide training of operating personnel in proper system operation and required user maintenance procedures.

2. Three operating manuals containing illustrations, description of each detection device, operation of control panels, switches, pilot lights, etc.

3. One 4-hour training sessions for operating personnel. These sessions are to cover proper operating and response procedures. These instructions shall be sufficient to enable a previously or untrained person to properly operate the system.

4. Provide three software manuals containing a listing of all points, event programs, basic programming and instructions, and software trouble-shooting information.

B. Technical Training

1. The Technical Service Staff shall be fully trained and be given the capability by the product Vendor and Installation Contractor to modify, to program, to fully repair, to service, and to maintain the system after the warranty period.

   a. Such training shall consist of one Technical Services Staff to be factory trained and certified to perform any programming and maintenance.

   b. Factory training shall include travel, per diem, housing, etc.

2. The above training shall include, but not limited to providing and reviewing all programming software, access codes, and licenses that allow the Owner to add or to delete any points, the mapping of devices, and to change a heat detector to a smoke detector. To meet this requirement, provide the necessary configuration and/or access code (hardware and/or hasp software key). If the Vendor and Installation Contractor cannot meet this requirement, the product is not acceptable.

END OF SECTION 28 31 00
DIVISION 31: EARTHWORK

31 23 16 Tree Protection: Earth Moving and Fill Excavation
31 25 13 Erosion and sedimentation Control
31 31 16 Termite Control
SECTION 31 23 16 – TREE PROTECTION: EARTH MOVING & FILL EXCAVATION

PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of the Texas State University for Tree Protection.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Summary

A. This Section of tree preservation procedures includes:

1. Establishing adequate tree protection fencing.

2. Raising low limbs by cabling, trimming or tying to allow access through existing roads and to allow access around the proposed building.

3. Containing concrete and other chemicals to specific washout areas away from root zones.

1.03 Quality Assurance

A. The work of this section shall be performed by a company which specializes in the type of tree preservation work required for this Project, with a minimum of 5 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Work shall be performed in compliance with Texas State University insurance underwriters’ requirements.

B. Manufacturer shall specialize in manufacturing the type of materials for tree preservation work specified in this section, with a minimum of 5 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents.

1.04 Submittals

A. Submit the following according to Conditions of the Construction Contract and Division 1 Specification Sections.
SECTION 31 23 16 – TREE PROTECTION: EARTH MOVING & FILL EXCAVATION

B. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by Texas State University, a “Material Safety Data Sheet” (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

C. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using format in Section 01 77 00/Closeout Procedures.

1.05 Warranty

A. Comply with General Conditions and Section 01 78 36/Warranties.

PART 2: PRODUCTS

2.01 Unauthorized Materials

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by Texas State University.

2.02 Acceptable Manufacturers

A. Products of the manufacturers specified in this section establish the minimum aesthetic, functional and quality standards required for the work of this section.

B. Substitutions: Comply with Section 01 25 13.

PART 3: EXECUTION

3.01 Tree Preservation Guidelines

A. Damaging Conditions not Allowed:

1. All trees to be preserved should be identified on plans before construction begins. Diameter Breast High (DBH) and full extent of canopy should be shown on plans. Once trees to be preserved are identified, the Critical Root Zone (CRZ) of each should be determined on site by the Director of Grounds Operations, or delegate, prior to any construction activities. Tree protection fencing shall be placed at the extent of the CRZ where possible and shall not be moved for the duration of the project, signage shall be attached to the fence at this time. Should a fence need to be moved for any reason, approval for such a move must be given by Director of Grounds Operations or delegate. Fencing material shall be chain link unless otherwise approved by
SECTION 31 23 16 – TREE PROTECTION: EARTH MOVING & FILL EXCAVATION

Director of Grounds Operations or delegate. CRZ shall also be shown on plans with dimensions from trunk of tree.

If Critical Root Zone (CRZ) can not be used, then the variance, in writing, from these standards has to be approved by the Director of Grounds Operation or delegate. Should there be an exception that would allow protective fencing closer that 4 foot from trees trunk, protect the trunk with strapped 2x4x8’ lumber in addition to the protective fencing.

a. It should be determined by the Director of Grounds Operations or delegate and the Project Manager what pruning will be required to accommodate equipment. Prevent damage by improper pruning techniques or contact from equipment such as backhoes.

b. Pruning shall be performed to specs written in accordance with ANSI A300 standards by an ISA Certified Arborist at the Contractor’s expense. The contractor shall be given a pruning objective list for each pruning situation requested.

2. Prevent compaction of root zone areas by foot and vehicular traffic and material storage.

a. Soil compaction, one of the leading contributors to tree decline and death associated with construction, can be controlled with the use of adequate tree protection fencing and mulching.

b. Minimum tree protection fencing should include the area from the tree trunk out to the canopy dripline or CRZ.

3. Prevent poisoning by pouring or spilling chemicals including gasoline, oil, paint, concrete acid washed concrete surfaces and other injurious materials on or near root zone areas.

4. It is the contractor’s responsibility to prevent stress and damage from lack of moisture during periods without adequate natural rainfall, or from changing the natural drainage patterns. Supplemental irrigation may be required as determined by Director, Grounds Operations, or delegate. Method of irrigation must be acceptable to Director of Grounds Operations or delegate; Slow-Soaking by Drip Irrigation is often used. Supplemental irrigation amounts and duration will be requested by the Director of Grounds Operations or delegate via the Texas State University document titled: Tree Preservation Checklist.

5. Prevent change in soil pH caused by the addition of lime in root zones by direct application or concrete waste. After protection fences are removed, no soil or fill should be added within root zone without approval of
SECTION 31 23 16 – TREE PROTECTION: EARTH MOVING & FILL EXCAVATION

Director, Grounds Operations, or delegate. Should any materials such as mulch or silt that were installed or accumulated during construction need to be removed, it must be done by hand; No Heavy Equipment allowed within the CRZ without written approval.

6. Prevent change in grade. No change in grade within CRZ should occur. Should a grade change be required for any reason, consultation with an Arborist as well as the Director Grounds Operations or delegate required.

7. If damage occurs to protected trees or trees become stressed as a result of the construction process, remediation measures shall be recommended by ISA Certified Arborist and implemented at the Contractor’s expense. If pruning is required, this shall be done only by or under the oversight of an ISA Certified Arborist.

8. Erosion control barriers shall be installed and or maintained in a manner that will not allow for silt or sediment to build up in the CRZ.

B. Protection Procedures:

Limit construction access by placing temporary tree protection fencing around trees to be preserved, along with proper signage (See A1 above). Fence location shall be measured and inspected regularly to maintain integrity of protection.

During construction and/or periods of drought it may be requested that trees be mulched to a depth as follows:

1. Trees should be mulched to a depth of at least 6 inches within fence and not be mulched closer than 6” to the trunk; no mulch on root flare.

   a. Fencing should be placed as far out from the tree trunk as possible, a minimum distance to include the branch dripline or CRZ. And should be installed and removed by hand. No heavy equipment in CRZ.

   b. In areas where construction access is required, the natural grade can be protected from compaction by placing a blanket of mulch 12 inches deep over ¾” plywood over natural grade. This should be removed after the project is completed by hand, using no heavy equipment in CRZ.

2. Any work, excavation or grading required within the protected root zone areas should be limited and will require the approval of the Director of Grounds Operations or delegate. An ISA Certified Arborist may be hired at the contractors expense should remediation from damages be needed or requested by Texas State Staff.
SECTIONS 31 23 16 – TREE PROTECTION: EARTH MOVING & FILL EXCAVATION

Work in root zone areas where roots exceed ¾ inch diameter should be done by Airspade, including grading, landscaping and irrigation installation. An air spade should be used in areas where a trench is required across or through CRZ. Should a trench or similar be required within the CRZ, the ideal distance for excavation and continued tree health would be two foot of distance from trunk of tree for each inch diameter of tree at breast height. Absolute minimum would be one foot distance from the tree trunk for each inch diameter at breast height.

a. Proof and schedule of any such services (Airspade) provided by an ISA Certified Arborist shall have input from Texas State staff.

b. Tree removals within a fenced or protected area shall be done in a manner that has no negative effect on remaining trees.

3. Route underground utility and irrigation lines around root zone areas as a first priority; second priority, air spade; third priority, bore at a minimum depth of 3’ to eliminate open cuts through root zones.

When it is not possible to re-route, air spade, or to bore under the root system in order to preserve roots ¾” and larger, consult with Certified Arborist and Grounds Operations staff.

a. Airspade is required where applicable.

Place drives, walks, etc., on or above grade to eliminate altering or severing the root system. Should a walkway or other hard surface require excavation within the CRZ of a tree on campus consultation with a Certified Arborist and Grounds Operations staff is required before beginning any disruption of the soil.

4. To help reduce the number of roots damaged by ripping and tearing while excavating with a backhoe or any other large piece of equipment in tree root zone areas, cut roots along the edge of the required excavation point first using an Airspade. (Depth of trench should be limited to the depth of the required excavation for installation of the utility or 3’, whichever is less.) Any root ¾ inch or larger will be cut flush with loppers or a hand saw and painted with an acceptable tree paint immediately after damage has occurred.

a. If tree roots are exposed in trenches without cover of soil, accommodations will be made by the contractor to cover roots with hay or burlap within 8 hours of excavation and keep moist until covered by appropriate soil.

5. Trees affected by construction should have CRZ covered with compost to a 3” depth, Airspaded to a depth of 6-8 inches and then mulched with 2”
mulch and irrigated immediately after any construction damage. Fertilization may be required until the trees have become re-established, consulting with an ISA Certified Arborist may be required by Texas State staff. The cost of this shall be the responsibility of the Contractor.

6. During periods of minimal rainfall, supply supplemental moisture to damaged trees to help eliminate additional stress.

7. Due to threat of Oak Wilt, the pruning of any Oak trees should be done only at the hottest and coldest times of the year, July-August or December-January. Again, pruning should be done by an ISA Certified Arborist and can be performed outside of these times if performed by such.

8. Wound dressing must be applied to pruning cuts or damage to trunks or limbs, on all oak trees at all times of the year within 5 minutes of damage.

C. Cautions:

1. The area of soil from the branch dripline to the tree trunk is considered the most important part of the tree feeder root zone area that should be protected from disturbance.
   
   a. When possible, 10’ beyond the dripline should also be protected.

2. Request consultation with Grounds Operations before any disruption to the campus landscape.

3.02 Tree Preservation Procedures

A. Tree Protection Fencing:

1. Tree protection fencing should be installed to protect all tree root zone areas adjacent to areas of construction activity as designated on the site plan.
   
   a. Tree protection fences should be installed to protect root zones as well as low growing limbs which exist adjacent to the construction and materials storage areas.

   b. Locations for tree protection fencing should be designated on the construction documents.

2. The tree protection fence should be constructed of galvanized chain-link 6’ in height. Signage should be placed on all fences to clearly indicate in English and Spanish to all on site that fences shall not be moved by
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3. Tree protection fencing should be installed prior to any site activity and should remain in place in its original location until construction is complete and as authorized by the Director of Grounds Operations or delegate.

4. Access into protected root zone areas should be prohibited.
   a. Any necessary access into protected root zone areas should be approved by the Director of Grounds Operations or delegate.

B. Demolition of Existing Buildings, Parking Lots, sidewalks, or other hard surfaces with Tree in proximity:

1. Demolition should be accomplished working from the limits of the existing parking lot and building.
   a. Caution should be used when removing the hard surface and base material in order to keep from disturbing roots growing below the base material. Hand labor may be required.
   b. Test dig under the hard surface in proximity of trees, to determine if roots are growing below the paved surface. Should a significant number of roots be found within the base material by the project certified Arborist, the roots should be pruned prior to removing the base material, in a way indicated in 3.01 B.5 above. Consultation before any root pruning with Grounds Operations.
   c. Pruning the roots at the limit of the demolition area will minimize damage to roots outside of the area to be excavated.
   d. Soil below the base material should not be disturbed by excavating into the soil or by compaction caused by driving trucks and equipment over it.
   e. Should a variance to Tree Protection Fencing be requested approval will be through the Director of Grounds operations or delegate.

C. Construction:

1. Designate limited areas for concrete washout.
SECTION 31 23 16 – TREE PROTECTION: EARTH MOVING & FILL EXCAVATION

a. Locate concrete washout areas away from root zones to eliminate the chance of concrete or contaminated water from running into the root zone areas.

2. Stabilizing soils with lime or related products should be limited to a minimum distance of 10’ from the drip line of any tree.

3. Deviation from the Tree Preservation Procedures will occur only under written authority from a Texas State University representative.

3.03 Tree Services

A. Tree Limb Trimming:

1. Trees located adjacent to the construction access route to the construction site should be pruned by ISA Certified Arborist to allow access of vehicles hauling construction materials.

   a. Raising low limbs temporarily by using ropes to tie limbs up may be an alternative to trimming.

B. Tree Damage Assessment

Variations of these guidelines encroachment and damages to trees will be addressed and reported through the assigned university project manager. Random site visits by Texas State University Certified Arborist will occur throughout the project with results documented on the Tree Protection Checklist form.

1. Any damages or anticipated tree damages incurred during the construction process shall be addressed and reported through the assigned project manager.

2. Mitigation of damages shall occur at the cost of the contractor. Mitigation may include fertilization or root invigoration programs, corrective root pruning, and or structural corrective pruning. Mitigation needs may be determined by ISA Certified Arborist or Texas State University staff.

END OF SECTION 01 56 39
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

PART 1: GENERAL

1.01 Definitions

A. BMP – Best Management Practices means physical facilities schedules of activities prohibition of practices, maintenance procedures, and other management practices, when properly designed, installed, and maintained, will be effective to prevent or reduce the discharge of pollution associated with construction activities.

B. CSN – Construction Site Notice – (NOI-CSN for Large sites; CSN for Small sites).

C. EHSRM – Environmental Health, Safety and Risk Management

D. NOI & NOT – Notice of Intent and Notice of Termination for TPDES permits.

E. SWPPP – Storm Water Pollution Prevention Plan

F. TCEQ – Texas Commission on Environmental Quality

G. TPDES – Texas Pollutant Discharge Elimination System

H. Large Construction Activities – Construction activities including clearing, grading and excavating that result in land disturbance of equal to or greater than five (5) acres.

I. Small Construction Activities - Construction activities including clearing, grading and excavating that result in land disturbance of equal to or greater than one (1) and less than five (5) acres of land.

J. FPDC – Facilities Planning, Design and Construction

1.02 Scope of Standard

A. This standard pertains to the provisions for the control of erosion in the construction areas and in stockpile areas.

B. Texas State University designs all projects to meet LEED Silver design criteria. Construction activity pollution prevention is a mandatory requirement.
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

C. Contractor is responsible for meeting all local, state and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System, regulations from the Clean Water Act, and shall implement in accordance with Texas State University MS4 plan.

1.03 Related Work

A. Drawings and general provisions of the contract, including Procurement and Contracting Requirements, Division 00 and Division 01 of the project specifications.
B. Design Standards, Section 31 11 00 Clearing and Grubbing.
C. Design Standards, 31 22 13 Site Grading
D. Design Standards, 31 23 33 Trenching, Backfilling, and Compaction
E. Design Standards, 33 40 00 Drainage
F. Design Standards, 33 01 00 Utilities

1.04 Contractor Responsibilities

A. The contractor will adhere to the construction portions of the Texas State University Stormwater Management Plan as filed with the TCEQ under the University's MS4 permit. The University is considered a Level 2 MS4 operator under TPDES General Permit No. TXR040000 for University property within the City of San Marcos limits.

B. This project requires implementation of storm water “Best Management Practices” (BMP) for control devices and monitoring by the Contractor to comply with all provisions of the Storm Water Pollution Prevention Plan (SWPPP) developed for the project by the contractor. The Contractor must fulfill all TCEQ Texas Pollutant Discharge Elimination System (TPDES) regulatory requirements in the General Permit No. TXR 150000, including the filing of a NOI, and NOT or signing and posting of the Construction Site Notice (CSN).

C. The Contractor shall provide signatures of a corporate officer for the NOI, NOI-CSN, CSN and NOT and any other forms or applications as required by the TCEQ General Permit No. TXR 150000. The Contractor shall also provide delegated authorization to sign reports per 30 TAC305.128. Individuals conducting storm water inspections shall be qualified to the satisfaction of the Owner.

D. When the Contractor receives approval of the SWPPP from FPDC, the Contractor signs that NOI and/or CSN and sends the application fee and NOI to the TCEQ. The Contractor shall insert a copy of the signed NOI or CSN into the SWPPP booklet.
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

to be kept at the jobsite. The application fee is not required for Small Construction Sites or CSN sites.

E. The SWPPP notebook kept at the jobsite shall also contain the following:
   1. A copy of signed NOI
   2. A copy of the Construction Site Notice (Large or Small)
   3. Owner CSN for small sites or large CSN-Secondary Operator for large sites.
   4. Cover letters or fax cover sheets showing that the signed NOI was submitted to Texas State University 7 days prior to commencing construction for large construction sites or that the CSN was submitted to Texas State University 2 days prior to commencing construction activities for small construction sites.

F. The Contractor shall review the SWPPP and verify existing conditions at the site before determining scope of implementation of site controls. Site survey and site plan drawings shall be used for additional reference. The Contractor shall notify FPDC, in advance, of this site review to allow for Owner participation.

G. The Contractor shall construct a Project SWPPP sign and place it at the main entrance to the project site. This sign shall include the NOI and TPDES permit along with the TCEQ TPDES Large Construction Site Notice (NOI-CSN); or the Construction Site Notice (CSN) for small construction projects. The sign shall be constructed as detailed in the sample SWPPP sign drawing.

H. Contractor shall contact FPDC for review of initial site controls in place prior to commencing site-disturbing activities, to ensure that any unusual circumstances or unforeseen site conditions with regard to erosion and sedimentation have been addressed.

I. The Contractor shall provide all material, labor, equipment and services required to implement, maintain and monitor all erosion and sedimentation controls in compliance with the SWPPP. All controls implemented by the Contractor shall comply with TCEQ General Storm Water Permit TXR 150000. These controls shall remain in operation until project completion and reestablishment of the site or longer as directed by FPDC. The work shall include, but not be limited to the following:

   1. All earthwork as required to implement swales, dikes, basins and other excavations for temporary routing of utilities, to protect against erosion or sediment-laden (“polluted”) storm water runoff.

   2. All structural controls as shown or specified, including silt fences, sediment traps, stabilized construction entrance, subsurface drains, pipe slope drains, inlet/outlet protection, reinforced soil retention, gabions, rock berms, etc.

   3. All non-structural controls as shown or specified, including temporary or permanent vegetation, mulching, geotextiles, sod stabilization, preservation of
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

vegetative buffer strips, preservation/protection of existing trees and other mature vegetation.

4. All modifications and revisions of SWPPP necessary to meet changing site conditions and to address new sources of storm water discharges, as the work progresses.

5. All maintenance and repair of structural and non-structural controls in place shall continue until final stabilization is achieved or as directed by FPDC.

6. Site inspections, as required by the SWPPP, of pollutant sources, including hazardous sources, structural and non-structural controls, and all monitoring of SWPPP revisions and maintenance of inspection records.

7. BMP maintenance or noncompliance issues reported to the Contractor by FPDC should be corrected the day the maintenance or noncompliance issue is reported.

8. Keep records of inspections current in the SWPPP (in field office), available for review by EPA, TCEQ, FPDC, and Owner.

9. Removal of all structural and non-structural controls as necessary upon completion, and only after final stabilization is achieved.

10. Filing of Notice of Termination (NOT) with the TCEQ (original) and Texas State University (copy) for sites that required a NOI (i.e. > 5 acres) within 30 days of final stabilization being achieved and is approved by the Owner, or of another Operator assuming control of the unstabilized portions of the site. Provide Owner with a copy of this filing. For small construction sites, the Contractor will remove the CSN, date the lower right hand corner, as indicated, and send the CSN to the MS4 operator. A copy will be given to the Owner.
PART 2: EXECUTION

2.01 General

Specific site control devices are identified in the SWPPP. Where such devices are indicated, their material composition shall comply with these sections.

SECTION 1: SITE EVALUATION, ASSESSMENT, AND PLANNING

1.1 Project/Site Information
1.2 Contact Information/Responsible Parties
1.3 Nature and Sequence of Construction Activity
1.4 Soils, Slopes, Vegetation, and Current Drainage Patterns
1.5 Construction Site Estimates
1.6 Receiving Waters
1.7 Site Features and Sensitive Areas to be protected
1.8 Potential Sources of Pollution
1.9 Historic Preservation
1.10 Maps

SECTION 2: EROSION AND SEDIMENT CONTROL BMPS

2.1 Minimize Disturbed Area and Protect Natural Features and Soil
2.2 Phase Construction Activity
2.3 Control Stormwater Flowing onto and through the Project
2.4 Stabilize Soils
2.5 Protect Slopes
2.6 Protect Storm Drain Inlets
2.7 Establish Perimeter Controls and Sediment Barriers
2.8 Retain Sediment On-Site
2.9 Establish Stabilized Construction Exits
2.10 Additional BMPs

SECTION 3: GOOD HOUSEKEEPING BMPs

3.1 Material Handling and Waste Management
3.2 Establish Proper Building Material Staging Areas
3.3 Designate Washout Areas
3.4 Establish Proper Equipment/Vehicle Fueling and Maintenance Practices
3.5 Control Equipment/Vehicle Washing
3.6 Spill Prevention and Control Plan
3.7 Any Additional BMPs

- Mortar Mix Areas
- Paint Rinsewater Management
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

- Dewatering Procedures

3.8 Allowable Non-Stormwater Discharge Management

SECTION 4: SELECTING POST-CONSTRUCTION BMPs

4.1 Water Quality
4.2 Detention

SECTION 5: INSPECTIONS

5.1 Inspections
5.2 Delegation of Authority
5.3 Corrective Action Log

SECTION 6: RECORDKEEPING AND TRAINING

6.1 Recordkeeping
6.2 Log of Changes to the SWPPP
6.3 Training

SECTION 7: FINAL STABILIZATION

SECTION 8: CERTIFICATION AND NOTIFICATION

SWPPP APPENDICES

Appendix A- General Location Map
Appendix B - Site Maps
Appendix C - Construction General Permit
Appendix D- NOI and Acknowledgement Letter from EPA/State
Appendix E - Inspection Reports
Appendix F- Corrective Action Log (or in Part 5.3) Appendix G - SWPPP Amendment Log (or in Part 6.2) Appendix H - Subcontractor Certifications/Agreements
Appendix G – SWPPP Amendment Log (or in Part 6.2)
Appendix H – Subcontractor Certifications/Agreements
Appendix I – Grading and Stabilization Activities Log (or in Part 6.1)
Appendix J - Training Log
Appendix K- Delegation of Authority
Appendix L- Construction Site Notice

Revised Jan-15
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

2.02 Inspections and Record-Keeping

A. Contractor shall inspect all BMP’s daily and coordinate inspections with FPDC, who will also regularly inspect the site. Record all deficiencies of site controls and take appropriate action to correct any deficiencies recorded. Exception is rock berms located in a streambed. Any rock berm located in a streambed shall be inspected on a daily basis.

B. Contractor shall keep records of all Contractor inspections on file with SWPPP notebook at project site, and make available for review by Owner’s Representative/s or EPA, TCEQ or MS4 operator officials requesting review of SWPPP inspection records.

2.03 Maintenance

A. All erosion and sediment control measures and other protective measures identified in the SWPPP must be maintained in effective operating condition. Maintenance issues found during an inspection must be replaced or corrected immediately upon discovery.
SECTION 31 31 16 – TERMITE CONTROL

PART 1: GENERAL

1.01 Related Documents

A. Provisions established within General and Supplementary Conditions of the Contract, Division 1 – General Requirements, and the Drawings are collectively applicable to this Section.

1.02 Section Includes

A. Soil treatment below structural slabs and at foundation perimeter for subterranean insects.

1.03 Quality Assurance

A. Applicator: Company specializing in soil treatment for termite control with 5 years documented experience.

B. Materials: Provide certification that toxicants conform to specified requirements.

C. Material Packaging: Manufacturer’s labels and seals identifying content.

1.04 Regulatory Requirements

A. Conform to applicable requirements of authorities having jurisdiction for application licensing and authority to use toxicant chemicals.

1.05 Submittals

A. Submit product data and manufacturer’s installation instruction under provisions of Section 013300.

B. Indicate toxicants to be used, composition by percentage, dilution schedule, and intended application rate.

1.06 Warranty

A. Provide 5 year warranty for material and installation under provisions of Section 017800.

B. Warranty: Cover against invasion or propagation of subterranean termites, damage to building or building contents caused by termites, and repairs to building or building contents so caused.

C. Inspect work annually and report in writing to Owner.
SECTION 31 31 16 – TERMITE CONTROL

D. Owner reserves right to renew warranty for an additional five (5) years after the initial five (5) year period.

PART 2 – PRODUCTS

2.1 Manufacturers

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Termiticides:
   a. Aventis Environmental Science USA LP; Termidor
   b. Bayer Corporation; Premise 75
   c. Dow AgroSciences LLC; Equity
   d. FMC Corporation, Agricultural Products Group; Torpedo
   e. Syngenta; Demon TC

2.2 Soil Treatment

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product’s EPA-Registered Label.

2.3 Mix Dilution

A. Dilute toxicant chemical as recommended by manufacturer.

PART 3 – EXECUTION

3.1 Inspection/preparation

A. Verify the soil surfaces are unfrozen, sufficiently dry to absorb toxicant, ready to receive treatment.

B. Beginning of application means acceptance of soil conditions.
SECTION 31 31 16 – TERMITE CONTROL

3.2 Application

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer’s written instructions for EPA-Registered Label for products preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Verify the soil surfaces are unfrozen, sufficiently dry to absorb toxicant, ready to receive treatment.

C. Beginning of application means acceptance of soil conditions.

D. Apply Toxicant no more than 12 hours prior to installation of vapor barrier under mud slabs, structural slabs, slab-on-grade or finish grading outside foundation walls.

E. Apply toxicant in accordance with manufacturer’s instructions.

F. Apply extra treatment to structure penetrations, pipe, ducts, expansion joints, and other soil penetrations.

G. Apply as a coarse spray to ensure uniform distribution.

H. Coordinate soil treatment at foundation perimeter with finish grading and landscaping work to avoid disturbance of treated soil. Retreat disturbed treated soil.

I. Do not apply soil treatment solution until excavating, filing and grading operations are completed, except as otherwise required in construction operations. To insure penetration, do not apply soil treatment to excessively wet soils or during inclement weather.

J. Post signs in the areas of application, warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.

3.3 Retreatment

A. If inspection identifies the presence of termites, retreat soil and retest.

B. Use same toxicant as for original treatment.
DIVISION 32: EXTERIOR IMPROVEMENTS

32 05 19.13 Geo-textiles Exterior Improvements
32 10 00 Paving
32 32 23.13 Segmental Concrete Unit Masonry Retaining Wall-Height of 5-0” High
32 32 23.14 Segmental Concrete Unit Masonry Retaining Wall-Height Over 5-0” High
32 84 00 Landscape Irrigation
32 91 00 Soil Preparation
32 91 13.16 Mulching
32 91 13.19 Planting Soil Mixing
32 93 00 Plants
32 94 13 Landscape Edging
SECTION 32 05 19.13 – GEOTEXTILES EXTERIOR IMPROVEMENT

PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of the Texas State University for Geotextiles.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General

A. All site landscaping slopes greater than 15% are to be stabilized.

PART 2: PRODUCTS

A. Approved stabilizer: “Curlex Blanket” as manufactured by American Excelsior Company.

PART 3: EXECUTION (NOT USED)

END OF SECTION 32 05 19.13
SECTION 32 10 00 – PAVING

PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides legal protection & safety concerning the specific preferences of the Texas State University for Paving.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines for Streets Owned by City of San Marcos

A. Refer to Design Guideline, V. Working on City of San Marcos Property, for procedures of Street Construction.

B. Contractor must provide certification and follow the procedures for the most current TXDOT Work Zone Traffic Control & Flagging Standards & provide separate personalized certificates for each flagger person working on a City Street.

C. Must provide an appropriate TXDOT Typical Application Plan Number or an approved (by City’s Engineering Department) plan drawn and stamped by a qualified Engineering Study using Engineering Judgment that meets the Standard in the current Texas Manual on Uniform Traffic Control Devices.

D. Must obtain and provide the following on City of San Marcos Streets minimum of one week notice.

1. Approved Street and Lane Closure Permit from the Engineering Department, with copy attached (copy attached phone # 512-393-8134).

2. Approved Street Cut Permit from the Public Works Department, with copy attached (copy attached phone # 512-393-8036).

E. Contractors will provide signage and barricades that also meet the above standards and maintain them daily, checking them as required for day and night time.

F. Follow the Texas One Call System’s procedures and use the appropriate colors for marking lines. (Copy Attached) see www.texasonecall.com and call 1-800-545-6005 one week prior to any digging. Notify remarks with confirmation number after two weeks.
SECTION 32 10 00 – PAVING

G. Request University utilities be marked by TELCOM and the following Facility Department shops, (Grounds/Irrigations, Tech Services, A/C & Chill Water, Steam Distribution and Plumbing for Water, Sewer, Drains, and University gas lines, and Electric for pole lights and high voltage, also Bus Transportation Company and Notify University (Patricia Prado) one week ahead).

H. Mark proposed work with white temporary spray paint. Maintain markings and notify remarks as needed.

1.03 Design Guidelines for Streets Owned by Texas State University

A. All types of street construction shall conform to the Texas Department of Transportation Specification DOT TEX-113A5, as a minimum.

B. Contractor must provide certification and follow the procedures for the most current TXDOT Work Zone Traffic Control & Flagging Standards & provide separate personalized certificates for each flagger person working on a City Street.

C. Must provide appropriate City of San Marcos or TXDOT Typical details and specifications, approved (by City’s Engineering Department), drawn, and stamped by a qualified Engineering Study using Engineering Judgment that meets the Standard in the current Texas Manual on Uniform Traffic Control Devices.

D. Contractors will provide signage and barricades that also meet the above standards and maintain them daily, checking them as required for day and night time.

E. Follow the Texas One Call System’s procedures and use the appropriate colors for marking lines. (Copy Attached) see www.texasonecall.com and call 1-800-545-6005 one week prior to any digging. Notify remarks with confirmation number after two weeks.

F. Request University utilities be marked by TELCOM and the following Facility Department shops, (Grounds/Irrigations, Tech Services, A/C & Chill Water, Steam Distribution and Plumbing for Water, Sewer, Drains, and University gas lines and Electric for pole lights and high voltage. The Facilities Project Manager and/or Construction Manager must be notified three weeks in advance, for these utility locates.

G. Mark proposed work with white temporary spray paint. Maintain markings and notify remarks as needed.

H. Trenching Procedures: Before any trenching, the contractor shall call the Texas One Call System (1-800-545-6005), for locations of underground utilities.
SECTION 32 10 00 – PAVING

I. Trenching or digging is not permitted within 18” of natural gas pipelines.

J. Erosion Control: Contractor shall conform to EPA standard specifications, as well as, TX DOT standards.

K. Street Construction Types:

   1. Streets for Buses shall be concrete construction with locations as determined by Texas State University.

   2. Streets and Parking Lots, other than for Buses, shall be Flexible Paving, with locations as determined by Texas State University.

   3. All valves and manholes, located in streets, must have a concrete pavement apron around it, as detailed in EXHIBIT 1 and EXHIBIT 2, attached.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 32 10 00
SECTION 32 10 00 – PAVING

Exhibit 2:

CONCRETE PAVEMENT PATCH
ITEM 403S CLASS "A" CONCRETE
C-6 PAVING RING (STD. 511S-14)
C-7 LID (STD. 511S-12)

EXISTING H.M.A.C.

15M (#5) BARS @ MID-DEPTH
SAW CUT ALL AROUND
EXISTING H.M.A.C.

DEPTH VARIES
EXIST BASE

SEE NOTE 1

CUT EXISTING RISER PIPE AND REPLACE WITH A NEW LENGTH OF PIPE AS REQUIRED TO RAISE COVER TO FINAL GRADE.

SEE NOTE 9

SUBGRADE

EXIST. BASE

BACKFILL SEE NOTES 1 AND 5

C-5A COLLAR CASTING, SEE STD. DETAIL 511S-16

SECTION B-B

NOTES:

1. SUB-GRADE SHALL BE COMPACTED AS PER ITEM 201S, SUB-GRADE PREPARATION.
2. VALVE CASTINGS SHALL BE ADJUSTED TO GRADE AFTER FINAL LIFT OF OVERLAY IS IN PLACE.
3. CLEAN VALVE BOX OF ALL DEBRIS DOWN TO THE NUT OF THE VALVE; NUT SHALL OPERATE WITH NO OBSTRUCTION.
4. REMOVE EXISTING RISER PIPE DOWN 450mm (18") AND REPLACE TO THE NEW ELEVATION USING NEW PIPE AND A C-5A CASTING.
5. WHERE CAST IRON CASTINGS TO BE REMOVED REQUIRE EXCAVATION GREATER THAN 500mm (20") DEEP, CONTRACTOR MAY ELECT TO FILL EXCAVATION WITH CONTROLLED LOW STRENGTH MATERIAL (SPEC. ITEM 402S) TO THE UNDERSIDE OF THE CONCRETE PAVEMENT PATCH IN LIEU OF COMPACTED BACKFILL.
6. REINFORCING STEEL SHALL MEET SPEC. ITEM 406S.
7. NO MORE THAN 2 SECTIONS OF PIPE SHALL BE USED FROM VALVE TO FINAL GRADE.
8. BELL AND SPIGOT IS ACCEPTABLE FOR DEPTH OVER 5.5m (18")
9. PAVING RING SHALL SIT FLUSH ON RISER.

PLAN VIEW

225 mm (9") TYP.

75mm (3") CLEAR

450 mm (18") TYP.

CONCRETE PAD

VALVE BOX

15M (#5) BARS @ MID-DEPTH OF CONCRETE-4 SIDES (TYP.)

THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.

Kathi J. Flowers 01/31/2011

Revised Jan-15

Paving – 32 10 00 –5
PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of the Texas State University for a Segmental Retaining Wall up to 5-0” high.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.01 SECTION INCLUDES

A. Retaining wall system constructed of concrete segmental retaining wall units.

B. Geosynthetic reinforcement fabric

C. Leveling pad base

D. Drainage aggregate

E. Backfill

F. Drainage pipe

G. Adhesives

1.02 RELATED SECTIONS

A. Section 01270 - Unit Prices

B. Section 02300 - Earthwork: For finish grading.

1.03 REFERENCES

A. American Association of State Highway Transportation Officials (AASHTO)

1. AASHTO M288 Geotextile Specification for Highway Applications

2. AASHTO Standard Specifications for Highway Bridges
SECTION 32 32 23.13 SEGMENTAL CONCRETE UNIT MASONRY RETAINING WALL MAXIMUM HEIGHT OF 5-0” HIGH

B. American Society for Testing and Materials (ASTM)

1. ASTM C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

2. ASTM C1262 Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units.

3. ASTM C1372 Standard Specification for Segmental Retaining Wall Units.

4. ASTM D448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

5. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)(600 kN-m/m³).

6. ASTM D1556 Standard Test Method for Density and Unit Weight of Soil In Place by the Sand Cone Method.

7. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³)(2700 kN-m/m³).

8. ASTM D2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).


SECTION 32 32 23.13 SEGMENTAL CONCRETE UNIT MASONRY RETAINING WALL MAXIMUM HEIGHT OF 5-0” HIGH


C. National Concrete Masonry Association (NCMA)


2. NCMA SRWU-1 Determination of Connection Strength between Geosynthetics and Segmental Concrete Units.

3. NCMA SRWU-2 Determination of Shear Strength between Segmental Concrete Units.

1.03 DEFINITIONS

A. Backfill: Soil which is used as fill behind the drainage aggregate, and within the reinforced soil mass (if applicable).

B. Drainage Aggregate: Material used within (if applicable), between, and directly behind the concrete retaining wall units.

C. Filter Fabric: Material used for separation and filtration of dissimilar soil types.

D. Foundation Soil: Soil mass supporting the leveling pad and reinforced soil zone of the retaining wall system.

E. Geosynthetic Reinforcement: Material specifically fabricated for use as soil reinforcement.

F. Global Stability: The general mass movement of a soil reinforced segmental retaining wall structure and adjacent soil mass.

G. Project Geotechnical Engineer: Registered engineer employed by the Owner to perform site observations, provide recommendations for foundation support, and verify soil shear strength parameters.
SECTION 32 32 23.13 SEGMENTAL CONCRETE UNIT MASONRY RETAINING WALL MAXIMUM HEIGHT OF 5-0" HIGH

1.04 SUBMITTALS

A. Product Data: Material description and installation instructions for each manufactured product specified.

B. Shop Drawings: Retaining wall system design, including wall elevation views, geosynthetic reinforcement layout, pertinent details, and drainage provisions. The shop drawings shall be signed by a registered professional engineer licensed in the state of wall installation.

C. Design Calculations: Engineering design calculations prepared in accordance with the NCMA Design Manual for Segmental Retaining Walls, or the AASHTO Standard Specifications for Highway Bridges, Section 5.8 (whichever is applicable). Analysis of global stability must be addressed and incorporated into the shop drawings.

D. Samples

   a. Furnish one unit in the color and face pattern specified, if requested.

   b. Furnish 12 inch square or larger piece of the geosynthetic reinforcement specified.

E. Test Reports: Independent laboratory reports stating moisture absorption and compressive strength properties of the concrete retaining wall units meet the Project Specifications when tested in accordance with ASTM C140, Sections 6, 8 and 9.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials in accordance with manufacturer's recommendations, in such a manner as to prevent damage. Check the materials upon delivery to assure that proper material has been received. Store above ground on wood pallets or blocking. Remove damaged or otherwise unsuitable material, when so determined, from the site.

   1. Exposed faces of concrete wall units shall be free of chips, cracks, stains, and other imperfections detracting from their appearance, when viewed from a distance of 10 feet.

   2. Prevent mud, wet cement, adhesives and similar materials which may harm appearance of units, from coming in contact with system components.
SECTION 32 32 23.13 SEGMENTAL CONCRETE UNIT MASONRY RETAINING WALL MAXIMUM HEIGHT OF 5-0" HIGH

1.06 EXTRA MATERIALS

A. Furnish Owner with 3 replacement units identical to those installed on the Project.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Concrete Retaining Wall Units: "Anchor Highland Stone Retaining Wall Units" as manufactured under license from Anchor Wall Systems.

1. Physical Requirements

   a. Meet requirements of ASTM C1372, except the maximum water absorption shall be limited to 7 percent, and unit height dimensions shall not vary more than plus or minus 1/16 inch from that specified in the ASTM reference, not including textured face.
   b. Unit Face Area, 6-inch Unit: Not less than 0.25 square feet.
   c. Unit Face Area, 12-inch Unit: Not less than 0.50 square feet.
   d. Unit Face Area, 18-inch Unit: Not less than 0.75 square feet.

2. Color: San Marcos Blend

3. Face Pattern Geometry: Straight.

   a. Texture: Split Rock Face.
   b. Include an integral concrete shear connection flange/locator.

B. Geosynthetic Reinforcement: Polyester fiber geogrid or geotextile, or polypropylene woven geotextile, as shown on the Drawings.

C. Leveling Pad Base

1. Aggregate Base: Crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>35 to 70</td>
</tr>
<tr>
<td>No. 40</td>
<td>10 to 35</td>
</tr>
<tr>
<td>No. 200</td>
<td>3 to 10</td>
</tr>
</tbody>
</table>

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SECTION 32.32.23.13 SEGMENTAL CONCRETE UNIT MASONRY RETAINING WALL MAXIMUM HEIGHT OF 5-0” HIGH

a. Base Thickness: 6 inches (minimum compacted thickness).

2. Concrete Base: Nonreinforced lean concrete base.
   a. Compressive Strength: 500 psi (maximum).
   b. Base Thickness: At least 2 inches, but not more than 3 inches.

D. Drainage Aggregate: Clean crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>75 to 100</td>
</tr>
<tr>
<td>No. 4</td>
<td>0 to 60</td>
</tr>
<tr>
<td>No. 40</td>
<td>0 to 50</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 to 5</td>
</tr>
</tbody>
</table>

E. Backfill: Soil free of organics and debris and consisting of either GP, GW, SP, SW, or SM type, classified in accordance with ASTM D2487 and the USCS classification system.

1. Soils classified as SC and CL are considered suitable soils for segmental retaining walls with a total height of less than 15 feet unless the Plasticity Index (PI) is 20 or more.

2. Maximum particle size for backfill is 2 inches.

3. Unsuitable soils are organic soils and those soils classified as CH, OH, MH, OL, or PT

F. Percolation into the drainage zone behind the wall.

G. Drainage Pipe: Perforated or slotted PVC or corrugated HDPE pipe manufactured in accordance with D3034 and/or ASTM F405. The pipe may be covered with a geotextile filter fabric to function as a filter.

H. Construction Adhesive: Exterior grade adhesive as recommended by the retaining wall unit manufacturer.

H. Impervious Material: Clayey soil or other similar material which will prevent
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which the retaining wall system is to be erected, and notify the [Architect] [Engineer] [Owner] [Contractor] in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Promptly notify the wall design engineer of site conditions which may affect wall performance, soil conditions observed other than those assumed, or other conditions that may require a reevaluation of the wall design.

C. Verify the location of existing structures and utilities prior to excavation.

3.02 PREPARATION

A. Ensure surrounding structures are protected from the effects of wall excavation.

B. Excavation support, if required, is the responsibility of the Contractor, including the stability of the excavation and its influence on adjacent properties and structures.

3.03 EXCAVATION

A. Excavate to the lines and grades shown on the Drawings. Over-excavation not approved by the [Architect] [Engineer] [Owner (or Owner's representative)] will not be paid for by the Owner. Replacement of these soils with compacted fill and/or wall system components will be required at the Contractor's expense. Use care in excavating to prevent disturbance of the base beyond the lines shown.

3.04 FOUNDATION PREPARATION

A. Excavate foundation soil as required for footing or base dimension shown on the Drawings, or as directed by the Project geotechnical engineer.

B. The Project geotechnical engineer will examine foundation soil to ensure that the actual foundation soil strength meets or exceeds that indicated on the Drawings. Remove soil not meeting the required strength. Oversize resulting space sufficiently from the front of the block to the back of the reinforcement, and backfill with suitable compacted backfill soils.
SECTION 32 32 23.13– Segmental Concrete Unit Masonry Retaining Wall Maximum Height of 5-0” High

C. The Project geotechnical engineer will determine if the foundation soils will require special treatment or correction to control total and differential settlement.

D. Fill over-excavated areas with suitable compacted backfill, as recommended by the Project geotechnical engineer.

3.05 BASE COURSE PREPARATION

A. Place base materials to the depths and widths shown on the Drawings, upon undisturbed soils, or foundation soils prepared in accordance with Article 3.04.

1. Extend the leveling pad laterally at least 6 inches in front and behind the lowermost concrete retaining wall unit.
2. Provide aggregate base compacted to 6 inches thick (minimum).
3. The Contractor may at their option, provide a concrete leveling pad as specified in Subparagraph 2.01.C.2, in lieu of the aggregate base.
4. Where a reinforced footing is required by local code official, place footing below frost depth.

B. Compact aggregate base material to provide a level, hard surface on which to place the first course of units.

C. Prepare base materials to ensure complete contact with retaining wall units. Gaps are not allowed.

3.06 ERECTION

A. General: Erect units in accordance with manufacturer's instructions and recommendations, and as specified herein.

B. Place first course of concrete wall units on the prepared base material. Use only 18-inch units for the first course. Check units for level and alignment. Maintain the same elevation at the top of each unit within each section of the base course.

C. Ensure that foundation units are in full contact with natural or compacted soil base.

D. Place concrete wall units side-by-side for full length of wall alignment. Alignment may be done by using a string line measured from the back of the block. Gaps are not allowed between the foundation concrete wall units.

E. Place filter fabric directly behind the concrete wall units.

F. Place 12 inches (minimum) of drainage aggregate between, and directly behind the concrete wall units. Fill voids in retaining wall units with drainage aggregate.

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Provide a drainage zone behind the wall units to within 9 inches of the final grade. Cap the backfill and drainage aggregate zone with 9 inches of impervious material.

G. Install drainage pipe at the lowest elevation possible, to maintain gravity flow of water to outside of the reinforced zone. Slope the main collection drainage pipe, located just behind the concrete retaining wall units, 2 percent (minimum) to provide gravity flow to the daylighted areas. Daylight the main collection drainage pipe through the face of the wall, and/or to an appropriate location away from the wall system at each low point or at 50 foot (maximum) intervals along the wall. Alternately, the drainage pipe can be connected to a storm sewer system at 50 foot (maximum) intervals.

H. Remove excess fill from top of units and install next course. Ensure drainage aggregate and backfill are compacted before installation of next course.

I. Check each course for level and alignment. Adjust units as necessary to maintain level and alignment prior to proceeding with each additional course.

J. Install each succeeding course, using 6-inch, 12-inch, and 18-inch units. Backfill as each course is completed. Pull the units forward until the locating surface of the unit contacts the locating surface of the units in the preceding course. Interlock wall segments that meet at corners by overlapping successive courses. Attach concrete retaining wall units at exterior corners with adhesive specified.

K. Install geosynthetic reinforcement in accordance with geosynthetic manufacturer's recommendations and the shop drawings.

1. Orient geosynthetic reinforcement with the highest strength axis perpendicular to the wall face.

2. Prior to geosynthetic reinforcement placement, place the backfill and compact to the elevation of the top of the wall units at the elevation of the geosynthetic reinforcement.

3. Place geosynthetic reinforcement at the elevations and to the lengths shown on the Drawings.

4. Lay geosynthetic reinforcement horizontally on top of the concrete retaining wall units and the compacted backfill soils. Place the geosynthetic reinforcement within one inch of the face of the concrete retaining wall units. Place the next course of concrete retaining wall units on top of the geosynthetic reinforcement.

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SECTION 32 32 23.13– Segmental Concrete Unit Masonry Retaining Wall Maximum Height of 5-0” High

5. The geosynthetic reinforcement shall be in tension and free from wrinkles prior to placement of the backfill soils. Pull geosynthetic reinforcement hand-taut and secure in place with staples, stakes, or by hand-tensioning until the geosynthetic reinforcement is covered by 6 inches of loose fill.

6. The geosynthetic reinforcements shall be continuous throughout their embedment lengths. Splices in the geosynthetic reinforcement strength direction are not allowed.

7. Do not operate tracked construction equipment directly on the geosynthetic reinforcement. At least 6 inches ofcompacted backfill soil is required prior to operation of tracked vehicles over the geosynthetic reinforcement. Keep turning of tracked construction equipment to a minimum.

8. Rubber-tired equipment may pass over the geosynthetic reinforcement at speeds of less than 5 miles per hour. Turning of rubber-tired equipment is not allowed on the geosynthetic reinforcement.

3.07 BACKFILL PLACEMENT

A. Place reinforced backfill, spread and compact in a manner that will minimize slack in the reinforcement.

B. Place fill within the reinforced zone and compact in lifts not exceeding 6 to 8 inches (loose thickness) where hand-operated compaction equipment is used, and not exceeding 12 inches (loose thickness) where heavy, self-propelled compaction equipment is used.

1. Only lightweight hand-operated compaction equipment is allowed within 4 feet of the back of the retaining wall units. If the specified compaction cannot be achieved within 4 feet of the back of the retaining wall units, replace the reinforced soil in this zone with drainage aggregate material.

C. Minimum Compaction Requirements for Fill Placed in the Reinforced Zone

1. Walls Less Than 15 Feet High: Compact to 95 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)] for the entire wall height

2. Increase compaction requirements for retaining walls with slope heights at the back of the reinforced soil zone greater than 5 feet above the top of wall. Verify compaction requirements with Project geotechnical engineer.
SECTION 32 32 23.13– Segmental Concrete Unit Masonry Retaining Wall Maximum Height of 5-0” High

3. Utility Trench Backfill: Compact utility trench backfill in or below the reinforced soil zone to 98 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)], or as recommended by the Project geotechnical engineer. If the height from the utility to finish grade is higher than 30 feet, increase compaction to 100 percent of the standard Proctor density [modified Proctor density].

  a. Utilities must be properly designed (by others) to withstand all forces from the retaining wall units, reinforced soil mass, and surcharge loads, if any.

4. Moisture Content: Within 2 percentage points of the optimum moisture content for all wall heights.

5. These specifications may be changed based on recommendations by the Project geotechnical engineer.

  a. If changes are required, the Contract Sum will be adjusted by written Change Order.

D. At the end of each day's operation, slope the last level of compacted backfill away from the interior (concealed) face of the wall to direct surface water runoff away from the wall face.

  1. The General Contractor is responsible for ensuring that the finished site drainage is directed away from the retaining wall system.

  2. In addition, the General Contractor is responsible for ensuring that surface water runoff from adjacent construction areas is not allowed to enter the retaining wall area of the construction site.

E. Refer to Article 3.10 for compaction testing.

3.08 CAP UNIT INSTALLATION

A. Apply adhesive to the top surface of the unit below and place the cap unit into desired position.

B. Cut cap units as necessary to obtain the proper fit.

C. Backfill and compact to top of cap unit.

3.09 SITE CONSTRUCTION TOLERANCES

Revised Jan-15                     Segmental Retaining Wall 32 32 23.13-5
SECTION 32 32 23.13– Segmental Concrete Unit Masonry Retaining Wall Maximum Height of 5-0” High

A. Site Construction Tolerances

1. Vertical Alignment: Plus or minus 1-1/2 inches over any 10-foot distance, with a maximum differential of 3 inches over the length of the wall.

2. Horizontal Location Control From Grading Plan

   a. Straight Lines: Plus or minus 1-1/2 inches over any 10-foot distance.
   b. Corner and Radius Locations: Plus or minus 12 inches.
   c. Curves and Serpentine Radii: Plus or minus 2 feet.

3. Immediate Post Construction Wall Batter: Within 2 degrees of the design batter of the concrete retaining wall units.


3.10 FIELD QUALITY CONTROL

A. Installer is responsible for quality control of installation of system components. Employ a qualified independent third party to verify the correct installation of system components in accordance with these specifications and the Drawings.

B. The Owner, at their expense, will retain a qualified professional to perform quality assurance checks of the installer's work.

C. Correct work which does not meet these specifications or the requirements shown on the Drawings at the installer's expense.

D. Perform compaction testing of the reinforced backfill placed and compacted in the reinforced backfill zone.

1. Testing Frequency

   a. One test for every 2 feet (vertical) of fill placed and compacted, for every 50 lineal feet of retaining wall.

   b. Vary compaction test locations to cover the entire area of the reinforced soil zone, including the area compacted by the hand-operated compaction equipment.

3.11 ADJUSTING AND CLEANING
SECTION 32 32 23.13– Segmental Concrete Unit Masonry Retaining Wall Maximum Height of 5-0” High
   A. Replace damaged units with new units as the work progresses.
   
   B. Remove debris caused by wall construction and leave adjacent paved areas broom clean.

END OF SECTION 32 32 23.1
SECTION 32 32 23.14– Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

PART 1: GENERAL

1.00 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of the Texas State University for a Segmental Retaining Wall up to 5-0” high.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.01 Description

A. Work includes furnishing and installing segmental retaining wall (SRW) units to the lines and grades designated on the project’s final construction drawings or as directed by the Architect/Engineer. Also included are furnishing and installing appurtenant materials required for construction of the retaining wall as shown on the construction drawings.

1.02 Reference Standards

A. Segmental Retaining Wall Units
   1. ASTM C 140 - Sampling and Testing Concrete Masonry Units.

B. Geosynthetic Reinforcement
   2. ASTM D 5262 - Test Method for Evaluating the Unconfined Creep Behavior of Geosynthetics
   3. GRI:GG1 - Single Rib Geogrid Tensile Strength
   4. GRI:GG5 - Geogrid Pullout

C. Soils
   1. ASTM D 698 - Moisture Density Relationship for Soils, Standard Method
   2. ASTM D 422 - Gradation of Soils
   3. ASTM 4318 - Atterberg Limits of Soil
SECTION 32 23.14– Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

C. Drainage Pipe

1. **ASTM 3034** - Specification for Polyvinyl Chloride (PVC) Plastic Pipe
2. **ASTM D1248** - Specification for Corrugated Plastic Pipe

E. Engineering Design


F. Where specifications and reference documents conflict, the Architect/Engineer shall make the final determination of applicable document.

1.03 Submittals

A. Materials Submittals: The Contractor shall submit manufacturers' certifications two weeks prior to start of work stating that the SRW units and geosynthetic reinforcement meet the requirements of Section 2 of this specification.

B. Design Submittal: The Contractor shall submit two sets of detailed design calculations and final retaining wall plans for approval at least two weeks prior to the beginning of wall construction. All calculations and drawings shall be prepared and sealed by a professional Civil Engineer (P.E.) – (Wall Design Engineer) experienced in SRW design and licensed in the state where the wall is to be built.

1.04 Delivery, Storage and Handling

A. Contractor shall check materials upon delivery to assure that specified type and grade of materials have been received and proper color and texture of SRW units have been received.

B. Contractor shall prevent excessive mud, wet concrete, epoxies and like materials that may affix themselves from coming in contact with materials.

C. Contractor shall store and handle materials in accordance with manufacturer's recommendations.

PART 2: MATERIALS

2.01 Segmental Retaining Wall Units

A. SRW units shall be machine formed, Portland Cement concrete blocks specifically designed for retaining wall applications. SRW units currently approved for this project are:
SECTION 32 32 23.14– Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

1. Versa-Lok Square Foot Retaining Wall Units.

B. Color of SRW units shall be “Alamo Buff” for base; “LC Cream” for top cap.

C. Finish of SRW units shall be split-face.

D. SRW unit faces shall be of straight geometry.

E. SRW unit height shall be 8 inches, unit width shall be 18 inches, and unit depth shall be 12 inches.

F. SRW units (not including aggregate fill in unit voids) shall provide a minimum weight of 85 psf wall face area.

G. SRW units shall be interlocked with connection pins, designed with proper setback of 1-inch setback for each eight inch high course of units to provide near vertical cant of approximately 2 degrees.

H. SRW units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the structure. Cracking or excessive chipping may be grounds for rejection. Units showing cracks longer than 1/2" shall not be used within the wall. Units showing chips visible at a distance of 30 feet from the wall shall not be used within the wall.

I. SRW units shall be interlocked with connection pins, designed with proper setback to provide 8:1 vertical-to-horizontal batter (a 7-degree cant from vertical).

J. SRW units shall be capable of being erected with the horizontal gap between adjacent units not exceeding 1/8 inch.

K. SRW units shall be capable of providing overlap of units on each successive course so that walls meeting at corner are interlocked and continuous. SRW units that require corners to be mitered shall not be allowed.

L. SRW units shall be capable of providing a split-face, textured surface for all vertical surfaces that will be exposed after completion of wall, including any exposed sides and backs of units.

M. SRW units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the structure. Cracking or excessive chipping may be grounds for rejection. Units showing cracks longer than ½ inch shall not be used within the
SECTION 32 32 23.14– Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

wall. Units showing chips visible at a distance of 30 feet from the wall shall not be used within the wall.

N. Concrete used to manufacture SRW units shall have a minimum 28 days compressive strength of 3,000 psi and a maximum moisture absorption rate, by weight, of 8% as determined in accordance with ASTM C1372. Compressive strength test specimens shall conform to the saw-cut coupon provisions of ASTM C140.

O. SRW units’ molded dimensions shall not differ more than ± 1/8 inch from that specified, in accordance with ASTM C1372.

2.02 Segmental Retaining Wall Unit Connection Pins

A. SRW units shall be interlocked with VERSA-Tuff connection pins. The pins shall consist of glass-reinforced nylon made for the expressed use with the SRW units supplied.

2.03 Geosynthetic Reinforcement

A. Geosynthetic reinforcement shall consist of geogrids or geotextiles manufactured as a soil reinforcement element. The manufacturers/suppliers of the geosynthetic reinforcement shall have demonstrated construction of similar size and types of segmental retaining walls on previous projects. The geosynthetic type must be approved one week prior to bid opening. Geosynthetic types currently approved for this project are: VERSA-Grid Geogrids

B. The type, strength and placement location of the reinforcing geosynthetic shall be as determined by the Wall Design Engineer, as shown on the final, P.E.-sealed retaining wall plans.

2.04 Leveling Pad

A. Material for leveling pad shall consist of compacted sand, gravel, or combination thereof (USCS soil types GP, GW, SP, & SW) and shall be a minimum of 6 inches in depth. Lean concrete with a strength of 200-300 psi and 3 inches thick maximum may also be used as a leveling pad material. The leveling pad should extend laterally at least a distance of 6 inches from the toe and heel of the lowermost SRW unit.

2.05 Drainage Aggregate

Revised Jan-15
SECTION 32 23.14 – Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

A. Drainage aggregate shall be angular, clean stone or granular fill meeting the following gradation as determined in accordance with ASTM D422.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>75-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-60</td>
</tr>
<tr>
<td>No. 40</td>
<td>0-50</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-5</td>
</tr>
</tbody>
</table>

2.06 Drainage Pipe

A. The drainage collection pipe shall be a perforated or slotted PVC, or corrugated HDPE pipe. The drainage pipe may be wrapped with a geotextile to function as a filter.

B. Drainage pipe shall be manufactured in accordance with ASTM D 3034 and/or ASTM D 1248.

2.07 Reinforced (Infill) Soil

A. The reinforced soil material shall be free of debris. Unless otherwise noted on the final, P.E.-sealed, retaining wall plans prepared by the Wall Design Engineer, the reinforced material shall consist of the inorganic USCS soil types GP, GW, SW, SP, SM, meeting the following gradation, as determined in accordance with ASTM D422:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>20-100</td>
</tr>
<tr>
<td>No. 40</td>
<td>0-60</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-35</td>
</tr>
</tbody>
</table>

B. The maximum particle size of poorly-graded gravels (GP) (no fines) should not exceed 3/4 inch unless expressly approved by the Wall Design Engineer and the long-term design strength (LTDS) of the geosynthetic is reduced to account for additional installation damage from particles larger than this maximum.

C. The plasticity of the fine fraction shall be less than 20.

PART 3: DESIGN PARAMETERS

3.01 Soil

Revised Jan-15
SECTION 32 32 23.14– Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

A. The following soil parameters, as determined by the Owner's Geotechnical Engineer shall be used for the preparation of the final design:

<table>
<thead>
<tr>
<th></th>
<th>Unit Weight (γ) (pcf)</th>
<th>Internal Friction Angle (φ) (degrees)</th>
<th>Cohesion (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced Fill</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Retained Soil</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Foundation Soil</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(If internal friction angles are not available for the above section, the specifier can provide the USCS soil type classification for the reinforced, retained, and foundation soils and/or attach the geotechnical investigation report for this project.)

C. Should the actual soil conditions observed during construction differ from those assumed for the design, design shall be reviewed by the Wall Design Engineer at the Owner's Geotechnical Engineer's direction.

3.02 Design

A. The design analysis for the final, P.E.-sealed retaining wall plans prepared by the Wall Design Engineer shall consider the external stability against sliding and overturning, internal stability and facial stability of the reinforced soil mass and shall be in accordance with acceptable engineering practice and these specifications. The internal and external stability analysis shall be performed in accordance with the “NCMA Design Manual for Segmental Retaining Walls,” using the recommended minimum factors of safety in this manual.

B. External stability analysis for bearing capacity, global stability, and total and differential settlement shall be the responsibility of the Owner and the Owner's Geotechnical Engineer. Geotechnical Engineer shall perform bearing capacity, settlement estimates, and global stability analysis based on the final wall design provided by the Wall Design Engineer and coordinate any required changes with Wall Design Engineer.

C. While vertical spacing between geogrid layers may vary, it shall not exceed 2.0 feet maximum in the wall design.
SECTION 32 23.14– Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

D. The geosynthetic placement in the wall design shall have 100% continuous coverage parallel to the wall face. Gapping between horizontally adjacent layers of geosynthetic (partial coverage) will not be allowed.

PART 4: CONSTRUCTION

4.01 Inspection

A. The Owner or Owner's Representative is responsible for verifying that the Contractor meets all the requirements of the specification. This includes all submittals for materials and design, qualifications, and proper installation of wall system.

B. Contractor's field construction supervisor shall have demonstrated experience and be qualified to direct all work at the site.

4.02 Excavation

A. Contractor shall excavate to the lines and grades shown on the project grading plans. Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with compacted infill material, or as directed by the Engineer/Architect, at the Contractor's expense.

B. Contractor shall verify location of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall excavation. Excavation support, if required, is the responsibility of the Contractor.

4.03 Foundation Preparation

A. Following the excavation, the foundation soil shall be examined by the Owner's Engineer to assure actual foundation soil strength meets or exceeds the assumed design bearing strength. Soils not meeting the required strength shall be removed and replaced with infill soils, as directed by the Owner's Engineer.

B. Foundation soil shall be proof-rolled and compacted to 95% standard Proctor density and inspected by the Owner's Engineer prior to placement of leveling pad materials.

4.04 Leveling Pad Construction

A. Leveling pad shall be placed as shown on the final, P.E.-sealed retaining wall plans with a minimum thickness of 6 inches. The leveling pad should extend...
SECTION 32 32 23.14– Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

1. Segmental Retaining Wall (SRW) units shall be laid laterally at least a distance of 6 inches from the toe and heel of the lowermost SRW unit.

C. Granular leveling pad material shall be compacted to provide a firm, level bearing surface on which to place the first course of units. Well-graded sand can be used to smooth the top 1/4 inch to 1/2 inch of the leveling pad. Compaction will be with mechanical plate compactors to achieve 95% of maximum standard Proctor density (ASTM D 698).

4.05 SRW Unit Installation

A. All SRW units shall be installed at the proper elevation and orientation as shown on the final, P.E.-sealed wall plans and details or as directed by the Wall Design Engineer. The SRW units shall be installed in general accordance with the manufacturer's recommendations. The specifications and drawings shall govern in any conflict between the two requirements.

B. First course of SRW units shall be placed on the leveling pad. The units shall be leveled side-to-side, front-to-rear and with adjacent units, and aligned to ensure intimate contact with the leveling pad. The first course is the most important to ensure accurate and acceptable results. No gaps shall be left between the front of adjacent units. Alignment may be done by means of a string line or offset from base line to the back of the units.

C. The voids (cores) of the base course units shall be filled with crushed gravel. The cores of additional courses shall be filled with free-draining aggregate.

D. All excess debris shall be cleaned from the top of units and the next course of units installed on top of the units below.

E. Two VERSA-Tuff connection pins shall be installed through pin holes of each upper course unit into receiving slots in lower course units. Pins shall be fully seated in the pin slot below. Units shall be pushed forward to remove any looseness in the unit-to-unit connection and then check alignment. Level and alignment of the units shall be checked and corrected (if required) before proceeding.

F. Prior to placement of next course, the level and alignment of the units shall be checked and corrected where needed.
SECTION 32 32 23.14– Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

G. Lay out of curves and corners shall be installed in accordance with the plan details or in general accordance with SRW manufacturer's installation guidelines. Walls meeting at corners shall be interlocked by overlapping successive courses.

H. Procedures “C” through “F” shall be repeated until reaching top of wall, just below the height of the cap units. Geosynthetic reinforcement, drainage materials, and reinforced backfill shall be placed in sequence with unit installation as described in Section 4.06, 4.07, and 4.08.

4.06 Geosynthetic Reinforcement Placement

A. All geosynthetic reinforcement shall be installed at the proper elevation and orientation as shown on the final P.E.-sealed retaining wall plan profiles and details, or as directed by the Wall Design Engineer.

B. At the elevations shown on the final plans, (after the units, drainage material and backfill have been placed to this elevation) the geosynthetic reinforcement shall be laid horizontally on compacted infill and on top of the concrete SRW units, to within 1 inch of the front face of the unit below. Embedment of the geosynthetic in the SRW units shall be consistent with SRW manufacturer’s recommendations. Correct orientation of the geosynthetic reinforcement shall be verified by the Contractor to be in accordance with the geosynthetic manufacturer’s recommendations. The highest-strength direction of the geosynthetic must be perpendicular to the wall face.

C. Geosynthetic reinforcement layers shall be one continuous piece for their entire embedment length. Splicing of the geosynthetic in the design-strength direction (perpendicular to the wall face) shall not be permitted. Along the length of the wall, horizontally adjacent sections of geosynthetic reinforcement shall be butted in a manner to assure 100% coverage parallel to the wall face.

D. Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum of 6 inches of backfill is required prior to operation of tracked vehicles over the geosynthetic. Turning should be kept to a minimum. Rubber-tired equipment may pass over the geosynthetic reinforcement at slow speeds (less than 5 mph).

E. The geosynthetic reinforcement shall be free of wrinkles prior to placement of soil fill. The nominal tension shall be applied to the reinforcement and secured in place with staples, stakes or by hand tensioning until reinforcement is covered by 6 inches of fill.

4.07 Drainage Materials

Revised Jan-15
SECTION 32 22.14– Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

A. Drainage aggregate shall be installed to the line, grades and sections shown on the final P.E.-sealed retaining wall plans. Drainage aggregate shall be placed to the minimum thickness shown on the construction plans between and behind units (a minimum of 1 cubic foot for each exposed square foot of wall face unless otherwise noted on the final wall plans).

B. Drainage collection pipes shall be installed to maintain gravity flow of water outside the reinforced-soil zone. The drainage collection pipe shall daylight into a storm sewer or along a slope, at an elevation below the lowest point of the pipe within the aggregate drain.

4.08 Backfill Placement

A. The reinforced backfill shall be placed as shown in the final wall plans in the maximum compacted lift thickness of 10 inches and shall be compacted to a minimum of 95% of standard Proctor density (ASTM D 698) at a moisture content within 2% of optimum. The backfill shall be placed and spread in such a manner as to eliminate wrinkles or movement of the geosynthetic reinforcement and the SRW units.

B. Only hand-operated compaction equipment shall be allowed within 3 feet of the back of the wall units. Compaction within the 3 feet behind the wall units shall be achieved by at least three passes of a lightweight mechanical tamper, plate, or roller.

C. At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing and reinforced backfill to direct water runoff away from the wall face.

D. At completion of wall construction, backfill shall be placed level with final top of wall elevation. If final grading, paving, landscaping and/or storm drainage installation adjacent to the wall is not placed immediately after wall completion, temporary grading and drainage shall be provided to ensure water runoff is not directed at the wall nor allowed to collect or pond behind the wall until final construction adjacent to the wall is completed.

4.09 SRW Caps

A. SRW caps shall be properly aligned and glued to underlying units with VERSA-LOK adhesive, a flexible, high-strength concrete adhesive. Rigid adhesive or mortar are not acceptable.
SECTION 32 32 23.14  Segmental Concrete Unit Masonry Retaining Wall Height Over 5-0” High

B. Caps shall overhang the top course of units by 3/4 inch to 1 inch. Slight variation in overhang is allowed to correct alignment at the top of the wall.

4.10 Construction Adjacent to Completed Wall

A. The Owner or Owner's Representative is responsible for ensuring that construction by others adjacent to the wall does not disturb the wall or place temporary construction loads on the wall that exceed design loads, including loads such as water pressure, temporary grades, or equipment loading. Heavy paving or grading equipment shall be kept a minimum of 3 feet behind the back of the wall face. Equipment with wheel loads in excess of 150 psf live load shall not be operated within 10 feet of the face of the retaining wall during construction adjacent to the wall. Care should be taken by the General Contractor to ensure water runoff is directed away from the wall structure until final grading and surface drainage collection systems are completed.

END OF SECTION 32 32 23.14

Revised Jan-15

Segmental Retaining Wall – 32 32 23.14 -11
PART 1: GENERAL

1.01 Scope of Standards

A. This standard provides general guidance concerning the specific preferences of the Texas State University-San Marcos for Landscape Irrigation.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

C. WATER CONSERVATION is of paramount concern so designs must maximize distribution uniformity and minimize waste including, but not limited to, NO WATER ON STREETS OR HARDSCAPES either from direct spray or runoff.

D. Failure to adhere to these standards will result in rejection of proposals or plans.

E. Designers and contractors must comply with all applicable Texas rules and standards unless these standards are more stringent.

F. These standards are designed primarily for Capital Projects, i.e., from the ground up. Special Project conditions can be quite variable so these standards may not be applicable or appropriate. Consult with the Director, Grounds and Waste Management (GWM), for clarification on Special Projects.

1.02 DESIGN GUIDELINES

A. It is the intent of the Grounds Operations work group to serve as a model for large area landscape irrigation management in the State of Texas. Toward this end, designs for irrigation systems on our campus must be of high quality and demonstrate the highest level of design competency. Of course, all designs must meet all State requirements for such work but, in addition, our standards include:

1. All TCEQ rules and guidelines will be followed except where Texas State Construction Standards are more stringent.

2. All system design will attempt to maximize distribution uniformity (DU). The goal is a DU of at least 75% for rotors and 55% for sprays. To accomplish this, all factors which contribute to DU will be carefully scrutinized. These include (but are not limited to) head spacing, pressure within a zone, pressure at the section valve, the use of Pressure Regulators, and wind derating.
SECTION 32 84 00 – LANDSCAPE IRRIGATION

3. To this end, all heads should properly spaced in each section and there should be no more than 10% pressure variance between heads within each section. **To improve distribution uniformity, head spacing should always be 90% of Manufacturers recommendations.** For example, if the Manufacturer’s recommended head spacing is 50% of diameter, the required spacing will be 45% of diameter. This will ensure a better DU and also be sufficient for wind derating in most cases. Water should still not throw beyond the perimeter of the zone so 50% of diameter may be needed in some cases.

4. All zones shall have heads with matched precipitation rates.

5. All sections are to be hydro-zoned.

6. All section designs will consider slope in the layout. Specifically, when irrigating a slope, sections should run perpendicular to the slope where possible or elevation changes must be included in hydraulic calculations for the section. One exception to this is where pressure regulation occurs at each head or emitter. Runoff should be minimized while maximizing opportunity for infiltration. This requires the use of check valves to prevent low head drainage, including drip zones.

7. All system designs will account for elevation changes in the site as a part of design pressure calculations.

8. All landscape irrigation designs shall be clearly stamped/sealed by Licensed Irrigator (Texas) and provide a legend with all symbols used. The design pressure calculation(s) for the system’s critical head, or heads if the critical head is not clearly determined, shall be provided with the original design. If a drip zone is likely to be more “pressure challenged,” then a design pressure calculation shall be provided.

9. Sleeves shall be provided under all hard surfaces. Minimum 4” Schedule 40 PVC, extending a foot on each side and capped. Location shall be marked on surface of concrete with a brass bolt. Sleeves larger than 4” shall be SDR Class 200 or pipe with greater pressure rating than Schedule 40.

10. The designer/contractor will be responsible for verifying the Static Pressure reading for the site prior to the system design. The design pressure must be clearly indicated on the design. The “Pressure to Design To” will be shown on the design and represent the Static Pressure minus 10%. The Design Pressure provided must be lower than the Static Pressure.
SECTION 32 84 00 – LANDSCAPE IRRIGATION

11. All projects, even Special Projects, shall have flow controlled master valves to minimize wasted water.

12. Two-wire systems should follow manufacturer’s guidelines for required parts and installation including all grounding requirements.

B. In compliance with the Texas State University Stormwater Management Program, mandated by TCEQ MS4 Permit, landscape contractors providing services for on-campus departments are required to follow the Texas State University Campus Standards for Turf Management. A copy of the standards is available for your review on the Texas State Stormwater Webpage. These requirements are effective beginning August 1, 2016. These standards are required for all Texas State departments, as well as outside contractors who perform landscape or irrigation practices on campus, and are subject to random inspection by Texas State University.

1.03 INSTALLATION GUIDELINES

A. The installation must follow the approved design unless changes are approved by the Director, Grounds Operations.

B. Either a Licensed Irrigator or a Licensed Technician should be on site at all times and that person’s name and license number shall be provided to the Director of Grounds Operations prior to installation commencing.

C. For all installations, it is imperative that the contractor maintains at the job site a separate set of plans of the project.

1. This is for the sole purpose of recording, preferably with colored pencil, “as-built” changes and diagrams of those parts of the work as required by TCEQ.

D. At the conclusion of each project, three (3) copies of good, readable “as-built” schematics will be provided to the Owner, two being specifically labeled for the Grounds Operations Department.

1. All wires, emission devices and valves shall be located on the “as-built” plans.

2. All pipe sizes shall be indicated, and all valves shall be located by reference to existing features. As-builts must show correct location of these.

3. All valves on plans shall be marked to identify
SECTION 32 84 00 – LANDSCAPE IRRIGATION

a. Valve number to correspond to controller section

b. Flow in gpm of section

c. Valve size in inches

4. Project will not be accepted without as-builds provided.

E. On all projects, a walk through must be done with Texas State University-San Marcos to determine conditions of the system before work begins.

1. Before final acceptance of any project where irrigation is installed or otherwise impacted, a walk through must be completed and performance testing must be approved by the Director, Grounds Operations, Texas State University-San Marcos.

1.04 DESCRIPTION

A. The work covered by the plans and specification consists of installing a complete underground irrigation system as shown on the plans.

1. It shall include furnishing and installing piping and fittings, valves, quick-coupling valves, sprinkler heads, controller and all miscellaneous fittings and accessories needed for a complete and operating system.

2. It is the intention of these specifications, together with the accompanying drawings, to accomplish the installation of a sprinkler system which will operate in an efficient and satisfactory manner according to the standards established for quality sprinkler irrigation.

3. Certain construction procedures or minor equipment may have been omitted from these specifications that are necessary for the proper installation of the system.

1.05 GUARANTEE

A. The Contractor shall guarantee the satisfactory operation of the entire system, to the extent possible, under the scope of work included in this contract.

1. The entire system on which work is to be performed shall be guaranteed to be complete and work properly for a period of one year from date of acceptance, and contractor hereby agrees to repair or replace any defects occurring within that year free of expense to the Owner, only on that work performed by him and covering materials furnished by him.
SECTION 32 84 00 – LANDSCAPE IRRIGATION

1.06 EXISTING UTILITIES
   A. All of the existing utilities are not shown on the irrigation plans.
      1. The Contractor shall use reasonable care in trying to protect utilities
         encountered during this project. All Utilities shall be located prior to
         design. Any utilities damaged and requiring repair or replacement shall be
         the responsibility of the Contractor.

1.07 WORKMANSHIP
   A. Equipment shall be installed in accordance with the recommendations of
      the manufacturer and the best standard practice for this type of work. It is critical
      that the installation follow the design as closely as possible to result in a quality
      irrigation system. Variations from the design, including even slight changes in
      head spacing, must be approved by the Director, Grounds Operations.

1.08 WATER SUPPLY
   A. Connections shall be made to the existing water line at the location shown on the
      drawings. Contractor shall be responsible for tap. Connection to water supply
      shall be done in accordance with TCEQ regulations regarding oversight by a
      Licensed Irrigator, Irrigation Technician or Plumber and type of backflow
      prevention device (see Standards relating to backflow).
   B. When connecting to an existing irrigation system, Contractor shall be responsible
      for installing appropriately sized and located isolation valves so that existing
      system will continue to operate without interruption.

1.09 OPERATING INSTRUCTIONS
   A. The Contractor shall provide Owner’s representative with instructions on the
      operation and maintenance of the system and all parts thereof. On completion of
      the work, the Contractor shall furnish to the Owner operating instructions, spare
      parts lists, and descriptive literature of all items installed.

1.10 AS-BUILT PLANS
   A. The Contractor shall maintain at the job site a separate set of prints of the project
      for the sole purpose of recording with colored pencil, “as-built” changes and
      diagrams of those parts of the work in which actual construction is significantly
      different from the contract drawings.
      1. At the conclusion of the project an accurate, three readable copies of the
         “as-built” system will be given to the Owner, two specifically labeled for
         Grounds Operations.
2. All wires, sprinkler heads and valves shall be located on the “as-built” plans as well as controller, back flow prevention device and quick couplers.

3. All pipe sizes shall be indicated and all valves shall be located by reference to existing features.
SECTION 32 84 00 – LANDSCAPE IRRIGATION

1.11 SUBSTITUTIONS

A. The following procedure must be used to obtain approval of substitute materials as an equal:

1. To make a substitution, submit the following to the Owner:
   a. Actual samples of each material proposed as a substitute.
   b. Manufacturer’s catalog sheet showing full specifications of each material proposed as a substitute, i.e., discharge in GPM, minimum allowable operating pressure at the sprinkler, maximum allowable spacing and distance of throw (coverage).
   c. New Design Pressure calculations based on the proposed substitute. These pressure loss computations must prove that the proposed substitute will perform in accordance with the intent of the designed system either with the same piping and head layout design or with a change of either. (If a design change is required, drawings must accompany the request for approval of the substitute).

2. Approval or disapproval will be based on the comparative ability of the material to fully perform all purposes and functions of mechanics and general design considered to be possessed by the specified material.

3. Approval of a substitution shall be obtained from the Director, Grounds Operations, before construction is begun.

4. Approval of a substitute shall not remove the responsibility to demonstrate that the final installed sprinkler system will operate according to the intent of the originally designed and specified system.

PART 2: MATERIALS

2.01 GENERAL

A. All materials and accessories shall be of new (unused) material.

1. Any section of pipe found to be defective before or after installation shall be replaced with new pipe.
SECTION 32 84 00 – LANDSCAPE IRRIGATION

2. All new sprinkler irrigation equipment shall be essentially the standard product of the manufacturer.

3. All new equipment furnished shall have in-service performance records sufficient to verify published capabilities.

4. Sprinklers shall be designed to operate efficiently at the pressure, flow, and diameter of coverage indicated on the drawings.

5. All electrical components shall be UL approved.

2.02 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. All mainlines shall be schedule 40 PVC and all lateral piping shall be Class 200 (SDR-21).

1. All piping shall be purple pipe.

2. All main lines shall have 12” of cover minimum but no more than 18”.

3. All piping shall meet or exceed minimum requirements of Commercial Standards CS 256-63.

4. All piping shall be approved by the National Sanitation Foundation.

5. All fittings shall be of the type recommended by the pipe manufacturer.

6. Pipe shall be snaked in the trench sufficiently to permit expansion and contraction.

7. Mainlines shall be pressure tested at 120 psi water pressure for 24 consecutive hours. This shall be verified by Owner and conducted prior to filling any trenches.
2.03 REMOTE CONTROL VALVES

A. Remote control valves shall be 8200 CR Series electric valve as manufactured by WeatherMatic Sprinkler Division of Telsco Industries, or approved equal.

1. The control valves shall be electrically operated, normally closed, diaphragm type, brass valves with 24 volt, 60/50 HZ solenoids.

2. Valves shall be slow opening and closing.

3. Valves shall have manual flow control and manual bleed.

4. Each valve shall also have installed a WeatherMatic PRK-24 (XPR) Pressure Regulator.

5. Each valve shall be installed with an extra three feet (3’) of coiled valve wire attached to solenoid in the valve box.

6. King Dry Conn connectors (or equal) are to be used when connecting valve wires to each solenoid except when product specifications call for something different such as on two wire systems. Two wire specs addressed separately in this document

7. When two-wire systems are being installed, manufacturer’s recommended decoders must be used.

2.04 REMOTE CONTROL VALVE WIRE

A. Control wire shall be of the size and type recommended by the valve manufacturer, with a minimum gauge of 14 AWG.

1. Wire shall be of the direct burial type made for the irrigation industry. The successful bidder shall submit as a shop drawing a wiring diagram showing the size and amount of wire to be used.

2. Two spare valve wires will be placed in the trench along all mainline runs.

3. Submersion proof connectors (3M DBR/Y – 6 or comparable) will be used at each splice of direct-burial wire and placed in a valve box of sufficient size.

4. The common wire must be of a gauge to accommodate additional amperage should more than one section be run together in the future. This
SECTION 32 84 00 – LANDSCAPE IRRIGATION

shall be based on the maximum flow of the mainline and the number of sections of irrigation that would accommodate.

5. When two-wire systems are being installed, manufacturer’s recommended wire must be used.

6. Wiring should conform to the following color code:

   a. Red – power or “hot” wire
   b. White – common
   c. Blue – 2 wires serving flow meter, part of hydrometer
   d. Green – 2 wires serving hydrometer solenoid
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2.05 ISOLATION VALVES - BALL VALVES and GATE VALVES,

A. Isolation gate valves shall use threaded or bolted flange attachments.

B. An isolation valve shall be installed upstream immediately in front of each remote control valve and shall be a plastic ball valve construction.

C. All isolation valves to isolate main lines shall be Nibco, Model F-619-RW-son or approved equal. Must be iron body gate valve with resilient seat, non-rising stem with square key on 2” and larger.

D. Isolation valves shall be designed for a minimum water working pressure of 150 psi.

E. Location of all isolation valves shall be approved by Owner as a part of design review process.

2.06 Backflow Prevention

A. The Model 850 Double Check Valve Assembly (DCA) as manufactured by Febco shall be used unless site conditions require other type of backflow prevention.

1. The 850 Double Check Valve Assembly may be installed under continuous pressure, and must be preceded by an isolation valve and Y strainer as required by TCEQ.

2. The Double Check Valve shall be located underground with location and enclosure (valve box) sized to ensure accessibility for testing and meet all applicable codes.

3. Enclosure size and installation shall be approved by Owner.

4. All backflow prevention devices must be tested by Licensed Backflow Prevention Device Tester when installed.
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2.07 HYDROMETER - FLOW METER and MASTER VALVE COMBINATION

A. Each mainline shall be equipped with an automatic metering valve as manufactured by Arad Control Valves.

1. It shall be a model IS-BM-XX Hydrometer with electric pulse transmission every 10 gallons.

2. It shall be equipped with an electric remote control solenoid (24 VAC, normally closed) with manual override.

3. The meter shall be installed underground and down stream from the double check assembly.

4. It should have a valve box that allows easy access for reading meter.

5. On Special Projects, alternate devices may be required even though the ability to monitor flow and control master valve is still required. Consult with the Director, Grounds Operations, for alternates.

2.08 QUICK COUPLERS

A. Quick coupler valve shall be manufactured by WeatherMatic Industries or approved equal. Sizes and location shall conform to plan.

1. ¾” MIPS x ½” FIPS (Model QV75L)

2. Coupler shall be located in a valve box.

3. Isolation valve shall be installed immediately upstream of each quick coupler valve (refer to 2.06)
SECTION 32 84 00 – LANDSCAPE IRRIGATION

2.09 VALVE BOXES

A. Valve boxes shall be polypropylene plastic of sufficient size to allow easy access to electric valves, isolation valves, double check valves, water meters, and quick couplers and wire splices.
   1. Size to be approved by Texas State University-San Marcos, Grounds Operations, during the review process.
   2. Valve boxes will have sufficient spacing between the box and piping holes shall be covered with plastic or a sufficient material to help prevent backfill.

2.10 SWING JOINT RISERS AND NIPPLES

A. All swing joint nipples shall be unplasticized polyvinyl-chloride.
   1. Hunter Preassembled Swing Joint Assemblies or similar.
   2. Fittings at swing joints shall be Schedule 40 threaded elbows.

2.11 ROTARY SPRINKLER HEADS

A. Rotary sprinkler heads shall be adjustable from 30 degrees to 360 degrees with interchangeable nozzles (full circle heads where appropriate).
   1. Hunter MP Rotators shall be used whenever possible.
   2. Alternatively, sprinklers shall be Hunter PGP series or approved equal.
   3. Heads shall be set 4” or more from curbs.
2.12 POP-UP LAWN HEADS

A. Heads shall have a ½ inch female thread inlet.
   1. Pop-Up Series Heads shall be Hunter Pro Series, as manufactured by the Hunter Industries Incorporated or approved equal.
   2. Lawn Nozzle shall be MP Rotator.
   3. Pop-Up Sprinkler Heads shall be installed with the underside of flange flush with the finish grade.
   4. Heads shall be set 4” or more from curbs and other hardscape. NO WATER ON HARD SURFACES ALLOWED.

2.13 SHRUB HEADS ON RISERS, POP-UPS and NOZZLES

A. Should not be used on plantings that will outgrow height of riser under normal maintenance procedures. Drip may be preferable.

B. Shrub risers shall be ½” x 12” Sch 80 nipple fitted with a LXS Weathermatic Shrub adapter with a ½ inlet.
   1. Shrub spray heads shall be placed on ½ inch risers in areas of groundcover or shrubs where pedestrian traffic will not come in close proximity to risers.
   2. Along walkways, Hunter Pro Spray 12” pop-up heads shall be used.

C. Strip Nozzle shall be MP Rotator or approved equal.
   1. Shall have adjusting screw to regulate distance of throw.

D. Shrub nozzle shall be MP Rotator or approved equal.
SECTION 32 84 00 – LANDSCAPE IRRIGATION

2.14 TREE BUBBLERS

A. Shall be Hunter Multi-Stream Bubbler, Model MSBN-50

B. Shall be placed at edge of root ball.
   1. It shall be placed on a Hunter preassembled swing joint using a LXS Weathermatic shrub adapter with a ½” female threaded inlet

2.15 DRIP IRRIGATION

A. Drip irrigation shall consist of Techline tubing as manufactured by Netafim or substitute approved by Owner.
   1. Because of water stains on buildings, use drip next to walls where feasible.
   2. **Emitter and line spacing shall be on 12 inches** (TLDL4).
   3. It shall be installed accordingly to manufacturer’s specifications, including electric valve, water filter, ¾” Techline pressure regulator, and poly distribution tube.
   4. Keep individual drip zones relatively small. A maximum of 700 feet is recommended. Tubing shall be placed in each section on 12 inch spacing and staked every 36 inches.
   5. All drip tubing shall have pressure compensating emitters
   6. Subsurface drip is encouraged in areas where runoff may occur into the street. If chemical root intrusion protection is used, an RP backflow prevention device is required.

2.16 AUTOMATIC CONTROLLER

A. Irrigation controller shall be Baseline 3200 or Motorola (ACE IRRInet or AC IRRInet-M). **Proposed substitutions must be approved by Owner.**
   1. It shall be equipped with sufficient station capability depending on size of installation.
SECTION 32 84 00 – LANDSCAPE IRRIGATION

2. It shall be mounted according to manufacturing specifications, including proper grounding of unit.

3. It shall be located as approved by Owner for ease of maintenance. Product Distributor should be engaged to ensure radio communication with Owner’s central computer. Equipment includes UHF radio interface and antenna.

4. Contractor shall ensure communication is established from field unit to central computer before acceptance by Owner.

5. Water Management Accessories – Weathermatic Rain Sense or equal.

6. Ethernet connectivity required for Baseline 3200 installations.

PART 3: PERFORMANCE

3.01 GENERAL

A. Unless otherwise specified or shown on the drawings, the construction of sprinkler lines shall include excavation and backfill; the furnishing, installing and testing of sprinkler pipe and fittings, and electrical conductors; and the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications.

3.02 EXCAVATION, BACKFILL AND PROTECTION OF TREES

A. All excavation shall be unclassified and is to include earth, loose rock, rock or any combination thereof, in wet or dry state.

B. Backfill for general trenching shall be the material removed, compacted to density equal to the adjacent undisturbed soil and shall conform to the adjacent grades without dips, sunken areas, humps or other irregularities.

1. Initial backfill on all lines shall be of a fine granular material with no foreign matter larger than ½ inch in size.

2. If, in the opinion of the Owner, the excavated material is not satisfactory for use as backfill, the Contractor shall dispose of this unsatisfactory material.

3. Contractor shall be responsible for any settling of trenches for work done.
C. Backfill for trenching behind curbs and under paved areas and driveways shall be compacted select backfill to 95% density, meeting material and installation requirements set forth.

D. Trees and tree roots shall not be damaged. No trenching within the Critical Root Zone (CRZ) of trees without Texas State University-San Marcos approval; CRZ to be determined by Texas State University-San Marcos Director, Grounds Operations, or delegate. (See Section 01 56 39 – Temporary Tree Protection, Construction Standards.)

E. It is understood that the piping layout is diagrammatic and piping shall be routed around trees and shrubs in such manner as to avoid damage to plantings.

G. All lumber, rubbish, and large rocks shall be removed from the trenches and surrounding landscape.

1. Pipe shall have a firm, uniform bearing for the entire length of each line to prevent uneven settlement.

2. Wedging or blocking of pipe will not be permitted.

3. Pad the trenches with dirt or sand, if the soil is extremely rocky.

H. No PVC shall be laid when there is water in the trench.

1. No PVC shall be laid when temperature is 45 degrees or below.

2. PVC pipe will expand or contract 1 inch per 10 degrees F change in temperature.

3. Therefore, pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction.

I. All foreign matter or dirt shall be removed from inside of the pipe before welding, and piping shall be kept clean by approved means during and after laying of pipe.

J. Select fill-dirt or sand shall be used for backfill.

1. No backfill with rock or large clods shall be used.

2. Tamping or flooding shall be done to the satisfaction of Texas State University-San Marcos.
SECTION 32 84 00 – LANDSCAPE IRRIGATION

3. Backfill material will be used to within 6 inches of grade and remaining 6 inches is to be topsoil approved by the Owner.

4. Any vegetation disturbed is to be returned to its original state, i.e., resodded.

K. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for compaction, then refilled and compacted, with the surface restored to the required grade and left in a completed surface condition as described above.

L. All excavation and backfill shall be unclassified and covered in the basic bid.

1. No additional fee will be allowed for rock encountered.

3.03 AUTOMATIC CONTROLLER

A. Refer to 2.16. The controller shall be mounted in a location approved by Owner.

1. All control wires above the ground shall be enclosed in conduit.

2. All wiring shall be done in accordance with National Codes and all products used UL approved.

3. Grounding rod or plate shall be installed per manufacturer’s specifications.

3.04 PVC PIPE

A. PVC pipe, couplings and fitting shall be handled and installed in accordance with the manufacturer’s recommendations. Each pipe length shall be properly spaced in jointing to allow for expansion and contraction.

B. Contractor shall use only Weldon 735 cement and Weldon P-68 primer. The pipe and fittings shall be thoroughly cleaned of burs, dirt, dust, and moisture before applying primer and solvent.

C. Install concrete thrust blocks as necessary at direction changes, size changes, termination, and valves.

D. All pipe should be purple pipe.

3.05 VALVES
A. Install all new valves as indicated on the plans or as may be required for the proper control of the piping systems in which they are incorporated.

1. Valves shall be buried deep enough so that the valve box lid will not protrude above grade.
2. Isolation valves shall be set vertically.
3. Control valves shall be set to give the correct pressure at the sprinkler head.

3.06 SPRINKLER HEADS

A. Sprinkler heads shall be installed in plumb position at intervals not to exceed those shown and in the approximate location and configuration shown on the plans.

1. Sprinkler swing joints shall be made up as shown on the plans.
2. All nipples shall be minimum length required to allow sprinkler head adjustment motion without inducing load in the supply pipe.
3. Sprinkler heads in turf areas shall be installed flush with existing grade.

3.07 TESTING (PRIOR TO BACKFILLING DITCHES)

A. Before final acceptance of the installed system, make the following tests under the supervision of the Director, Grounds Operations or delegate:

1. When the main line or sections of the main line have been installed, the system (or section) will be thoroughly flushed.
   a. The system (or section) will then be pressurized during a 24 hour period at 120 psi to the operating pressure indicated on the drawings.
   b. Leakage will be repaired and re-tested as outlined above.

B. All joints and connections shall be pressure tested.
SECTION 32 84 00 – LANDSCAPE IRRIGATION

C. Lateral lines, from the control valve to the sprinkler head, shall be tested by opening the control valve and inspecting for leaks. Heads may be plugged or blocked to a position of throw away from the trenches during inspection.

(ANY TIME PRIOR TO FINAL ACCEPTANCE)

D. Each section of sprinklers shall be tested for area of coverage. Test shall be made by actual measurement of the radius of spray of the sprinklers.

E. Each section of sprinklers shall be tested for operating pressure at the sprinkler heads and compared with design specifications.

F. All section valve circuits shall be tested by Grounds Operations for partial connections (increased ohm readings). This shall be coordinated through the Director, Grounds Operations, or delegate.

3.08 FINAL ADJUSTMENT

A. After installation has been completed, final adjustment shall be made of the sprinkler system prior to Texas State University-San Marcos’ final inspection.

B. The system shall be completely flushed to remove any and all debris from the lines by removing the nozzle from all heads on ends of lines and turning on the system.

C. All sprinklers shall be checked for proper operation and alignment for direction of throw.

D. All nozzles shall be checked for proper arc of spray. Prevailing wind conditions may indicate that arc of spray should be other than as shown on the plan. In this case, nozzles shall be changed to provide correct coverage, at the Contractor’s expense.

3.09 EQUIPMENT TO BE FURNISHED, OPERATING INSTRUCTIONS

A. In addition to a comprehensive as-built drawing, the contractor shall provide as part of this contract two (2) each of any special tools required for any equipment and two (2) service manuals for all equipment used.

1. Manuals may be loose leaf and should show drawings or exploded view of equipment and catalog number and prices.

2. Operating instructions for all equipment shall also be furnished.

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3.10 CLEANUP

A. The contractor shall make final cleanup of all parts of the work and rocks left on the surface as a result of trenching before final acceptance.

1. This cleanup shall include removal of all construction materials and equipment, and in general, leaving the site in an orderly and finished appearance.

END OF SECTION 32 84 00
SECTION 32 91 00 – SOIL PREPARATION

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for Soil Preparation.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General

A. Excavate all beds minimum depth of 9”, and no deeper than plant material root balls. Remove all excavation from site and dispose. Unless reuse of this material is approved by Director of Grounds Operation or delegate.

B. Excavate larger planting holes, such as for trees, 12” wider than the root ball on all sides, but no deeper than the rootball.

C. Excavate turf areas to depth of 8” minimum.

D. Beds will be excavated to Native Soil Level or acceptable level approved by Director of Grounds Operations or delegate. All backfill for beds, in other words “Base” material below the Garden-Ville Mix, is to be weed free.

PART 2: PRODUCTS

A. Topsoil: Import topsoil to be high quality imported topsoil of loamy character, high in humus and organic content. Topsoil to be reasonably free from clay lumps, coarse sands, stones, roots, and other foreign matter, including weeds and weed seeds. There shall be no toxic amounts of alkaline or acid elements. Submit sample for Landscape Architect and Director of Grounds Operations or delegate approval.

B. Approved Planting Mix for Turf areas: "Lawn and Garden” from Ga or approved similar from another soil providing company.

C. Approved Planting Mix for Beds: “Lawn and Garden” from Gardenville or similar, planting mix, must be weed free.
SECTION 32 91 00 – SOIL PREPARATION

PART 3: EXECUTION (NOT USED)

END OF SECTION 32 91 00
SECTION 32 91 13.16 – MULCHING

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for Mulching.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General

A. All planting beds and tree wells shall be covered by a continuous 3” deep layer of shredded Humus Type mulch after planting and not placed on trunks of plants.

B. Larger pieces of mulch are not acceptable.

PART 2: PRODUCTS

A. Approved mulch: “Double Shredded” or “Native Hardwood” located at Garden Ville, or similar type company, in Central Texas, humus type mulch.

PART 3: EXECUTION (NOT USED)

END OF SECTION 32 91 13.16
SECTION 32 91 13.19 – PLANTING SOIL MIXING

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for Planting Soil Mix.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 General

A. Planting Mix for Turf Areas:

1. Only planting mix that is high in organic content and well drained, from the San Marcos area should be used.

2. Percent (%) sand, silt and clay of soil test should be provided to Texas State University project manager prior to installation, when requested by Texas State. Not needed if requested soils are utilized.

3. Planting mix shall be free of obvious weed remnants which will likely result in weed re-growth. Any variance would be approved by Director of Grounds Operations or delegate.

4. Soils placed in turf areas will be slightly compacted to help alleviate settling.

B. Planting Mix for Bed Areas:

1. Only weed free composted planting mix that is high in organic content and well drained should be used.

2. Soils placed in beds will be compacted slightly to help alleviate settling.

C. All planting mix used in beds or turf areas is to be approved by Director of Grounds Operations or delegate. After accepting soil, proof by way of shipping slips or receipts will be provided the project manager for all soils and each load of soil used on site. Incorrect soils will be removed from site by contractor responsible.
SECTION 32 91 13.19 – PLANTING SOIL MIXING

PART 2: PRODUCTS

A. Approved Planting Mix for Turf Areas: “Composted Topsoil”, “Contractors four way Mix” or similar material located at Garden Ville, or similar company in Central Texas.

B. Approved Planting Mix for landscaped beds: "Lawn and Garden" or similar located at Garden Ville, or similar type company, in Central Texas.

PART 3: EXECUTION (NOT USED)

END OF SECTION 32 91 13.19
SECTION 32 93 00 – PLANTS

PART 1:  GENERAL

1.01  Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University for Plants.

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02  Maintenance

A  General

1. Maintain plant materials, weed removal, in all beds, tree wells pits and lawn areas until substantial Completion and Final Acceptance of the project. Maintenance period shall be based on Substantial Completion and Final Acceptance schedule for the project

2. Three (3) Month Maintenance Period AFTER SUBSTANTIAL COMPLETION Requirements: after receipt of Substantial Completion Letter, a 3-month maintenance period shall begin. Contractor shall maintain the project landscape. Maintenance shall include but not be limited to the following irrigation schedule: weeding (manual and chemical within one week of Ground Operations Request and written record of chemical application), cultivating, pruning (as required by Grounds Ops), mowing, re-staking, adjustments of stakes, restoring of plant and tree wells, maintenance of mulch cover, edging of beds and curbs, litter removal in bed areas and lawns, and removal of and replacement of dead plants and dead trees

3. Grass height should not exceed 4” between mowing. Mow as needed to maintain an approximate 2-1/2” height or approximately every 7 to 10 days or on special occasions or for special requests.

B. Trees Protection

1. All trees and natural areas to be preserved shall be protected during construction with chain link fence. Location of fences and installation details shall be included in construction documents. Refer to Section 01 56 39 Tree Protection.
PART 2: PRODUCTS

2.01 Landscape Products

A. Plantings: Specify container-grown unless otherwise approved by Texas State University Project Representative. Plant materials shall follow ANSI Z60 American Standards for Nursery Stock guidelines. Plants shall be first quality, healthy, vigorous and densely foliated. Plants with diseases, pests, girdling roots, absence of root flare, improper branch spacing, or other objectionable characteristics shall be rejected. No trees shall be lifted by the trunk at any time. Plant materials showing mechanical damage may be rejected.

B. Supplements: Grounds Operations may specify that fertilizer shall be supplied as recommended.

C. Backfill: Use only approved weed free soil mix backfilled in maximum six-inch lifts. Lightly compact each six-inch lift.

D. Staking/Guying: Guy wires may be required on large trees at Director of Grounds Operations or delegate’s request. Removal of synthetic material and/or wire or burlap, is required if included in the plants root ball.

E. Plant tags and flagging are to be removed after plant materials have been accepted and planted.

2.02 PLANTS:

A. The list of plants below has been approved in the Texas State University Master Plan. Deviation from this list will have to be approved by Texas State University.

B. Campus Plant Zones: The Texas State University Campus is divided into 3 zones; Plateau, Prairie, and Wetlands.

C. Approved Plants to be used on Texas State University Campus.
## Shade Trees

<table>
<thead>
<tr>
<th>Category</th>
<th>Scientific Name/Common Name</th>
<th>Zone</th>
<th>Evergreen</th>
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<tbody>
<tr>
<td>1</td>
<td>Acer grandidentatum/Bigtooth Maple</td>
<td>PL/PR</td>
<td>D</td>
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<tr>
<td>2</td>
<td>Acer negundo/Box Elder</td>
<td>W</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>Acer rubrum/Red Maple</td>
<td>W/PR</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
<td>Carya illinoensis/Pecan cultivars</td>
<td>PR/W</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>Cupressus arizonica/Arizona Cypress</td>
<td>PL</td>
<td>E</td>
</tr>
<tr>
<td>6</td>
<td>Ehretia anacua/Anacua</td>
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<td>Fraxinus texensis/Texas Ash</td>
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<td>Juniperus virginiana/Eastern Red Cedar</td>
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<td>Liquidambar styraciflua/Sweetgum</td>
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## SECTION 32 93 00 – PLANTS

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<td>Cotinus obovatus/Smoketree</td>
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<td>Cupressus arizonica/Arizona Cypress</td>
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<td>Diospyros texana/Texas Persimmon</td>
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<td>Eriobotrya japonica/Loquat</td>
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<td>Ilex vomitoria/Yaupon Holly cultivars</td>
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<td>Lagerstroemia indica/Crape Myrtle cultivars</td>
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<td>Leucaena retusa/Goldenball Leadtree</td>
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<td>Palm spp.</td>
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### SECTION 32 93 00 – PLANTS

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<td>20</td>
<td>Prunus caroliniana/Cherry Laurel</td>
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<td>21</td>
<td>Prunus mexicana/Mexican Plum</td>
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<td>Sophora affinis/Eve’s Necklace</td>
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SECTION 32 93 00 – PLANTS

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<tr>
<td>26</td>
<td>Ungnadia speciosa/Mexican Buckeye</td>
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<tr>
<td>27</td>
<td>Viburnum rufidulum/Black Haw Viburnum</td>
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<td>Vitex agnus-castus/Chaste Tree</td>
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Shrubs

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<tr>
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<td>2</td>
<td>Berberis trifoliolata - Agarita</td>
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<tr>
<td>3</td>
<td>Caesalpinia gilliesii-red &amp; yellow/Bird of Paradise</td>
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### SECTION 32 93 00 – PLANTS

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<td>5</td>
<td>Callicarpa americana/American Beauty Berry</td>
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<td>6</td>
<td>Eleagnus pungens/Eleagnus</td>
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<tr>
<td>7 TBG</td>
<td>Dietes iridoides Butterfly Iris</td>
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<td>8</td>
<td>Fatsia japonica/Fatsia</td>
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<td>9 TBG</td>
<td>Feijoa sellowiana Pineapple Guava</td>
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<td>10</td>
<td>Hibiscus militaris/Rose Mallow</td>
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<td></td>
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<td>Location</td>
<td>Category</td>
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<td>Jasminum mesnyi/Primrose Jasmine</td>
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<td>12</td>
<td>Leucophyllum spp./Cenizo cultivars</td>
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<tr>
<td>13</td>
<td>Mimosa Borealis/Fragrant Mimosa</td>
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<td>14</td>
<td>Myrica cerifera/Southern Wax Myrtle</td>
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<td>Maphigia punicifolia Barbados Cherry</td>
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<tr>
<td>16</td>
<td>Nerium oleander ‘Petite’ Dwarf oleander</td>
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### SECTION 32 93 00 – PLANTS

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<td>Sabal Minor/Dwarf Palmetto</td>
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<td>Salvia spp. Salvia</td>
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<td>22</td>
<td>Senna corymbosa/Flowering Senna</td>
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<td>23 SPECK</td>
<td>Senna lindeheimeriana/Lindeheimer Senna</td>
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<td>24</td>
<td>Xylosma congestum/Xylosma</td>
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</table>
### SECTION 32 93 00 – PLANTS

| Perennials                  |                      |   |   |
|-----------------------------|----------------------|--|--
| 1  | Achellia millefolium/Yarrow | PR/PL | E |
| 2  | Agave spp./Agave cultivars | PL   | E |
| 3  | Anisacanthus wrightii/Flame Acanthus | PL | D |
| 4  | Aquilegia spp./Columbine | PL/PR | D |
| 5  | Artemesia sp./Artemesia | PL   | D |
| 6  | Aster frikartii/Fall Aster | PL   | D |
## SECTION 32 93 00 – PLANTS

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<td>Carex spp./Sedge</td>
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<td>Coreopsis lanceolata/Coreopsis</td>
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<td>Cyrtomium falcatum/Holly Fern</td>
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<td>Chrysactinia mexicana/Damianita</td>
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### SECTION 32 93 00 – PLANTS

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<td>16</td>
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<td>Hymenocallis liriosme/Spider Lily</td>
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## SECTION 32 93 00 – PLANTS

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<tr>
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<td>Liriope gigantiea/Giant Liriope</td>
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<td>Malaviscus arboreus/ Turk's Cap</td>
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### SECTION 32 93 00 – PLANTS

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<td>Rudbeckia spp. /Black-eyed Susan</td>
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<td>Ruellia spp. /Mexican Petunia</td>
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**Vines**

| 1 | Bignonia/Crossvine | PL/PR | D/E |   |

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# SECTION 32 93 00 – PLANTS

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<td>Gelsemium sempervirens/Carolina Jessamine</td>
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</tr>
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<td>Lonicera sempervirens/Coral Honeysuckle</td>
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<td>Mascagnia macroptera/Butterfly Vine</td>
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<td>7</td>
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<td>Wisteria frutescens/Texas Wisteria</td>
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Groundcover

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Lawn

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SECTION 32 93 00 – PLANTS

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<td>PL  D</td>
</tr>
<tr>
<td>4</td>
<td>Zoysia</td>
<td>PL/PR  D</td>
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</table>

PART 3: EXECUTION

3.01 All landscaping activities shall be performed in a manner that reduces the discharge of pollutants to the storm sewer system. Applicators of fertilizer, pesticides, and herbicides must be trained and appropriately, certified. Application of all fertilizer, pesticides, and herbicides shall be in a manner that minimizes their application to impervious cover and unvegetated areas. Storage shall be in rainfall protected location within secondary containment. Unused fertilizer, pesticides, and herbicides and their residues and containers shall be properly disposed of according to applicable state and federal regulations. Spills shall be cleaned up immediately and disposed of properly. Clean up rocks, pots, and other debris. Clean mulch off of grass and hard surfaces. Remove all tags and labels from installed plants. Also, remove tree stakes that were brought in pots from nursery.

END OF SECTION 32 93 00
SECTION 32 94 13 – LANDSCAPE EDGING

PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of the Texas State University-San Marcos for Mulching.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

PART 2: PRODUCTS

A. Approved Landscape Edging:

B. 1. Col-Met, or similar, commercial grade steel edging, 7 gage (3/16”), 25 lbs., 4” Wide.

2. Finish: Powder coat painted black only.

C. Stakes: 10 gage x 12” Long, powder coat paint finished in black.

PART 3: EXECUTION (NOT USED)

END OF SECTION 32 91 13.16
DIVISION 33: Utilities

31 25 13 Earthwork
33 00 00 Utilities
33 51 13 Natural Gas Piping
33 63 13 Underground Steam and Condensate Distribution Piping
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

PART 1: GENERAL

1.01 Definitions

A. BMP – Best Management Practices means physical facilities schedules of activities prohibition of practices, maintenance procedures, and other management practices, when properly designed, installed, and maintained, will be effective to prevent or reduce the discharge of pollution associated with construction activities.

B. CSN – Construction Site Notice – (NOI-CSN for Large sites; CSN for Small sites).

C. EHSRM – Environmental Health, Safety and Risk Management

D. NOI & NOT – Notice of Intent and Notice of Termination for TPDES permits.

E. SWPPP – Storm Water Pollution Prevention Plan

F. TCEQ – Texas Commission on Environmental Quality

G. TPDES – Texas Pollutant Discharge Elimination System

H. Large Construction Activities – Construction activities including clearing, grading and excavating that result in land disturbance of equal to or greater than five (5) acres.

I. Small Construction Activities - Construction activities including clearing, grading and excavating that result in land disturbance of equal to or greater than one (1) and less than five (5) acres of land.

J. FPDC – Facilities Planning, Design and Construction

1.02 Scope of Standard

A. This standard pertains to the provisions for the control of erosion in the construction areas and in stockpile areas.

B. Texas State University designs all projects to meet LEED Silver design criteria. Construction activity pollution prevention is a mandatory requirement.
C. Contractor is responsible for meeting all local, state and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System, regulations from the Clean Water Act, and shall implement in accordance with Texas State University MS4 plan.

1.03 Related Work

A. Drawings and general provisions of the contract, including Procurement and Contracting Requirements, Division 00 and Division 01 of the project specifications.
B. Design Standards, Section 31 11 00 Clearing and Grubbing.
C. Design Standards, 31 22 13 Site Grading
D. Design Standards, 31 23 33 Trenching, Backfilling, and Compaction
E. Design Standards, 33 40 00 Drainage
F. Design Standards, 33 01 00 Utilities

1.04 Contractor Responsibilities

A. The contractor will adhere to the construction portions of the Texas State University Stormwater Management Plan as filed with the TCEQ under the University's MS4 permit. The University is considered a Level 2 MS4 operator under TPDES General Permit No. TXR040000 for University property within the City of San Marcos limits.

B. This project requires implementation of storm water “Best Management Practices” (BMP) for control devices and monitoring by the Contractor to comply with all provisions of the Storm Water Pollution Prevention Plan (SWPPP) developed for the project by the contractor. The Contractor must fulfill all TCEQ Texas Pollutant Discharge Elimination System (TPDES) regulatory requirements in the General Permit No. TXR 150000, including the filing of a NOI, and NOT or signing and posting of the Construction Site Notice (CSN).

C. The Contractor shall provide signatures of a corporate officer for the NOI, NOI-CSN, CSN and NOT and any other forms or applications as required by the TCEQ General Permit No. TXR 150000. The Contractor shall also provide delegated authorization to sign reports per 30 TAC305.128. Individuals conducting storm water inspections shall be qualified to the satisfaction of the Owner.

D. When the Contractor receives approval of the SWPPP from FPDC, the Contractor signs that NOI and /or CSN and sends the application fee and NOI to the TCEQ. The Contractor shall insert a copy of the signed NOI or CSN into the SWPPP booklet
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

to be kept at the jobsite. The application fee is not required for Small Construction Sites or CSN sites.

E. The SWPPP notebook kept at the jobsite shall also contain the following:
   1. A copy of signed NOI
   2. A copy of the Construction Site Notice (Large or Small)
   3. Owner CSN for small sites or large CSN-Secondary Operator for large sites.
   4. Cover letters or fax cover sheets showing that the signed NOI was submitted to Texas State University 7 days prior to commencing construction for large construction sites or that the CSN was submitted to Texas State University 2 days prior to commencing construction activities for small construction sites.

F. The Contractor shall review the SWPPP and verify existing conditions at the site before determining scope of implementation of site controls. Site survey and site plan drawings shall be used for additional reference. The Contractor shall notify FPDC, in advance, of this site review to allow for Owner participation.

G. The Contractor shall construct a Project SWPPP sign and place it at the main entrance to the project site. This sign shall include the NOI and TPDES permit along with the TCEQ TPDES Large Construction Site Notice (NOI-CSN); or the Construction Site Notice (CSN) for small construction projects. The sign shall be constructed as detailed in the sample SWPPP sign drawing.

H. Contractor shall contact FPDC for review of initial site controls in place prior to commencing site-disturbing activities, to ensure that any unusual circumstances or unforeseen site conditions with regard to erosion and sedimentation have been addressed.

I. The Contractor shall provide all material, labor, equipment and services required to implement, maintain and monitor all erosion and sedimentation controls in compliance with the SWPPP. All controls implemented by the Contractor shall comply with TCEQ General Storm Water Permit TXR 150000. These controls shall remain in operation until project completion and reestablishment of the site or longer as directed by FPDC. The work shall include, but not be limited to the following:

   1. All earthwork as required to implement swales, dikes, basins and other excavations for temporary routing of utilities, to protect against erosion or sediment-laden (“polluted”) storm water runoff.

   2. All structural controls as shown or specified, including silt fences, sediment traps, stabilized construction entrance, subsurface drains, pipe slope drains, inlet/outlet protection, reinforced soil retention, gabions, rock berms, etc.

   3. All non-structural controls as shown or specified, including temporary or permanent vegetation, mulching, geotextiles, sod stabilization, preservation of
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

vegetative buffer strips, preservation/protection of existing trees and other mature vegetation.

4. All modifications and revisions of SWPPP necessary to meet changing site conditions and to address new sources of storm water discharges, as the work progresses.

5. All maintenance and repair of structural and non-structural controls in place shall continue until final stabilization is achieved or as directed by FPDC.

6. Site inspections, as required by the SWPPP, of pollutant sources, including hazardous sources, structural and non-structural controls, and all monitoring of SWPPP revisions and maintenance of inspection records.

7. BMP maintenance or noncompliance issues reported to the Contractor by FPDC should be corrected the day the maintenance or noncompliance issue is reported.

8. Keep records of inspections current in the SWPPP (in field office), available for review by EPA, TCEQ, FPDC, and Owner.

9. Removal of all structural and non-structural controls as necessary upon completion, and only after final stabilization is achieved.

10. Filing of Notice of Termination (NOT) with the TCEQ (original) and Texas State University (copy) for sites that required a NOI (i.e. > 5 acres) within 30 days of final stabilization being achieved and is approved by the Owner, or of another Operator assuming control of the unstabilized portions of the site. Provide Owner with a copy of this filing. For small construction sites, the Contractor will remove the CSN, date the lower right hand corner, as indicated, and send the CSN to the MS4 operator. A copy will be given to the Owner.
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

PART 2: EXECUTION

2.01 General

Specific site control devices are identified in the SWPPP. Where such devices are indicated, their material composition shall comply with these sections.

SECTION 1: SITE EVALUATION, ASSESSMENT, AND PLANNING

1.1 Project/Site Information
1.2 Contact Information/Responsible Parties
1.3 Nature and Sequence of Construction Activity
1.4 Soils, Slopes, Vegetation, and Current Drainage Patterns
1.5 Construction Site Estimates
1.6 Receiving Waters
1.7 Site Features and Sensitive Areas to be protected
1.8 Potential Sources of Pollution
1.9 Historic Preservation
1.10 Maps

SECTION 2: EROSION AND SEDIMENT CONTROL BMPS

2.1 Minimize Disturbed Area and Protect Natural Features and Soil
2.2 Phase Construction Activity
2.3 Control Stormwater Flowing onto and through the Project
2.4 Stabilize Soils
2.5 Protect Slopes
2.6 Protect Storm Drain Inlets
2.7 Establish Perimeter Controls and Sediment Barriers
2.8 Retain Sediment On-Site
2.9 Establish Stabilized Construction Exits
2.10 Additional BMPs

SECTION 3: GOOD HOUSEKEEPING BMPs

3.1 Material Handling and Waste Management
3.2 Establish Proper Building Material Staging Areas
3.3 Designate Washout Areas
3.4 Establish Proper Equipment/Vehicle Fueling and Maintenance Practices
3.5 Control Equipment/Vehicle Washing
3.6 Spill Prevention and Control Plan
3.7 Any Additional BMPs

- Mortar Mix Areas
- Paint Rinsewater Management
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

• Dewatering Procedures

3.8 Allowable Non-Stormwater Discharge Management

SECTION 4: SELECTING POST-CONSTRUCTION BMPs

4.1 Water Quality
4.2 Detention

SECTION 5: INSPECTIONS

5.1 Inspections
5.2 Delegation of Authority
5.3 Corrective Action Log

SECTION 6: RECORDKEEPING AND TRAINING

6.1 Recordkeeping
6.2 Log of Changes to the SWPPP
6.3 Training

SECTION 7: FINAL STABILIZATION
SECTION 8: CERTIFICATION AND NOTIFICATION

SWPPP APPENDICES

Appendix A- General Location Map
Appendix B - Site Maps
Appendix C - Construction General Permit
Appendix D- NOI and Acknowledgement Letter from EPA/State
Appendix E - Inspection Reports
Appendix F- Corrective Action Log (or in Part 5.3) Appendix G - SWPPP Amendment Log (or in Part 6.2) Appendix H - Subcontractor Certifications/Agreements
Appendix G – SWPPP Amendment Log (or in Part 6.2)
Appendix H – Subcontractor Certifications/Agreements
Appendix I – Grading and Stabilization Activities Log (or in Part 6.1)
Appendix J -Training Log
Appendix K- Delegation of Authority
Appendix L- Construction Site Notice
SECTION 31 25 13 – EROSION AND SEDIMENTATION CONTROL

2.02 Inspections and Record-Keeping

A. Contractor shall inspect all BMP’s daily and coordinate inspections with FPDC, who will also regularly inspect the site. Record all deficiencies of site controls and take appropriate action to correct any deficiencies recorded. Exception is rock berms located in a streambed. Any rock berm located in a streambed shall be inspected on a daily basis.

B. Contractor shall keep records of all Contractor inspections on file with SWPPP notebook at project site, and make available for review by Owner’s Representative/s or EPA, TCEQ or MS4 operator officials requesting review of SWPPP inspection records.

2.03 Maintenance

A. All erosion and sediment control measures and other protective measures identified in the SWPPP must be maintained in effective operating condition. Maintenance issues found during an inspection must be replaced or corrected immediately upon discovery.

END OF SECTION 31 25 13
SECTION 33 00 00 – UTILITIES

PART 1: GENERAL

1.01 SCOPE OF STANDARD

A. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

B. All utility connections to the various campus utility distribution systems 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.

C. Record documents are the basis for the University’s BIM to FM Program. The BIM program implements the required Construction Operations Building information exchange (COBie). COBie is the required process of data collection by the architect/engineer and the contractor to handoff a data file at project closeout that is consumable by the University’s CMMS or CAFM software.

D. All site utilities shall be included as part of the BIM(s). All site utilities shall be shown accurately in terms of size, depth and location.

E. Verification of design to ensure the sanitary sewer system is not cross connected to stormwater, rainwater collection or guttering inside and outside of building

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 00 Earth Work
B. Section 22 00 00 Plumbing
C. Section 26 00 00 Electrical

PART 2: SCOPE OF WORK

2.01 SANITARY SEWER UTILITIES

A. Refer to Section 22 00 00 – Plumbing General Systems Design

2.02 WATER UTILITIES

A. Refer to Section 22 00 00 – Plumbing General Systems Design
SECTION 33 00 00 – UTILITIES

2.03 STORM DRAINAGE UTILITIES
   A. Refer to Sections 22 00 00 – Plumbing and Section 31 00 00 Earth Work

2.04 ELECTRICAL DISTRIBUTION (Underground Ductbanks)
   A. Refer to Section 26 00 00 – Electrical

2.05 MANHOLE COVERS
   A. Texas State University has standardized utility manhole covers to be used on all underground utility access on campus. All new manhole cover installations must be heavy duty gray iron as manufactured by East Jordon Iron Work (EJ) or approved equal. Standard thickness is used for pedestrian and non-vehicular application. For manholes in vehicular traffic roadways and drives a DOT rated thickness is required.
   B. Locking system consisting of security driven bolt and spring loaded pistons required.
   C. Refer to the attached specification sheet for MANHOLE COVER MARKING STANDARDS.

PART 3 – EXECUTION

3.01 N/A
SECTION 33 00 00 – UTILITIES
PART 1: GENERAL

1.01

A. Do not include a manual bypass around the natural gas regulator.

B. Avoid 2-1/2, 3-1/2 and 5-inch pipe in natural gas systems.

C. Valves for use on natural gas shall typically be plug-type, AGA approved and meeting requirements of local gas utility companies. Where ball valves are approved, they must be manufactured as AGA approved.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 33 51 13
PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for Steam Distribution.

B. Texas State University-San Marcos recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University-San Marcos projects.

1.02 System Description

A. Steam Distribution System: Steam is the primary heat source for a variety of heating functions throughout the University. Saturated steam is generated at the Co-Generation Facility and distributed via a loop piping system, which operates at 60 psig (308°F). (Design conditions for piping are 135 psig and 400°F. The distribution system serves all sections of Central Campus as well as West Campus.

B. Condensate Return System: The condensate return system operates with 180°F condensate at 20 psig. Design conditions for piping are 100 psig and (212°F).

1.03 Code Compliance and Standards:

Use current edition in effect at time of design and construction.

A. American Society of Mechanical Engineers (ASME) - Boiler and Pressure Vessel Code.

B. American National Standards Institute (ANSI) - B31.1 Power Piping.

C. Expansion Joint Manufacturers Association (EJMA) – Standards.

D. Texas Department of Transportation – Standards.

1.04 Quality Assurance.

A. All materials shall be certified new from factory. Pipe, fittings, and valves shall meet or exceed ANSI/ASME standards and be suitably stamped.

B. Welder Qualifications: Welder(s) shall be qualified in accordance with ASME Section VIII, Pressure Vessels, ASME Section IX, Welding and Brazing.
QUALIFICATIONS

Welders shall be thoroughly familiar with ANSI B31.1 requirements.

C. The Contractor shall furnish to the Project Manager all applicable welding procedures and welder certification and procedure qualification records. All documentation shall be signed and dated by the appropriate Contractor personnel.

1.05 Submittals

A. Manufacturer’s Data: Manufacturer’s standard drawings, catalog cuts, specifications, and data sheets for all materials and equipment (piping, valves, expansion joints, insulation, etc.) shall be submitted to the Project Manager for approval.

B. Shop Drawings: Manufacturer’s shop drawings for underground piping or conduit systems, including anchors, guides, supports, vault penetrations and trenches shall be submitted to the Project Manager for approval.

C. Welder’s Performance Qualifications: Welder’s performance qualification records shall be submitted to the Project Manager for approval prior to beginning work.

1.06 Delivery, Storage, and Handling

A. Delivery and Storage:

1. Contractor shall be responsible for inspecting materials delivered to site for damage.

2. Materials shall be stored on-site in enclosures or under protective coverings. Materials shall not be stored directly on ground.

3. Insulation, expansion joints, joint materials, fittings, valves, and gaskets shall be stored under cover out of direct sunlight.

B. Handling:

1. Pipe, conduit sections, fittings, valves and other accessories shall be handled in such a manner as to ensure delivery to the trench in sound, undamaged condition.

2. Special care shall be taken to avoid injury to coatings and linings on pipe and fittings. Damaged coatings and linings shall be repaired by the Contractor to the satisfaction of the Project Manager.
SECTION 33 63 13 – UNDERGROUND STEAM AND CONDENSATE DISTRIBUTION PIPING

PART 2: PRODUCTS

2.01 Pipe and Fittings.

A. Pipe:

1. ASTM A-106 (seamless), Grade B, black carbon steel.

2. Condensate lines: all sizes to be Schedule 80.

3. Steam lines:
   a. 2 inch and smaller: Schedule 80,
   b. 2.5 inch through 10 inch: Schedule 40,
   c. 12 inch through 14-inch, 0.375-inch wall,

B. Fittings:

1. Threaded or socket weld (2 inches and smaller): ANSI B16.11 forged carbon steel, ASTM A105, 2000# class.

2. Butt-Welded (2.5 inch and larger): ANSI B16.9, ASTM A234 WPB, schedule to match pipe.

3. Flanged (2.5 inch and larger): ANSI B16.5, ASTM A105 forged steel, 150 or 300 pound class, weld-neck flanges shall be used to match equipment.


5. Dielectric flange sets shall be rated for the service intended.

6. All buried pipe fittings shall be butt welded for all sizes.

2.02 Valves.

A. General: Valves shall be threaded for 2 inch and smaller piping, flanged for 2.5 inch and larger. Socket weld or butt weld valves shall only be used if specified on the Contract Drawings. Acceptable valve manufacturers for steam or condensate service are provided below, no substitutions unless approved by the Project Manager.

1. No cast iron due to vulnerability to fracture from water hammer.
B. Gate Valves:
   1. Threaded (2 inch and smaller): ANSI B16.34, 800 pound class, forged steel, bolted bonnet, conventional port gate valve Walworth, Vogt, Crane, or Edwards.
   2. Flanged (2.5 inch and larger): ANSI B16.34, 150 pound class, A216 WCB cast steel body, bolted bonnet, stainless steel trim; Walworth, Crane, Velan or Stockham.
   3. Butt weld (2.5 inch and larger): ANSI B16.34, 150 pound class, A216 WCB cast steel body, bolted bonnet, stainless steel trim, Walworth, Crane, Velan or Stockham.
   4. Warm up lines: All gate valves 4 inches and larger shall have bypass lines with appropriately sized warm up valves.

C. Globe Valves:
   1. Threaded (2 inch and smaller): ANSI B16.34, 800 pound class, forged steel body, stainless steel seat ring and plug, bolted bonnet, rising steam; Walworth, Vogt, or Edwards.
   2. Flanged (2.5 inch and larger): ANSI B16.34, 150 pound class, A216 WCB cast steel body, stainless steel trim, Walworth, Crane, or Stockham.

D. Ball Valves:
   1. Threaded (2 inches and smaller): 150-pound class, steam-rated, cast steel/stainless steel, Nibco or Walworth.

E. Check Valves (condensate systems only):
   1. Threaded (for steam trap discharge): 800 pound class, forged steel, stainless steel disc, swing check, Vogt, Edwards, or Walworth.
   2. Flanged (2.5 inch and larger): ANSI B16.34, 150 pound class, A216 WCB cast steel body, bolted flange cover, swing check; Walworth or Stockham.
   3. Vertical lift check valves: threaded, 150/200-pound class, for steam powered condensate pump, Stockham, United, Walworth.

F. Rotary Valves:
   1. 150-pound class, carbon steel, flanged, Adams or Keystone Vanessa.
SECTION 33 63 13 – UNDERGROUND STEAM AND CONDENSATE DISTRIBUTION PIPING

2.03 Piping Specialties

A. Gaskets: Non-asbestos containing Mica Graphite Spiral Wound to be used with Standard ASME B 16.5 flanges, suitable for the fluids and temperatures encountered.

B. Bolting: ASTM A193, Grade B7, for bolts and studs, and ASTM A194, Grade 2H for nuts.

C. Sleeves: Sleeves for foundation wall penetrations shall be fabricated of one-eighth inch (1/8”) thick steel, with two inch (2”) wide collar welded in place, and the assembly hot-dip galvanized.

D. Wall Penetration Seals: High temperature elastomeric link type mechanical seals compressed with corrosion-protected bolts and compression plates, Thunderline Link-Seal, no substitution.

E. Expansion Joints:

1. Expansion joints shall be slip tube type or externally pressurized bellows type as designed for the specific location. They shall be 150-psig steam rating, flanged, and shall conform to the Standards of the Expansion Joint Manufacturers Association.

2. Bellows type joints shall have 316 ss bellows, and may be single or double bellows style as required for the intended service: Hyspan, Pathway or Senior Flexonics.

3. Slip-tube type shall have external and internal high performance guides rated for 500°F and designed for packing under pressure, Yarway or Hyspan.

4. Slip-tube joints shall be single or double type with center take-off taps as required for the given service.

F. Steam Traps for main line or building- Install test valve downstream of trap and before check valve. Armstrong, Spirex Sarco, or Hoffman.

G. Automatic Air Vents (for high points on condensate systems): ¾ inch thread-o-let with ¾ inch gate isolation valve is required upstream of air vent. Air vent shall be ¾ inch 150 # rating, Sarco 13W or approved equal. Discharge of condensate air vents in vaults shall be routed to the floor.
SECTION 33 63 13 – UNDERGROUND STEAM AND CONDENSATE DISTRIBUTION PIPING

H. Strainers (for use on steam trap stations): Y-type with cast or forged steel body, 1/16 inch mesh monel strainer elements, threaded for 2 inch and smaller piping; C.M. Bailey or Spirax Sarco IT.

I. Pipe Hangers and Supports: Pipe hangers and supports shall be designed, and located per the requirements of B31.1 and the recommendations of the powder insulation or prefabricated conduit system vendor.

J. Pressure gauges: 4.5 inch dial, bourdon tube, 0 to 200 psig on steam mains, 0 to 50 psig on condensate mains, Ashcroft. Include isolation valve and pigtail coil on steam gauges.

K. No vents on steam side.

L. Insulation:
   1. In manholes, pipe 2.5 inch and greater shall be insulated with ASTM C533, Type I, calcium silicate; 2.5 to 6 inch steam (3 inches thick), 8 to 12 inch steam (4 inches thick), 2.5 to 6 inch condensate (2 inches thick).

   2. In manholes, tunnels, and exterior installations: pipe and fitting insulation shall be covered with 0.016-inch smooth aluminum jackets with integral moisture barrier. Stainless steel band on 12-inch center shall hold the insulation to the pipe.

   3. Valves and equipment shall be insulated with removable shop-fabricated fiberglass padding rated for 500oF, with thin wire mesh lining, and covered with 18 ounce high-temperature fiberglass cloth with Velcro straps.

2.04 Manholes

A. General:
   1. All structures shall be of reinforced concrete. Main line junctions and service connections shall be in vaults, which require two openings. Minor assemblies such as drip legs, can be in pits, which require only one opening.

   2. Prefabricated or field-constructed manholes shall be provided with walls, floors, and roofs not less than 8 inches thick and reinforced with steel bars. Floors shall drain to sump hole.

   3. Prefabricated concrete manholes shall conform to TX Dot Standard Specifications.
SECTION 33 63 13 – UNDERGROUND STEAM AND CONDENSATE DISTRIBUTION PIPING

4. Concrete shall be 2500 psi minimum compressive strength after twenty-eight (28) days, for both prefabricated and field-constructed manholes.

5. Waterproofing shall be provided according to TX Dot Standard Specifications.

6. Ladders shall be provided according to TX Dot Standard Specifications. Covers and openings shall be vehicular traffic rated (H-20). One minimum 40 inch solid lid and marked STEAM.

2.05 Buried Conduit Systems

A. The condensate return piping shall not be in the same conduit as the steam piping.

B. Steel or Corrugated Steel Casing to meet engineers’ specs. Fiberglass Conduit Casing: No fiberglass casing shall be used.

C. Conduit End Seals: Conduit end seals shall be fixed type where there is no thermal pipe expansion through the end seal, and shall be slip type where there is thermal pipe expansion through the end seal. One-half inch (1/2”) threaded pipe ports at top and bottom of each end seal shall be provided for draining, venting, and pressure testing of conduit casings.

D. Insulation: ASTM C533, Type I, calcium silicate, mineral fiber, or C552 cellular glass three inch (3”) for steam, and two inch (2”) for condensate shall be used on the steel pipe within the casing.

E. Expansion Loops and L-Bends:

1. ANSI B31.1, factory fabricated, with weld testing per design. Casing, couplings, insulation, and piping shall be identical to those used for straight runs and designed to ensure complete drainage. Fabricated materials shall be shipped to the job site in maximum feasible size sections to minimize number of field joints.

2. Loop casings shall be sized to contain pipe movement without crushing the insulation or causing other damage. Eccentric reducers and increasers or welding collars designed to serve the same purpose shall be used to allow free drainage through the loop.

3. Pipe supports shall be slotted to permit unrestricted lateral movement of piping, and shall be otherwise identical to pipe supports specified for straight runs.
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F. Pipe Supports: Anchors shall be located outside vaults. Inside vaults, vent and drain holes shall be provided at the top and bottom of casing closure plates.

PART 3: EXECUTION

3.01 Trenching, Backfilling, and Compacting

A. Refer to Excavation and Fill Standards

B. Trenching: Stanford may limit the amount of trench to be opened at any time.

C. Bedding:

1. Pre-insulated conduit systems: Ditch bedding shall be accurately graded with a minimum of six inches (6”) of sand. Sand shall pass a ¼-inch screen with not more than fifteen percent (15%) passing a No.200 sieve. Sand shall be backfilled to a minimum of six inches (6”) above the pipe casing. Bedding shall be laid to firmly support the piping along its entire length.

2. Steel pipe and powder insulation system: The steel pipes shall be top hung or bottom supported to allow a bedding of powder insulation underneath (in accordance with manufacturer’s specifications). The powder insulation shall be placed to the minimum thickness shown on the Contract Drawings. The insulation shall be installed and compacted (per the manufacturer specifications) to firmly support the piping along its entire length.

D. Backfilling: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits.

E. Damage Repair: Utilities, walls, piping, and other improvements damaged during the course of work shall be repaired to their original condition or replaced by the Contractor.

F. Excess Material: Excess material and debris shall be removed and disposed of, at an approved disposal site, within one week after final approval of installation.

3.02 Piping Installation

A. General:

1. Piping and pipe systems shall be fabricated, assembled, welded, installed and tested in accordance with ANSI B31.1.
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2. Piping shall be cut accurately to field measurements and worked into place without springing or forcing, except where cold-springing is specified. Piping shall not be buried, concealed, or insulated until it has been inspected, tested, and approved in accordance with Article 3.07, Field Quality Control (below).

3. Materials and equipment shall be protected from the weather during construction.

4. Pipe runs underground between vaults shall be welded. Flanged and threaded joints shall not be buried.

5. Gaskets, packing, and thread compounds shall be suitable for the service. Joint compound or thread tape shall be applied to male threads only.

6. Arrangement of all piping shall be shown on the drawings. During installation, care shall be taken to avoid interference with other piping, conduit, and equipment. Lines shall be trapped only where shown on the drawings.

7. Reducing fittings shall be used for changes in pipe sizes. Bushings shall not be used.

8. In horizontal lines two inches (2”) and larger, reducing fittings of the eccentric type shall be used to maintain the bottoms of the lines in the same plane for steam, and the tops of the lines in the same plane for condensate.

9. Pipe shall be adequately supported and anchored so that strain from weight and thermal movement of piping is not imposed on piping, equipment, or structures.

B. Cleaning:

1. Each section of pipe, fittings, and valves shall be thoroughly cleaned free of all foreign matter before erection. Interior of piping shall be cleaned thoroughly as described in Article 3.07 (below) before final connections are made.

2. Open ends of mains shall be plugged or capped during shutdown periods. Lines shall not be left open at any place where foreign matter might accidentally enter pipe.

C. Pipe Expansion: Expansion of pipes shall be accommodated by expansion loops, L-bends, Z-bends in buried locations, or by slip or bellows expansion joints in
manholes, tunnels and buildings. Expansion joints shall be set to ensure proper function and movement during system operation.

D. Connections: Locations of capped or plugged outlets for future connections shall be shown on the Drawings. Weld-o-lets or welding fittings shall be used for tapping existing systems.

E. Steam Line Drainage: Steam lines shall be pitched according to engineering specifications to allow for condensate drainage to the low point steam pots. For steam pipes in tunnels sloped down in the direction of steam flow, a minimum of three inches per one-hundred feet (3” per 100’) of length is required. Where counter flow of condensate must be accommodated in steam tunnels, lines shall be pitched up in the direction of steam flow six inches per one hundred (6” per 100’) feet of length. Buried steam lines shall be pitched according to engineering specifications to accommodate the worst case of 6” per 100 feet. Steam lines may be peaked with lines pitched as above. Final pipe elevations must be recorded on the as-built drawings.

F. Welding:

1. Responsibilities of Contractor for Electric Fusion Welding:
   a. Contractor shall be responsible for the quality of all welding.
   b. Contractor shall be capable of performing all welding operations required for construction of the steam distribution and condensate return systems.
   c. Contractor shall determine the suitability of welding procedures used to ensure that welds meet the requirements specified herein.

2. Beveling: Field bevels and shop bevels shall be done by mechanical means or by flame cutting. Where beveling is done after flame cutting, surfaces shall be ground and thoroughly cleaned of scale and oxidation just prior to welding. Beveling shall conform to ANSI standards.

3. Butt welds: All butt welds shall be open root, multi-pass welds, 6010 or 6011 root with 6010 filler caps (SMAW welding process).

4. Electrodes shall be stored in a dry, warm area and kept free of moisture during fabrication operations. Electrodes that have lost part of their coatings shall be discarded.

5. Welds shall be inspected in accordance with ANSI B31.1 requirements.

6. If any welds are found to be defective, the Contractor is responsible for full 100% testing of all the welds. Repair of defective welds by adding
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weld material over the defect, or by peening shall not be permitted. Welders responsible for defective welds shall be re-qualified before performing more welding on the job.

G. Anchor Blocks:

1. Anchor Blocks: Concrete anchor blocks shall be provided for pipe anchorage not less than five feet (5’) from building or manhole walls (except where metal anchor at the vault wall is shown on the Contract Drawings). Size and position of anchor blocks shall be as shown on Standard Drawings. Anchor blocks shall be cast against undisturbed earth using concrete that conforms to ASTM C-94 and has a minimum compressive strength of 2,500 psi at twenty-eight (28) days.

2. Fabricated Structural Anchors: Fabricated structural anchors shall be provided if necessary in vaults, tunnels, and mechanical rooms as described in the Contract Drawings.

H. Wall Penetrations: Galvanized steel sleeves shall be provided for penetrations in concrete walls six inches (6”) or less in thickness, and masonry walls. Existing concrete walls thicker than six inches (6”) shall be core drilled or equipped with galvanized steel sleeves. High temperature elastomeric link type seals shall be acceptable for use in all locations.

I. Insulation and Jackets:

1. Insulation shall be continuous through pipe hangers with calcium silicate inserts to prevent crushing of insulation.

2. Steam and condensate valves and equipment in manholes and buildings shall be insulated and covered with removable jackets. Insulation shall stop short of bolts/studs at flanges to allow their removal without damage of permanent insulation.

3. Trap sections between unions in steam trap manifolds shall not be insulated.

4. No exposed insulation will be permitted. Aluminum or PVC end caps that match the insulation jackets shall be used to cover the ends of insulation runs.

5. Steam and condensate lines in manholes, tunnels, and buildings shall be color coded as follows, or as otherwise directed by the Project Manager: High-pressure steam - RED (darker shade) Reduced pressure steam - RED (lighter shade)
3.03 Valve Installation

A. Valves shall be installed in accordance with ANSI B31.1 and ASME Section VIII.

B. Valves shall be installed as shown on the drawings and as required for proper functioning of the system.

C. Valve hand wheels shall be installed in locations accessible from floor level, preferably with vertical stems, for operation and repair.

D. All flange bolts shall be lubricated with a high temperature bolt lubricant approved by the Project Manager. Flanged bolt torque shall be in an incremental staggered pattern to assure even compression of the gasket.

3.04 Piping Specialties Installation

A. Traps and Manifolds: Steam drip and mud legs, guard and blow down valves, and piping shall be as shown on Standard Drawing. Traps stations shall be installed at all mud legs unless otherwise indicated on the drawings. Multiple trap manifolds at one location shall be in the same horizontal plane.

B. Hangers and Supports:

1. Hangers shall be sized to allow for continuous pipe insulation through the hangers. Hangers shall not be permitted to touch steam pipe.

2. Expansion bolts shall be acceptable for use in wall or ceiling construction.

3.05 Buried Conduit Installation

A. Conduit Field Joints:

1. Conduit sections shall be joined after leak testing of carrier pipe. Conduit joining materials provided or specified by the system manufacturer shall be used.

2. Pipe shall be insulated and casing joined to provide field joint equal to factory-fabricated section on conduit system. Connections to existing conduit systems of a different manufacturer or type shall be made only in manholes or buildings and never in buried locations.
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B. Conduit End Seals: Conduit end seals in manholes or tunnels shall be provided with gooseneck vents on the top and drain valves on the bottom. In buildings, conduit end seals shall be provided with threaded brass plugs.

3.06 Field Quality Control

A. General: The Project Manager or his representative will conduct field inspections and shall witness all field tests specified in this Section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required by the Project Manager, that any item of work has been constructed properly in accordance with the Contract Drawings and Specifications.

B. Field Tests:

1. General: All anchor blocks and restraints shall be complete prior to testing. Concrete supports shall be fully cured.

2. Piping Initial Air Leak Tests: Before insulation is applied at field joints, piping shall be pressurized to twenty-five (25) psig air pressure and tested for leaks with soap solution. Leaks shall be repaired and test repeated.

3. Piping Hydrostatic Pressure Tests:
   a. Test pressure gauges for a specific test shall have dials indicating not less than one and one-half (1-1/2) times nor more than two (2) times the test pressure.
   b. After installation of insulation, anchor blocks, and backfill, hydrostatic pressure shall be applied to 100 psig and allowed to stabilize to ground temperature while maintaining 100 psig, +/- 10 psi. After stabilization, pressure source shall be removed. Piping must hold 100 psig, +/- 10 psi, for at least two (2) hours. Leaks shall be repaired and the test repeated if the pressure does not hold.

4. Conduit Casing Pressure Tests: Before backfilling, conduit casing shall be pressurized to fifteen- (15) psig air pressure and allowed to stabilize. After stabilization the pressure source shall be removed. Casing must hold fifteen- (15) psig air pressure, +/- 2 psi, for at least one (1) hours. Pressure test shall be repeated after backfilling. Leaks shall be repaired and the test repeated if the pressure does not hold.

5. Cleaning: After pressure and hydrostatic testing, the pipe system shall be flushed with Steam/Condensate. The Project Manager shall approve the procedure, cleaning solutions, and disposal.
6. Operational Tests: After completion of the work, the system shall be operated for not less than six (6) hours at operational temperatures and pressures to demonstrate satisfactory function. The movement of each expansion joint shall be checked, and each valve shall be operated in both cold and hot conditions.