



2022 LONG-RANGE FACILITIES MASTER PLAN

TECHNICAL DESIGN  
GUIDELINES

February 16, 2023





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# Fort Bend ISD Technical Design Guidelines

## INTRODUCTION

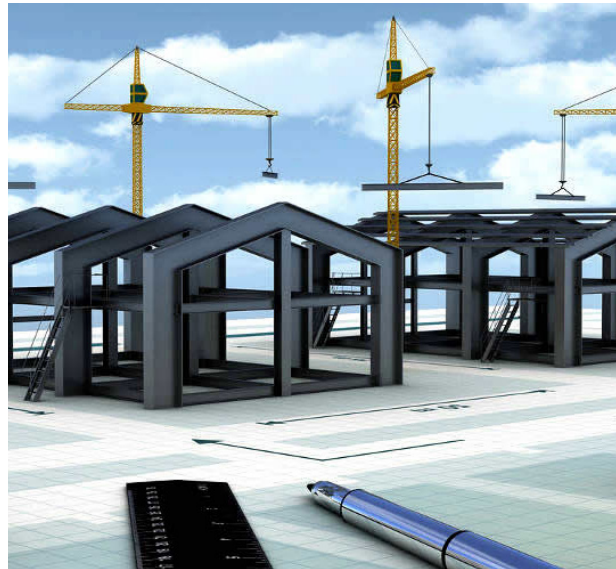
### Definition, Purpose & Use

Because the design, construction, commissioning, operation, maintenance, renovation and/or repurposing of school facilities is a complex process that often transpires over the course of many years, it is essential that construction practices, guidelines and standards are clearly communicated and understood in order to build and maintain optimum learning environments for all Fort Bend ISD students and staff across the District.

Technical Design Guidelines (TDG's) provide documentation regarding Fort Bend ISD standards and design preferences for the construction of new buildings as well as the repair and/or modernization of existing facilities. These standards include both technical and performance-based specifications in addition to prescriptive requirements, including preferred products, systems and materials to be used in programming, design, and construction.

The Fort Bend ISD TDGs were developed to provide District personnel as well as Architects and Engineers with a cohesive set of standards and guidelines for use in the planning and design of Fort Bend ISD facilities. The Fort Bend ISD TDGs were intended to work in unison with the Fort Bend ISD Educational Specifications, as required by the Texas Education Agency, which are defined as a written document that guides the design process of new facilities and major renovations to existing facilities.

A variety of key stakeholders were involved in the development of these Technical Design Guidelines including representatives from FBISD Design & Construction, Maintenance, and Technology Departments as well as a team of professional consultants, engineers and architects, including those involved in the facilities assessment and master planning initiative. TDG development meetings began in January, 2018 and continued through December, 2018. Preliminary standards were drafted, reviewed and revised to incorporate FBISD preferences and observations.



The standards for exterior and interior materials, building systems, and site requirements provide baseline information to guide future construction and renovation.

The materials and systems specified for school buildings should be durable; easy to maintain; provide energy efficient performance; and ideally, environmentally friendly.

It is not the intent of these Technical Design Guidelines to dictate specific project scopes of work, or to address all items required for all projects. Speciality products unique to an individual project that are not addressed herein shall be reviewed and approved by the District as necessary.

The District welcomes suggestions to improve upon these standards; however, any deviation from them must be specifically approved, in writing, by the District. Meanwhile, it is recommended that these standards be reviewed and evaluated annually in order to maintain accuracy and relevancy.

In the event of any conflicts, ambiguities, or discrepancies within this document or for current LEED requirements, interpretations will be made by the FBISD Design Manager.





# Fort Bend ISD Technical Design Guidelines






## SUSTAINABILITY

### Sustainability

The Fort Bend Independent School District is committed to incorporating sustainability into all of its building projects as indicated by the Design Principles. The District strives to create spaces that are energy efficient, using renewable energy and post-recycled materials when possible. The core principles of sustainability include the following:

- Decreasing the amount of energy the facilities consume, primarily electricity and water.
- Employing materials that are less resource consuming.
- Enhancing the learning environment by creating healthier indoor environments.

For projects not pursuing LEED Certification, the “LEED GUIDELINES” section should be considered for inclusion into all FBISD projects. Refer to the Leaf designation within this document for sustainable guidelines that should be incorporated into all projects, not only projects required to be LEED certified. The District highly recommends creativity in sustainable design.

	<b>Sustainability:</b> Spaces are energy efficient, using renewable energy and post-recycled materials when possible.
	<b>Wellness Spaces:</b> Environment allows for a connection to nature through the use of transparency and other biophilic elements. Spaces are diverse in size and shape to allow staff and students opportunities to recharge and refocus throughout the day.
	<b>Technology/Future Ready Tools:</b> Environment provides access to technologically advanced tools, systems, processes, spaces, and futuristic advances to enhance the Learner Experience.
	<b>Learning Spaces:</b> Equips students, inspires learning and fosters the development of the critical attributes included in the FBISD Profile of a Graduate such as collaboration, creativity, and critical thinking.
	<b>Adaptive Spaces:</b> Utilize materials, natural lighting, aesthetics, flexibility, inclusive of outdoor and wellness areas, to create a calm and inviting environment conducive to learning.



# Fort Bend ISD Technical Design Guidelines


## SUSTAINABILITY

### SUSTAINABILITY

The Fort Bend Independent School District is committed to incorporating sustainability into all of its building projects as indicated by the Design Principles. The District strives to create spaces that are energy efficient, using renewable energy and post-recycled materials when possible. The core principles of sustainability include the following:

- Decreasing the amount of energy the facilities consume, primarily electricity and water.
- Employing materials that are less resource consuming.
- Enhancing the learning environment by creating healthier indoor environments.

For projects not pursuing LEED Certification, the sustainable practices below are required for inclusion into all FBISD projects. The District highly recommends creativity in sustainable design and is interested

in pushing the limits to achieve more efficient and healthier buildings. The  Leaf designation can be found throughout this entire document on items considered to be sustainable best practices or items that require LEED coordination. These items should be incorporated into all projects, not only projects required to be LEED certified. Coordinate any items that may be unattainable or not within the project scope or budget with the FBISD Project Manager.



**Optimize Energy Use** – Reduce overall energy use through energy efficient equipment and systems and conservation practices. Building performance modeling should be used as both a design and cost-benefit analysis tool. Consider impacts on all systems including mechanical systems, lighting systems, envelope, and renewables, etc. as well as impacts on operational and maintenance practices.



**Optimize Water Use** through conserving and/or reusing water wherever possible. Consider rainwater harvesting for irrigation use, “where underground detention required, consider over-sizing capacity so that static water level is possible, for use by irrigation system.”



**Optimize building orientation** for the use of natural daylighting by maximizing south facing exposures while considering use of appropriate glare-reduction techniques. Consider use of Exterior Sun Control Devices for the south side of the building. Utilize only passive systems to be approved by FBISD Design Manager prior to incorporating into design documents. East-west axis should be within plus or minus 15 degrees of geographical east-west.



**Consider the environmental impact of materials to be installed.** Maximize use of Recycled, renewable, durable, reused materials, materials/manufacturers within 500 miles of the project site. Avoid non-domestically manufactured materials and those with initial manufacturing (thus replacement) time frames of more than 10 weeks.



**Design for Health and Wellness** including the use of low emitting materials and systems, , providing views of nature, active design, access to healthy foods, and places of respite



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY



Optimize acoustics and sound control when considering layout, materials, and systems to create quiet spaces to learn and work.



Consider adding signage or other teaching tools that introduce sustainable features within the building or site to students (Ex: rain gardens, rainwater cisterns, energy dashboards, planters, sustainability lesson planning, etc.)



Maximize the site potential by using native Landscaping, providing open space, and consider space for gardens and /composting



Optimize the site for transportation access, including providing bike racks, dedicated spaces for Low-emission, electric and/or carpool vehicles Consider vehicle emissions when planning drop-off areas.



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

### LEED GUIDELINES

The use of the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system has been authorized by the District to achieve these goals. A minimum of a LEED Certified rating must be met unless otherwise instructed. Major renovations or additions to be coordinated with the FBISD Project Manager.

The LEED Building Design and Construction: Schools rating system applies to new construction projects as well as major renovations. Refer to Design Principles Section in Introduction for overall Sustainability and LEED concepts for further explanation.

A list of all attempted LEED credits as depicted on LEED scorecard shall be included in both the Schematic Design and Design Development submissions for review and approval by the Fort Bend Independent School District Design and Construction Department and should be coordinated with the contract. Do not include credits listed as "Not Allowed" in referenced table below. All attempted credits should be selected in keeping with maintaining the overall construction budget and schedule. Prior to project award, the Contractor should be required to demonstrate their knowledge of sustainable design and present documentation of experience on previous projects. Requirements within this document that would prohibit LEED Certification should be coordinated with FBISD Design Manager.

Additional LEED credits shall be selected as applicable to attain the required points for a Certified LEED rating. Innovation credits are additional credits that demonstrate exceptional performance above the LEED requirements and can be elected by the project team. The most common Innovation Credits for schools include "Green Building Education" and "The School as a Teaching Tool" (Highly Recommended by Fort Bend ISD). Additional Innovation credits can be chosen at the discretion of the project team. Refer to Innovation credits within table below.

The LEED rating system address geographically-specific environmental, social equity and public health priorities through the Regional Priority Credits (RPCs). RPCs require that a specific point threshold be met for each corresponding credit in order to earn an additional point. The following credits have been identified as particularly important for Fort Bend County:

Credit	Category	Required Point Threshold
Optimize energy performance	Energy & Atmosphere	10
High priority site	Location & Transportation	2
Access to quality transit	Location & Transportation	3
Building product disclosure and optimization - material ingredients	Materials & Resources	2
Rainwater management	Sustainable Sites	2
Outdoor water use reduction	Water Efficiency	2

Note: The U.S. Green Building Council website should be consulted to confirm whether new RPCs have been added.



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

### FORT BEND ISD LEED CREDIT REQUIREMENTS

The following is a list of LEED credits which are required, recommended, or not allowed on Fort Bend ISD projects. Project teams have the opportunity to apply the requirements of LEED v4.1 credits and prerequisites in place of the LEED v4 language (*Based on LEED BD+C: Schools v4.0 and v4.1 Beta*)

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Minimum Project Requirements</b>							
MPR1	Must be in a permanent location on existing land	✓				FBISD	Design
MPR2	Must use reasonable LEED boundaries	✓				FBISD + Architect	Design
MPR3	Must comply with project size requirements	✓				FBISD	Design
<b>Integrative Process</b>							
IPc1	Integrative Process <ul style="list-style-type: none"> <li>Identify synergies across disciplines for energy and water</li> </ul>	✓				ALL	Design
<b>Location and Transportation</b>							
LTc1	LEED For Neighborhood Development Location				✓	Architect	Design
LTc2	Sensitive Land Protection				✓	Civil Engineer	Design
LTc3	High-Priority Site				✓	Civil Engineer	Design
LTc4	Surrounding Density + Diverse Uses				✓	Architect	Design
LTc5	Access to Quality Transit				✓	Architect	Design
LTc6	Bicycle Facilities <ul style="list-style-type: none"> <li>Connect to bike routes and provide bicycle storage and showers.</li> </ul>				✓	Architect	Design
LTc7	Reduced Parking Footprint			✓		Architect	Design
LTc8	Location and Transportation: Green Vehicles <ul style="list-style-type: none"> <li>Recommend to pursue Option 2 in version 4.1, provide EV-ready spaces including infrastructure for future equipment</li> </ul>				✓	Architect	Design



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Sustainable Sites</b>							
SSp1	Construction Activity Pollution Prevention (Prerequisite) <ul style="list-style-type: none"> <li>Create erosion and sedimentation control (ESC) plan</li> </ul>	✓				Contractor	Construction
SSc1	Environmental Site Assessment (Prerequisite) <ul style="list-style-type: none"> <li>Identify and remediate any contaminated soils and/or groundwater</li> </ul>	✓				Civil Engineer	Design
SSc2	Site Development – Protect or Restore Habitat <ul style="list-style-type: none"> <li>Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity. If pursued, Option 1 is required. District will not provide financial support for conservation.</li> </ul>				✓	Landscape Architect	Design
SSc3	Open Space <ul style="list-style-type: none"> <li>Provide outdoor space with vegetation that is pedestrian-oriented; recreation-oriented; has garden space; or preserved habitat.</li> </ul>		✓			Landscape Architect + Architect	Design
SSc4	Rainwater Management <ul style="list-style-type: none"> <li>Reduce rainfall runoff volume and improve water quality</li> </ul>		✓			Landscape Architect + Civil Engineer	Design
SSc5	Heat Island Reduction <ul style="list-style-type: none"> <li>Use roofing and paving materials with high solar reflectance index (SRI) or provide parking spaces under cover</li> </ul>		✓			Landscape Architect + Civil Engineer	Design
SSc6	Light Pollution Reduction <ul style="list-style-type: none"> <li>Meet uplight and light trespass requirements using the backlight-uplight-glare (BUG) rating or calculation method</li> </ul>		✓			Electrical Engineer	Design





# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Sustainable Sites</b>							
SSc7	For Schools: Site Master Plan <ul style="list-style-type: none"> <li>Project must achieve 4 of the 6 credits: LTc3, SSc2, SSc3, SSc4, SSc5, SSc6</li> </ul>		✓			FBISD + Architect	Design
SSc8	For Schools: Joint Use of Facilities <ul style="list-style-type: none"> <li>Provide access to the public for shared use or Contract with the community or other organizations to provide dedicated-use spaces or Use Shared Space Owned by Other Organizations.</li> <li>FBISD Project Manager to provide written confirmation that these spaces will be made available to the public.</li> </ul>		✓			FBISD + Architect	Design



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Water Efficiency</b>							
WEp1	Outdoor Water Use Reduction (Prerequisite) <ul style="list-style-type: none"> <li>Reduce the project's landscape water requirement</li> </ul>	✓				Landscape Architect	Design
WEp2	Indoor Water Use Reduction (Prerequisite) <ul style="list-style-type: none"> <li>Meet fixture requirements and reduce water consumption</li> </ul>	✓				MEP Engineer	Design
WEp3	Building-Level Water Metering (Prerequisite) <ul style="list-style-type: none"> <li>Install permanent water meters for building and provide monthly/annual summaries. Owner to commit to sharing water-use data with USGBC for five years.</li> <li>District to provide a letter committing to share water and energy usage data through FBISD's third party data source. FBISD Project Manager to coordinate with Energy Manager or Zone Facilities Manager.</li> </ul>	✓				MEP Engineer + FBISD	Design
WEc1	Outdoor Water Use Reduction				✓	Landscape Architect	Design
WEc2	Indoor Water Use Reduction <ul style="list-style-type: none"> <li>Further reduce fixture and fitting water use.</li> </ul>		✓			MEP Engineer	Design
WEc3	Cooling Tower Water Use <ul style="list-style-type: none"> <li>To conserve water used for mechanical processes and cooling tower makeup</li> </ul>		✓			MEP Engineer	Design
WEc4	Water Metering <ul style="list-style-type: none"> <li>Install permanent water meters for two or more water subsystems</li> </ul>	✓				MEP Engineer	Design



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Energy and Atmosphere</b>							
EAp1	Fundamental Commissioning and Verification (Prerequisite) <ul style="list-style-type: none"> <li>CxA to be contracted directly with FBISD. Designation of CxA to be coordinated with FBISD Project Manager. CxA to review Owner's Project Requirements (OPR) and Basis of Design (BOD), and create Cx Plan, Functional Performance Testing (FPT) reports. CxA to be included in project meetings beginning in Schematic Design.</li> </ul>	✓				Commissioning Agent	Construction
EAp2	Minimum Energy Performance (Prerequisite) <ul style="list-style-type: none"> <li>Reduce the environmental and economic harms of excessive energy use by achieving a minimum level of energy efficiency for the building and its systems.</li> <li>Recommended Option or Path: Whole building approach using Appendix G.</li> </ul>	✓				MEP Engineer	Design
EAp3	Building-Level Energy Metering (Prerequisite) <p>Install energy meters or submeters that can be aggregated to provide building-level data. Owner to share the resulting energy consumption data with USGBC for a five-year period.</p> <ul style="list-style-type: none"> <li>District to provide a letter committing to share water and energy usage data through FBISD's third party data source. FBISD Project Manager to coordinate with Energy Manager or Zone Facilities Manager.</li> </ul>	✓				MEP Engineer + FBISD	Design



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Energy and Atmosphere (cont'd)</b>							
EAc1	Enhanced Commissioning <ul style="list-style-type: none"> <li>CxA to be contracted directly with FBISD. Designation of CxA to be coordinated with FBISD Project Manager.</li> <li>Option 2 (no preference) requires Building Envelope Commissioning Agent</li> </ul>	✓				Commissioning Agent	Construction
EAc2	Optimize Energy Performance <ul style="list-style-type: none"> <li>Reduce energy performance, minimum 10% required (v4.0). Recommended Option: Whole-building energy simulation.</li> </ul>	✓				MEP Engineer	Design
EAc3	Advanced Energy Metering <ul style="list-style-type: none"> <li>Install advanced metering for all whole-building energy sources</li> </ul>	✓				MEP Engineer	Design
EAc4	Demand Response				✓	MEP Engineer	Construction
EAc5	Renewable Energy Production <ul style="list-style-type: none"> <li>Design and install on-site renewable energy systems.</li> </ul>		✓			MEP Engineer	Design
EAc6	Enhanced Refrigerant Management <ul style="list-style-type: none"> <li>Avoid or minimize usage of refrigerants</li> </ul>		✓			MEP Engineer	Design
EAc7	Green Power + Carbon Offsets (Removed in v4.1)			✓		FBISD	Construction



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Materials and Resources</b>							
MRp1	Storage and Collection of Recyclables (Prerequisite) <ul style="list-style-type: none"> <li>Must provide infrastructure for future building occupants to recycle. Must provide for collection/storage/disposal of 2 of the following: batteries, mercury-containing lamps, and electronic waste.</li> <li>FBISD Project Manager to coordinate recycling contract for LEED Facilities with campus Principal.</li> </ul>	✓				Architect + FBISD	Design
MRp2	Construction and Demolition Waste Management Planning <ul style="list-style-type: none"> <li>Contractor must develop and implement a Construction Waste Management Plan.</li> </ul>	✓				General Contractor	Construction
MRC1	Building Life-Cycle Impact Reduction				✓	General Contractor	Construction
MRC2	Building Product Disclosure and Optimization – Environmental Product Declarations <ul style="list-style-type: none"> <li>Design Team must specify a certain amount of environmentally, socially, and economically friendly products that are EPD products or Third Party/USGBC approved. Recommend Option 1 (FF&amp;E is not included in project scope)</li> </ul>		✓			General Contractor	Construction



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Materials and Resources (cont'd)</b>							
MRc3	Building Product Disclosure and Optimization – Sourcing of Raw Materials <ul style="list-style-type: none"> <li>Team must provide responsibly sourced and extracted materials from manufacturers with compliant sustainability reports. Recommend Option 2 (FF&amp;E is not included in project scope) in v4.0</li> </ul>		✓			General Contractor + FBISD	Construction
MRc4	Building Product Disclosure and Optimization – Material Ingredients <ul style="list-style-type: none"> <li>Team must select products from manufacturers with disclosed information about the ingredients in their products, complying with approved material ingredient reporting methods. Recommend Option 1 (FF&amp;E is not included in project scope)</li> </ul>		✓			General Contractor + FBISD	Construction
MRc5	Construction and Demolition Waste Management <ul style="list-style-type: none"> <li>Builds on Construction Waste Management Planning by increasing diversion rates and material streams</li> </ul>		✓			General Contractor	Construction





# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Indoor Environmental Quality</b>							
EQp1	Minimum Indoor Air Quality Performance (Prerequisite) <ul style="list-style-type: none"> <li>Project to be designed to meet ventilation and monitoring requirements</li> </ul>	✓				MEP Engineer	Design
EQp2	Environmental Tobacco Smoke Control (Prerequisite) <ul style="list-style-type: none"> <li>Provide 'smoking is prohibited' signs on site and at all doors. FBISD Project Manager to provide copy of District no smoking policy</li> </ul>	✓				FBISD + Architect	Design
EQp3	For Schools: Minimum Acoustic Performance (Prerequisite) <ul style="list-style-type: none"> <li>Design team specify and design space to minimize HVAC background noise &amp; exterior noise and provide adequate reverberation time.</li> </ul>	✓				MEP Engineer + Architect + Acoustical Consultant	Design
EQc1	Enhanced Indoor Air Quality Strategies <ul style="list-style-type: none"> <li>Enhance building ventilation through entryway systems, filtration, contamination prevention, etc. Prefer Option 1.</li> </ul>				✓	MEP Engineer	Design
EQc2	Low-Emitting Materials <ul style="list-style-type: none"> <li>Specify products and materials that are inherently non-emitting, low emitting materials, or low VOC. (FF&amp;E is not recommended pathway)</li> </ul>		✓			General Contractor + FBISD	Construction



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Indoor Environmental Quality (cont'd)</b>							
EQc3	Construction Indoor Air Quality Management Plan <ul style="list-style-type: none"> <li>Construction Team to implement IAQ management plan during construction.</li> </ul>	✓				General Contractor	Construction
EQc4	Indoor Air Quality Assessment <ul style="list-style-type: none"> <li>Construction team to perform building flush or air testing prior to owner move in. Option 1 – Path 1 Pre-Occupancy flush preferred.</li> </ul>		✓			MEP Engineer + General Contractor	Construction
EQc5	Thermal Comfort <ul style="list-style-type: none"> <li>Team to design building for occupant comfort and provide individual comfort controls for at least 50% of individual occupant spaces.</li> </ul>		✓			MEP Engineer	Design
EQc6	Interior Lighting <ul style="list-style-type: none"> <li>Provide lighting controls for 90% of individual occupant spaces and 100% of shared spaces. Option 1 preferred.</li> </ul>		✓			Electrical Engineer	Design
EQc7	Daylight <ul style="list-style-type: none"> <li>Connect building occupants with the outdoors, reinforce circadian rhythms, and reduce the use of electrical lighting by introducing daylight into the space. Option 3 not recommended.</li> </ul>		✓			Architect	Design
EQc8	Quality Views		✓			Architect	Design
EQc9	Acoustic Performance <ul style="list-style-type: none"> <li>Builds on Minimum Acoustic Credit above. Meet requirements for maximum background noise and STC requirements.</li> </ul>	✓				MEP Engineer + Architect + Acoustical Consultant	Design



# Fort Bend ISD Technical Design Guidelines

## SUSTAINABILITY

Category and Credit		Required	Highly Recommended	Not Allowed	No Preference	Responsible	Submittal
<b>Innovation</b>							
INc1	<b>School as a Teaching Tool</b> <ul style="list-style-type: none"> <li>Provide teacher and student training on the high performance features of the building. Collaboration with FBISD Teaching &amp; Learning Department during design is essential. Coordinate with FBISD on curriculum and staff training.</li> </ul>	✓				FBISD + Architect	
INc2	<b>Green Building Education</b> <ul style="list-style-type: none"> <li>Provide comprehensive signage on the benefits of green buildings, develop a guide to inform the design of other buildings, and/or develop an educational outreach program.</li> </ul>	✓				Architect	
INc3	<b>LEED Accredited Professional</b> <ul style="list-style-type: none"> <li>One principal participant of the project team must be LEED AP.</li> </ul>	✓				Architect	Design

# Commissioning

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## 1.0 General:

- 1.1 This Section establishes general and administrative requirements pertaining to commissioning of equipment, devices, and building systems on the project. Technical requirements for commissioning of particular systems and components are established in the respective technical sections of this Project Manual.
- 1.2 It is of primary concern that all operable systems installed in the Project perform in accordance with the Contract Documents, the Owner's Project Requirements (OPR) and the Basis of Design (BOD). During Commissioning, the Contractor systematically demonstrates to the Owner or Owner's representative that the operable systems have been installed and performing in strict accordance with the Contract Documents.
- 1.3 Commissioning requires cooperation and involvement of all parties throughout the construction process. The Contractor shall deliver a successful Commissioning process. Successful Commissioning requires that installation of all building systems complies with Contract Document requirements and that full operational check-out and necessary adjustments are performed prior to Substantial Completion with the exception of deferred tests approved in advance by the Owner.
- 1.4 Commissioning will encompass and coordinate traditionally separate functions of system documentation, installation checkout, System Verification Checklists and start-up, control system calibration and point-to-point checkout, testing, adjusting, and balancing, Functional Performance Tests, Integrated System Tests, Contractor demonstration to the Owner, and training of Owner's personnel. This requires assembling all related documentation into one cohesive collection. Commissioning is intended to achieve the following specific objectives of the Contract Documents:
  - 1.4.1 Verify and document proper installation and intended performance of equipment, systems, and integrated systems.
  - 1.4.2 Ensure that operating and maintenance and Commissioning documentation requirements are complete.
  - 1.4.3 Provide the Owner with functional buildings and systems that meet the Contract Document requirements and the Owner's Project Requirements (OPR) at Substantial Completion.
- 1.5 Building Envelope Commissioning Authority (BECA) is only required if Mechanical design is performance based in lieu of prescriptive based.
  - 1.5.1 Building Envelope Commissioning Authority (BECA) to oversee the commissioning of all building envelope components.
  - 1.5.2 The BECA shall be approved and engaged by the Owner at the time of Basis-Of-Design, and shall be provided for the Project until all building systems have been accepted by both the Designer and the Owner.
  - 1.5.3 The BECA shall have, at a minimum, 10 years' experience in the practices that encompass building envelope commissioning, including understanding systems design intent, performing architectural and shop drawing peer reviews, evaluating submittal compliance, administering preconstruction meetings, performing/supervising field performance testing, fulfilling field construction administration responsibilities, evaluating component/assembly compliance and performing forensic evaluations, as relating to Divisions 03 through 14 Sections for building envelope commissioning requirements



specific to the Work of each Section.

- 1.5.4 The BECA shall be accredited by the International Accreditation Services, Inc. (IAS) and American Architectural Manufacturers Association (AAMA) in accordance with ISO/IEC 17025 (International Standards Organization) for the test methods used in the building envelope commissioning process. If the BECA does not meet these requirements, a subcontractor or vendor responsible for testing under the direction of the BECA must satisfy these same requirements.
- 1.5.5 The BECA cannot be financially associated with any of the Division 01 through 14 contractors or vendors prior to engaging in this contract.
- 1.5.6 All security systems shall be commissioned ensuring 100% systems functionality and operation.

## 1.6 Leadership in Energy and Environmental Design (LEED)

- 1.6.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
- 1.6.2 Refer to Appendix for Exhibit 01\_02 CxA Scope and Deliverables.
- 1.6.3 Related Credits (as applicable)
  - 1.6.3.1 EAp1: Fundamental Commissioning and Verification
  - 1.6.3.2 EAc1: Energy and Atmosphere credit: Enhanced Commissioning
  - 1.6.3.3 EAc3: Energy and Atmosphere credit: Advanced Energy Metering
  - 1.6.3.4 EAc4: Energy and Atmosphere credit: Demand Response
  - 1.6.3.5 EAc5: Energy and Atmosphere credit Renewable Energy Production

## 2.0 Commissioning Team:

- 2.1 FBISD shall appoint the following Members
  - 2.1.1 Owner's Project Manager and any other designated representatives of the Owner's staff.
  - 2.1.2 Commissioning Authority (CxA).
  - 2.1.3 Building Envelope Commissioning Authority (BECA)
  - 2.1.4 Architect/Engineer (A/E).
  - 2.1.5 Test, Adjust and Balance Firm (TAB)
- 2.2 Contractor shall appoint the following Members
  - 2.2.1 Individuals, each having authority to act on behalf of the entity they represent, explicitly organized to implement the Commissioning process through coordinated actions. At a minimum, the Contractor shall designate a Commissioning Coordinator and each major sub-contractor (Mechanical, Electrical, Plumbing, and Building Automation) shall have a dedicated representative.
  - 2.2.2 Vendor representatives (as needed) required for start-up, operational testing, Functional Performance Testing, Integrated Systems Testing, and Owner Training activities.
  - 2.2.3 Representatives of independent testing agencies (Test, Adjust and Balance, Electrical Testing Agency, etc.)

## 3.0 Commissioning Corresponding Divisions

- 3.1 Refer to Paragraph 1.5 above for requirements related to Divisions 03 – 14.
- 3.2 Thermal and Moisture Protection (Division 07)
  - 3.2.1 FBISD retains the right to contract with Building Envelope Specialist if provisions outlined within the section are not compiled with during design and construction. In extreme cases, payment for these additional services may be the responsibility of Contractor at no expense to FBISD.
- 3.3 Opening (Division 08)
  - 3.3.1 Openings and all associated Hardware is not required; HOWEVER, a Punch List by Hardware Specifier IS REQUIRED. FBISD Locksmith and General Contractor's hardware installer must be present during punch list review. Punch list will be attached to substantial completion form, same as other punch lists.
- 3.4 Equipment (Division 11)
  - 3.4.1 Theatrical Lighting
    - 3.4.1.1 Coordinate with division 11 for specific information on the theatrical and/or stage lighting.

- 3.5 Special Construction (Division 13)
  - 3.5.1 A/E's Acoustical Consultant to perform testing of all areas noted in Division 13 section after substantial completion and prior to occupancy.
- 3.6 Conveying Systems (Division 14)
  - 3.6.1 Elevator Equipment: Recommend to consider commissioning, in addition to State Inspections.
- 3.7 Fire Protection (Division 21)
  - 3.7.1 Require third party inspections prior to final payment.
  - 3.7.2 Require contractor to perform work as required to comply with third party inspections.
  - 3.7.3 The scope of commissioning shall include the third party inspections, site verification of entire system, witness and verification of the "material and test certificates".
  - 3.7.4 Commissioning provider to coordinate and provide, licensed, third party inspection prior to final payment. Inspection to include flow test and overhead inspection.
- 3.8 Plumbing (Division 22)
  - 3.8.1 Establish a training and demonstration requirement that is tied to contractor payment applications.
  - 3.8.2 Any pumps and pump controllers shall have a video copy of the training for future use.
  - 3.8.3 Commissioning of plumbing shall be included in the project specifications. Specifications shall communicate the responsibilities of contractors and the exact systems to be commissioned.
  - 3.8.4 Components and systems to be commissioned shall be directed by FBISD.
  - 3.8.5 At the time of the MEP punch list walk, plumbing contractor to demonstrate accessibility and proper removal of every clean-out plug with the use of a special tool. If a special tool IS required, three copies must be turned over to FBISD at close-out.
  - 3.8.6 All plumbing piping shall be labeled to identify the system. Labels shall be applied to piping in accessible spaces such as ceiling plenum, mechanical rooms and other spaces not visible to building occupants but accessible to maintenance personnel.
  - 3.8.7 All water piping shall be tested at 1-½ times the working pressure or 150 psi (whichever is higher) immediately prior to completion. District representative and Architects/Engineers representative shall monitor and approve all test.
- 3.9 HVAC (Division 23)
  - 3.9.1 Include functional testing forms and procedures for HVAC control systems are completed and submitted at scheduled phases throughout the project construction.
  - 3.9.2 Confirm proper operation of HVAC system, fume hoods and any renewable/sustainable energy systems.
  - 3.9.3 Witness of pipe flushing/cleaning to be included in commissioning scope.
  - 3.9.4 Include full hydronic quality test of existing loops.
  - 3.9.5 Include full hydronic test and balance.
  - 3.9.6 BAS vendor shall provide full demonstration to owner and design team that all controls and sequences are complete in their entirety.
  - 3.9.7 Confirm control electric water heaters and circulation pumps through building control system, using schedules, so equipment is enabled only when building is occupied.
  - 3.9.8 Confirm the leaving water temperature of water heaters is set and delivering correct temperature.
  - 3.9.9 Confirm control electric drinking fountain power through scheduling.
  - 3.9.10 Confirm meter for cooling tower make-up water connected to building automation system, for monitoring.
  - 3.9.11 Owner's representative or commissioning agent to be present to observe cleaning of piping systems at each phase.
  - 3.9.12 Submit status report upon completion of each phase of work on each system.
- 3.10 Integrated Automation (Division 25)



- 3.11 Electrical (Division 26)
  - 3.11.1 Commissioning includes review of electrical drawings, submittals, site verification of system and verification testing. Scope to include:
    - 3.11.1.1 Electrical System.
    - 3.11.1.2 Lighting controls
    - 3.11.1.3 Renewable energy systems
    - 3.11.1.4 Review of training video.
  - 3.11.2 Commissioning authority to observe and document grounding resistance test.
  - 3.11.3 Confirm coordination study of building electrical distribution.
  - 3.11.4 Confirm contactors on electric water heaters are installed to allow scheduling of water heaters.
  - 3.11.5 Confirm installation of circulation pump circuits via lighting control panel for scheduling.
  - 3.11.6 Theatrical Lighting
    - 3.11.6.1 Coordinate with Division 11 for specific information on the theatrical and/or stage lighting.
    - 3.11.6.2 Provide recessed bead lighting at HS stage (see Division 11) and at aisles in high school auditoriums. Similar to Tivoli soft aisle lighting and Tivoli light tube.
    - 3.11.6.3 Provide incandescent lighting at dressing room mirrors and Cole lighting "In use" sign connected to dressing table receptacles.
- 3.12 Electronic Safety and Security (Division 28)
  - 3.12.1 These systems and includes review of submittals, site verification of installation, witness and verification of the systems.

**END OF COMMISSIONING**

## Division 00 and 01

# General Requirements

Advertisement (Dates and Times)		00 01 13
CSP Instructions		00 11 53
Bid Form (Two Forms – Base and Alternate)		00 41 11
Required Forms (36 pages – 23 forms)		
General Provisions (Procurement requirements, Contract takes precedence)		
Contract (A101-2007 and A201-2007 (Non-Negotiable))		
FBISD Safety Program Guideline		00 73 19
Manual Rev. 2		
Summary of Work		01 10 00
Contractor Identification		01 14 13
Certification of Compliance		
Allowances		01 21 00
Unit Prices		01 22 00
Alternates		01 23 00
Substitution Procedures		01 25 00
Contract Modification Procedures		01 26 00
Payment Procedures		01 29 00
Schedule of Values		01 29 73
Project Management and Coordination		01 31 00
Project Coordination		01 31 13
Small Business Enterprise Procedure		01 31 20
Subcontractor-Subconsultant Utilization Report		01 31 20.01
Subcontractor-Subconsultant-Suppliers		01 31 20.02
Payment Certification Format		
Construction Progress Documentation		01 32 00
Construction Progress Schedule		01 32 16
Photographic Documentation		01 32 33
Submittal Procedures		01 33 00
Historic Treatment Procedures		01 35 91
Quality Requirements		01 40 00
References		01 42 00
Testing, Adjusting, and Balancing for HVAC		01 45 23.01
Testing and Inspection Services		01 45 23.02
Temporary Facilities and Controls		01 50 00



Temporary Facilities for Students		01 52 14
Traffic Controller		01 55 26
Indoor Air Quality Controls		01 57 21
Product Requirements		01 60 00
Volatile Organic Compounds		01 61 16
VOC Content Restriction		
Execution		01 73 00
Closeout Procedures		01 77 00
Operation and Maintenance Data		01 78 23
Project Record Documents		01 78 39
Demonstration and Training		01 79 00
Sustainable Design Requirements		01 81 13

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## **DIVISION 00 and 01 – GENERAL REQUIREMENTS**

### **00 00 00 - General Requirements**

- 1.0 General
  - 1.1 This section establishes general and administrative requirements of the District pertaining to Divisions 00 and 01.
  - 1.2 The FBISD Procurement department shall provide all Division 00 documents as listed above to the A/E firm at the beginning of the Procurement phase.
  - 1.3 The FBISD Project Manager shall provide all Division 01 documents as listed above to the A/E firm upon request.

**END OF DIVISION 00 and 01**

## Division 03

# Concrete

General Requirements for Concrete		03 00 00
Maintenance for Concrete		03 01 00
Common Work Results for Concrete		03 05 00
Schedules for Concrete		03 06 00
Concrete Forming and Accessories		03 10 00
Concrete Reinforcing		03 20 00
Cast-in-Place Concrete		03 30 00
Precast Concrete		03 40 00
Cast Decks and Underlayment		03 50 00
Grouting		03 60 00
Concrete Cutting and Boring		03 80 00

### DIVISION 03 - CONCRETE

#### 03 00 00 - General Requirements for Concrete

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3 Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations
      - 1.3.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials
      - 1.3.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients
      - 1.3.2.4 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials
- 2.0 Comparable Products
  - 2.1 Approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.



- 3.0 Requirements
  - 3.1 Geotechnical Report
    - 3.1.1 Wherever Geotechnical report identified hydrostatic pressure issues, provide keyways at all construction joints and include continuous water stops.
  - 3.2 Hot & Cold Concrete Temperature
    - 3.2.1 General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
    - 3.2.2 Weather Concreting: Protect concrete Work from physical damage or reduced strength which could be caused by front, freezing actions, or low temperatures.
      - 3.2.2.1 When ambient temperature at site is below 40°F or is expected to fall to that temperature within ensuing 24 hours, heat water and/or aggregate prior to adding to mix so that temperature of concrete will be between 55°F and 85°F at time of placement.
      - 3.2.2.2 Maintain temperature of deposited concrete between 50°F and 70°F for minimum of seven (7) days after placing.
      - 3.2.2.3 Add the specified noncorrosive accelerator for all floor concrete placed at air temperatures below 50°F.
    - 3.2.3 Temperature Changes: Maintain changes in concrete temperature as uniformly as possible, but in no case exceed change of 5°F per hour or 25°F in any 24 hour period.
  - 3.3 The substrate must be sound, smooth, dry and clean. When tested with the latest version of ASTM F2170, 85-93% RH according to the adhesive used.
  - 3.4 NO CONDUIT RUNS in slab, no exceptions.
  - 3.5 Provide pest sleeves at all vertical pipe penetrations in slabs.
  - 3.6 Edges of all housekeeping pads to be chamfered.
  - 3.7 Recesses
    - 3.7.1 Provide 1 ½" to 2" recess in plumbing chase at Pre-K Toilet Rooms to accommodate carrier. Refer to Appendix for Diagram 03\_01. Refer to Division 22 – Plumbing.
    - 3.7.2 Provide recess for wood flooring as indicated in Division 09 – Finishes.
  - 3.8 Exposed Concrete
    - 3.8.1 Do not use fly ash in architecturally exposed concrete. Fly ash is allowed in all other non-architecturally exposed concrete. The weight of the fly ash shall be added to the weight of the cement in the calculation of the water cement ratio. The contractor shall confirm writing that the use of fly ash will not interfere with the performance of other products and materials that will be in contact with the concrete.
  - 3.9 Concrete Floors
    - 3.9.1 Mechanical rooms, custodial closets, and unfinished storage areas, etc. shall have hard-troweled concrete floors, finished with a concrete sealer.
    - 3.9.2 Slope concrete in toilet rooms and mechanical rooms from corner of room to drain, no 36" sweeps only at drain. Indicate slope on foundation plans. Refer to Appendix for Diagram 03\_01. Coordinate with Division 22 – Plumbing.
    - 3.9.3 For slab-on-grade construction, where concrete shall be exposed in its final state and/or where floor shall receive high traffic loads, contractor shall provide an approved sawcut joint filler to be placed within all sawcut and formed control

joints within concrete slabs. Acceptable products are MM80 and Euco 700.

### 3.10 Concrete Curbs

- 3.10.1 Provide 4 inch (nominal, average) concrete curbs under gypsum board walls (3.5" or 5.5" recommended, lumber dimensions) in Mechanical Rooms.
- 3.10.2 If curb installed after slab, provide reinforcement for connection to curb, including application of water-stop. It is preferred for slab and curb to be monolithic.

### 3.11 Concrete Paving

- 3.11.1 ALL exterior concrete to be sidewalk, even at covered areas, not part of building slab.
- 3.11.2 Provide 5' concrete sidewalk directly adjacent to ENTIRE building perimeter. Sidewalk helps ensure accessible route to all building entrances and exits and help reduce foundation problems by directing water away from the building. Provide irrigation at ALL areas immediately adjacent to buildings, ALL sides. (Coordinate with Irrigation Standards in Division 32 – Exterior Improvements & Geotechnical Report).

### 3.12 Foundation

- 3.12.1 Foundation (grade beams) for overhangs to be lowered to ensure no conflicts with sidewalk placement. It is recommended that all sidewalk be placed towards END of construction.
- 3.12.2 For each site the final subgrade PVR values, subgrade treatment, and chosen foundation system shall be closely studied related to the full perimeter of the building for purposes of determining if 1 stoops are required. For areas of exterior concrete at entries and similar transitions the soils that will remain immediately below this concrete shall be closely studied for differential PVR between this exterior concrete/soils vs the building foundation/soils.
- 3.12.3 Structurally suspended/sub-grade isolated stoops shall be required at all man doors at all buildings for both slab-on-grade and structurally suspended foundation systems.



### 3.13 Chemical Admixture

- 3.13.1 Provide admixtures certified by manufacturer to be compatible with other admixtures and that do not contain more than 0.05 percent water soluble chloride ions. Do not use calcium chloride or admixtures containing calcium chloride.
- 3.13.2 Water-Reducing Admixture: ASTM C 494, Type A.
  - 3.13.2.1 Retarding Admixture: ASTM C 494, Type B.
  - 3.13.2.2 Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
  - 3.13.2.3 High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
  - 3.13.2.4 High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
  - 3.13.2.5 Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
- 3.13.3 At all depressions greater than or equal to minus 6 inches from the main finish floor the general contractor shall provide Xypex C-1000 admixture (at an assumed minimum rate of 15 lbs/cu yd) into all of the concrete. The admixture shall be placed into the mix at the time of batching at the plant, do not add dry bag mix to the wet concrete truck on-site. The general contractor shall strictly follow all manufacturer's instructions for addition, use, handling, etc. The admixture shall be added to all of the concrete which makes up any depression greater than or equal to minus 6 inches from the main finish floor, this includes but is not limited to: depressed slabs (full thickness), all vertical stem walls (full thickness) and/or any grade beams (full depth and thickness) which form any portion of the vertical drop and all horizontal slab for the depressed area. This does not reduce or revise any waterproofing treatments, layers or substrates that are currently required by the structural, architectural, and/or other consultant



drawings, this is in addition to those current measures. The cost for this add mixture shall be accounted for within the base bid and shall include, but is not limited to all areas architecturally labeled as follows: orchestra pit, all elevator pits, and the below grade fly-loft rigging pit. Please note: Xypex C-1000 has been chosen as a neutral mix additive that is not intended to change the currently planned concrete set time. If for some reason the set time is desired to be increased or decreased Xypex does have alternative formulations which may be used; however, the general contractor must get written approval from the engineer of record prior to any change in the Xypex C-1000 formulation. The Xypex C-1000 is an additional moisture intrusion mitigation measure that is required in addition to the specified waterstops noted in the other general notes and details related to concrete cold-joints and other concrete transitions of plane.

### 3.14 Structural Concrete (All Types)

- 3.14.1.1  Utilize recycled aggregate in concrete design mixes, as applicable.
- 3.14.1.2  Where historic performance data available, consider concrete mized with reclaimed aggregate or crushed concrete aggregate.

### 4.0 Coordination

- 4.1 Architect shall provide dimensions to all floor drains, same as other plumbing fixtures. Exception is at mechanical rooms where coordination is required with General Contractor-proposed housekeeping pad layout.
- 4.2 General Contractor shall provide proposed housekeeping pad layouts for all mechanical areas via submittal to Architect & Engineer for review prior to slab placement. This will allow for coordination with floor drains, so that pad/drain conflicts are minimized.
- 4.3 Contractor to submit alternate concrete mix design in case of shortage from one location for approval by Engineer.
- 4.4 Coordinate 5' concrete sidewalk along building perimeter with Irrigation Standards in Division 32 – Exterior Improvements & Geotechnical Report.
- 4.5 Architect/Engineer to show actual piping size at verticals on foundation plan, coordinate to relocate penetration away from grade beams and steel beams supporting second floor slabs.
- 4.6 Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacturer approved moisture barrier prior to installation of all flooring products. Contractor shall provide certified moisture testing results per ASTM F2170 (*Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes*) to Architect and FBISD Project Manager prior to floor installation. Acceptable moisture content of concrete sub floor shall be within approved manufacturer limits or lower prior to installation.
  - 4.6.1 Refer to Division 09 – Finishes. General Contractor / Subcontractor are responsible for any expense necessary to meet this requirement and no additional time to achieve the acceptable limits will be granted.
  - 4.6.2 Refer to concrete adhesive for concrete protection as noted below.
- 4.7 Coordinate locations of embedded sleeves in the gymnasium slab with the volleyball equipment manufacturer.

### 03 01 00 - Maintenance for Concrete

- 1.0 Protect stained or polished concrete during construction with Masonite or other solid durable covering, including sealed edges (tape).
- 2.0 Do not tape or adhere products to stain or polished concrete slabs.

### 03 05 00 - Common Work Results for Concrete

- 1.0 Testing Requirements: Compressive Strength Tests: ASTM C 39; for each class of concrete poured in any one day, one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete test placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required unless more stringent requirements stated in Geotechnical Report.
- 2.0 Five (5) test cylinders for elevated cast-in-place concrete is acceptable, with additional cylinder for 3-day break. Structural Engineer to verify strength requirements for 3-day test. Reference Division 1 & Geotechnical Report for recommendations.
- 3.0 Carton forms to be used only based on structural engineer and geotechnical report recommendations. Consider the use of hollow-core pre-cast if possible. Coordinate with Geotechnical Report.

### 03 06 00 – Schedules for Concrete

- 1.0 Provide grade beam schedule in drawings.
- 2.0 Provide slab schedule in drawings.
- 3.0 Provide footing schedule in drawings.

### 03 10 00 – Concrete Forming and Accessories

- 1.0 Exposed exterior grade beams to be wood or prefabricated form formed – interior grade beams may be earth formed if allowed by soils reports and structural engineer recommendations.
- 2.0 Fully formed grade beams are NOT required; however, ENTIRE outside face of exterior grade beams MUST BE fully formed.
- 3.0 Concrete masonry blocks or clay bricks are NOT ALLOWED as substitute for plastic or steel chairs.
- 4.0 Foundation designs must be approved by soils engineer, with any approved deviations from original geotechnical report recorded as Addenda by soils engineer. This includes any deviations related to forming and/or placement requirements that appear in Geotechnical Report.


### 03 20 00 – Concrete Reinforcing

- 1.0 General Requirements:
  - 1.1 Architect's representatives to observe concrete pours unless directed by FBISD Project Manager.
- 2.0 Concrete Reinforcing (Organic Fiber & Carbon Fiber)
  - 2.1 Allowed for use in topping slabs only.

### 03 30 00 – Cast-in-Place Concrete

- 1.0 General:
  - 1.1 Preparation of existing interior concrete slabs, including shot blasting, surface defect repair, application of moisture vapor control system, and moisture vapor and pH testing, where indicated on drawings, for underlayment and finish flooring specified in other sections.
  - 1.2 Protect stained or polished concrete during construction with masonite or othersolid durable covering, including sealed edges (tape).
  - 1.3 Finish Floor and Slabs to comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces.
  - 1.4 Color Pigment: ASTM C 979, only integral colors allowed. No surface pigment permitted.
  - 1.5 Kitchen: Freezer and Cooler Prep: Provide for recessed insulated floor foundation to set freezer and cooler flush to kitchen floor, eliminating need for steps or ramps.

- 2.0 Underslab Vapor Retarders and Barriers
  - 2.1 Provide vapor retarding poly under slab (15 mil minimum) so that city and A/E inspectors can verify substrate condition prior to concrete placement. Refer to Division 07.
  - 2.2 Vapor Retarder Membrane: ASTM E1745, Class A.
  - 2.3 Thickness: 15 mils minimum to be used in all locations.
  - 2.4 Permanence as tested after mandatory conditioning (ASTM E154 sections 8, 11, 12, 13) less than 0.01 Perms (grains/ft<sup>2</sup> \*hr\* in Hg).
  - 2.5 Provide seam tape, boots, and other accessories required for a completely sealed system. All accessories to meet or exceed vapor barrier properties.
    - 2.5.1 Approved manufacturers:
      - 2.5.1.1 Stego Industries.
      - 2.5.1.2 W.R. Meadows.
      - 2.5.1.3 Raven Industries.
      - 2.5.1.4 Tex-Trude.
- 3.0 Plain Steel
  - 3.1 Minimum #3, all locations, however, it is preferred that #4 or greater be utilized for greater stability and strength.
  - 3.2 Use of steel mesh reinforcing not allowed except at housekeeping pads and topping slabs.
  - 3.3 Fibrous Reinforcing – NOT ALLOWED.
    - 3.3.1 Composite Reinforcing (Organic Fiber & Carbon Fiber). ALLOWED FOR USE IN TOPPING SLABS ONLY.
- 4.0 General Finishes
  - 4.1 Concrete foundations shall be designed per Geotechnical Report's recommendations which align the Project's budget. If the Engineer does not agree with the Report's recommendations and wishes to use an alternate system, then he must submit a justification to the FBISD Project Manager & Architect/Engineer.
  - 4.2 Integral colors at specified ramps, not dust-on, or applied. Verify color with FBISD Design Manager prior to installation.
  - 4.3 Where floor drains are required and the finish floor is to be ceramic tile, the slab shall be recessed to permit tile to be installed over a mortar bed (thickset installation method).
- 5.0 Materials
  - 5.1 Basic concrete mix shall be appropriate to its use.
  - 5.2 Concrete masonry blocks or clay bricks are NOT ALLOWED as substitute for plastic or steel chairs.
- 6.0 Concrete Placement
  - 6.1 Concrete shall not be placed until forms and reinforcement are observed by the FBISD Project Manager and Architect or Structural Engineer. Contractor shall notify the FBISD Project Manager and Architect or Structural Engineer approx. 48 hours in advance of schedule placement.
  - 6.2 For aesthetic reasons, exposed concrete grade beams should not exceed 12" above finished grade.
  - 6.3 Wood formed grade beams are required.
  - 6.4 Form lumber shall be discarded, NOT ALLOWED to be used for other construction materials.
  - 6.5 Structural Engineer may permit the option of "Neat Cut" grade beams where sides are not exposed.
- 7.0 Waterstop
  - 7.1 Seal pipe penetration at perimeter of slab using a moisture dam at all utility trenches entering building. One acceptable choice of moisture dam is a 5'-0" section of compacted stabilized material.
  - 7.2 Provide a waterstop at all cold joints in the slab.

- 8.0 Penetrations
  - 8.1 Seal all penetrations through slab with a vapor barrier.
- 9.0 Expansion joints: No redwood joints. Expansion and Isolation Joint Filler Strips
  - 9.1 ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
  - 9.2 Coordinate slab control joints at walls.
- 10.0 Cementitious Material
  - 10.1 Portland Cement: ASTM C150, Type I or Type I/II, gray.
  - 10.2 Fly Ash: ASTM C618, Class F or C. Carbon content shall not exceed 3 percent by volume.
    - 10.2.1  Use of fly ash is permitted, provided that historic performance data is available for mix intended for use. (Use of fly ash must be approved by the Structural Engineer).
  - 10.3 Before fly ash is used, confirm approval by Structural Engineer.
    - 10.3.1 For Elements such as pier, grade beams, below grade elements that are not exposed (and for large mass items) fly ash is acceptable and can even be beneficial. Not allowed at exposed slab areas.
  - 10.4 Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
- 11.0 Concrete Finishing
  - 11.1 Indicate where special finishes are required. Indicate to provide site mock-ups for any specialty finishes, such as broom-finish at ramps.
  - 11.2 Basis of Design: VOCOMP-20 is the curing and sealing compound or comparable product equal approved by FBISD Design Manager.  
<http://www.wrmeadows.com/wrm00026.htm>.
  - 11.3 Any finishes for concrete, to be approved by the FBISD Design Manager prior to proceeding beyond design development.
  - 11.4 General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Mockup to be provided.
- 12.0 Scratch Finish
  - 12.1 While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
  - 12.2 Apply scratch finish to surfaces that are to receive concrete floor toppings or mortar setting beds for bonded cementitious floor finishes.
- 13.0 Float Finish
  - 13.1 Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straighten until surface is left with a uniform, smooth, granular texture.
  - 13.2 Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- 14.0 Trowel Finish
  - 14.1 After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 14.2 Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic, or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

- 14.3 Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
- 14.4 The Contractor shall anticipate that grinding will be required as a result of curling or other slab defects. Grinding required to bring the slab surface into acceptable tolerances for finished flooring installation shall be included as part of the Work.
- 15.0 Trowel and Fine-Broom Finish
  - 15.1 While concrete is still plastic, slightly scarify surface with a fine broom. After applying first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method.
  - 15.2 Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
    - 15.2.1 Overall values of flatness, Ff = 35; and levelness, FI = 25; with minimum local values of flatness, Ff = 24; and levelness, FL = 17.
- 16.0 Broom Finish
  - 16.1 Include sidewalks & paving to exterior concrete platforms, steps, and ramps.
  - 16.2 Sidewalks will be light broom finish. Provide mockup for approval from FBISD Design Manager.
  - 16.3 Paving will be medium broom finish. Provide mockup for approval from FBISD Design Manager.
  - 16.4 Swimming pool deck finishes shall be non-slip broom finish.
- 17.0 Finish at Pool Pit Area
  - 17.1 Finish slabs below pools per pool manufacturer requirements.
  - 17.2 Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- 18.0 Concrete Curing (Water, Sand, Membrane)
  - 18.1 Curing Compounds should be specified carefully where bonded finishes are to be used (such as tile or epoxy finishes). Ensure compatible with adhesives and/or membranes required for installation of final finish.
  - 18.2 Must be compatible with all specified floor finishes. If specified floor finish prevents use of curing compounds then damp curing with wet cotton mats is acceptable.

### **03 40 00 – Precast Concrete**

- 1.0 Precast Structural Concrete:
  - 1.1 Bollards.
  - 1.2 Hollow Core Planks.
  - 1.3 Slabs.
  - 1.4 Stairs.
  - 1.5 Pre-Tensioned.
  - 1.6 Post-Tensioned.
- 2.0 Precast Architectural Concrete (Faced, Post-Tensioned, and Pre-Tensioned):
  - 2.1 Confirm intended uses with FBISD Design Manager before proceedings beyond Design Development.
- 3.0 Site-Cast Concrete (Tilt-Up and Lift-Slab)
  - 3.1 Require Subcontractor to have MINIMUM 5 years of experience with site-cast concrete.
- 4.0 Precast Concrete Specialties
  - 4.1 Bollards:
    - 4.1.1 4-inches diameter bollards, 2-feet from wall to prevent impact damage from large trucks.

- 5.0 Glass-Fiber-Reinforced Concrete (Column Covers, Spandrels, Trim)
  - 5.1 For use on renovations only with FBISD Project Manager Approval. Verify intended use with FBISD Design Manager before including beyond Design Development.
  - 5.2 Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints, shall be uniform, straight, and sharp. Finish exposed-face surfaces of GRFC to match approved mockups.
  - 5.3 Finishes
    - 5.3.1 As Cast Surface Finish: Provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb, with uniform color and texture.
    - 5.3.2 Textured Surface Finish: Impart by form liners.
    - 5.3.3 Retarded Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
    - 5.3.4 Sand or Abrasive Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
  - 5.4 Acid Etched Finish: Use acid and hot water solution equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
- 6.0 Insulated Concrete Formwork – Bautex Systems or comparable product to be used per FBISD Design Manager approval only.
- 7.0 Concrete Bollards: Reinforced with epoxy-coated steel rebar for high-impact protection, 3000 psi compressive strength, 6" diameter. Location to be determined by FBISD Design Manager.

### **03 50 00 – Cast Decks and Underlayment**

- 1.0 General
  - 1.1 Underside of deck should always be job-painted when exposed (such as at gyms).
  - 1.2 Consider perforated vented deck or acoustical treatment to comply with acoustical properties. Discuss with FBISD Design Manager. Coordinate with Division 09 - Finishes.
  - 1.3 In areas with exposed decking (gymnasiums), revise from lightweight insulating concrete to standard steel decking with insulation board. Provide acoustical panel treatment below deck. Coordinate with Division 09 - Finishes.
  - 1.4 Waterborne shop primer on bearing surface of steel joists may become emulsified when in contact with excess water from insulating concrete. Remove primer from bearing surface, or specify oil based primer.
  - 1.5 Basis of Design:
    - 1.5.1 Type I EPS board 6 inches thick, unless shown otherwise.
    - 1.5.2 Vermiculite or Cellular with minimum 200 PSI at 28 days.
    - 1.5.3 Cement – Portland Type I or III conforming to ASTM C150.
- 2.0 Concrete Topping (Emery-Aggregate and Iron-Aggregate):
  - 2.1 For use over Pre-Cast Planks or as slab leveler in Renovations ONLY.

### **03 60 00 – Grouting**

- 1.0 Refer to Division 04 – Masonry.

### **03 80 00 – Concrete Cutting and Boring**

- 1.0 Refer to Division 07 – Thermal and Moisture Protection for additional information on type and installation of water stop at areas where saw-cut concrete intended for replacement.



- 2.0 Concrete Boring (Core Drilling)
  - 2.1 Core drilling for handrails is acceptable, however A/E to consider this during design, adjusting reinforcement AWAY from final rail location.
  - 2.2 Handrail shop drawings must be approved prior to the time of concrete placement. It is preferred to install steel sleeves in lieu of core drilling.
  - 2.3 Ensure escutcheons are provided at all guard and handrails.

**END OF DIVISION 03**

## Division 04

# Masonry

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### DIVISION 04 - MASONRY

#### 04 00 00 - General Requirements for Masonry

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3 Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations
      - 1.3.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials
      - 1.3.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients
      - 1.3.2.4 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials
- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.



### 3.0 Requirements

- 3.1 Recommend use of durable masonry materials in all high-use areas.
  - 3.1.1 At middle and high schools consider use at corridors, cafeteria, athletics, fine arts, CTE, and toilet rooms.
  - 3.1.2 At elementary schools consider use at corridors, cafeteria, gymnasium, and toilet rooms.
- 3.2 Exposed CMU at inside of open mechanical courtyards should be painted with an elastomeric paint, and the top of wall covered with a pre-finished metal cap in order to avoid efflorescence in the finished brick face (cast stone less desirable due to flashing issues as well as discoloration of material over time).
- 3.3 All wire ties, steel straps, locking channels and screws shall be hot dipped galvanized.
- 3.4 At building addition to existing building tie-ins; All exterior backup walls shall be tied together with flashing. Portions of exterior cladding along these transitions are to be removed to ensure envelope is sealed completed.
- 3.5 Any location where glazed tile is used as a starter course or for banding within a structural wall, product data shall be provided to prove that the "structural glazed tile" that is being provided is capable of withstanding the same loads and stresses as an equivalent concrete masonry unit of the same width.
- 3.6 Mockups:
  - 3.6.1 Architect to provide elevation of preferred mock up in construction documents. Refer to Appendix for Diagram 04\_01.
  - 3.6.2 General Requirements:
    - 3.6.2.1 Construct cavity wall mockup, 8 feet long by 8 feet high minimum to include inside and outside corner, including all exterior wall finish materials, all masonry types and colors, mortar and accessories, structural backup, window, flashings, wall insulation, and weeps. Coordinate all trades to provide samples for mock up.
    - 3.6.2.2 Include a sealant-filled control joint.
    - 3.6.2.3 Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects and to set quality standards for materials and execution.
    - 3.6.2.4 Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    - 3.6.2.5 Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    - 3.6.2.6 Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
    - 3.6.2.7 Structural backup wall to consist of CMU and cold formed metal framing.
    - 3.6.2.8 Clean one/half of exposed faces of mockups with masonry cleaner using methods anticipated for the Work.
    - 3.6.2.9 Protect accepted mockups from the elements with weather resistant membrane.
    - 3.6.2.10 Brace and support as required to withstand structural wind loads.
    - 3.6.2.11 Omit masonry above flashing to leave a 12 inch length of the flashing exposed to view.
  - 3.6.3 Location:
    - 3.6.3.1 Locate in a well-lit area where approved by Architect.
    - 3.6.3.2 Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.

- 3.6.3.3 Remove mockup when directed by Architect, unless part of permanent construction.
- 3.6.4 Sample Panel(s):
  - 3.6.4.1 Sample panel should be included as part of completed work within the building.
  - 3.6.4.2 Do not start masonry until Architect has approved submittal samples and mock-up.
  - 3.6.4.3 Sample panel size and location shall be coordinated with Architect.
  - 3.6.4.4 Sample panel shall show selected color range and texture, bonding, joint shape, and quality of workmanship. Include any specialty details, such as reveals, soldier courses, etc. Include installation of sill and lintel above openings, window jambs and sills. (Refer to mock-up requirements).
  - 3.6.4.5 A separate sample panel for each type of masonry used is required.
- 3.7 Cavity Drainage
  - 3.7.1 Refer to Appendix for Diagram 04\_02.
  - 3.7.2 Cavity drainage protection such as Mortar Net or similar product shall be specified on all projects.
  - 3.7.3 Weep hole vents shall be specified on all projects – sized to match masonry opening – including custom sizing.
  - 3.7.4 Provide weeps in masonry screen walls and masonry wraps on building exterior. Ensure weeps are coordinated with final grade.
  - 3.7.5 No plastic tube weeps.
- 3.8 Provide suitable backer material inside door frames so silencers can be securely installed in frame after grouting
- 3.9 Provide special uncured face brick in locations where cores would be exposed in finish work.
- 3.10 Provide special shapes at corners that are not 90° corners.
- 3.11 Submittals:
  - 3.11.1 Product Data: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.
  - 3.11.2 Samples: Two (2) sets of color chips representing manufacturer's full range of available colors and textures of each face brick for Architect's selection and approval.

#### **04 01 00 - Maintenance of Masonry**

- 1.0 Clean with detergent mix only, no power wash.
- 2.0 No attic stock is required.
- 3.0 Cleaning materials and equipment
  - 3.1 Clean, potable, free of oils, acids, alkalis, salts, and organic matter.
  - 3.2 Brushes: Fiber bristle only.
  - 3.3 Cleaning Products
    - 3.3.1 "TexClean"; AHI Supply.
    - 3.3.2 "Sertec"; Sermac, a Division of Service Master Industries, Inc.
    - 3.3.3 "Sure Klean Restoration Cleaner," Prosoco, Inc.

- 3.4 The following products based on AHI Supply TexClean products are intended as a guide only and does not preclude the contractors use of equal products by listed manufacturers. Consult manufacturer prior to application for any questions or inconsistencies.

Substrate	Color/Type	Cleaning Solution
Brick	Red	Tex Clean Masonry Cleaner
	Light	Tex Tral Masonry Cleaner
	Dark	Tex Tral Masonry Cleaner
	Pavers	Tex Clean Masonry Cleaner
CMU	Glazed	Tex Tral Masonry Cleaner
	Split Face	Tex Tral Masonry Cleaner
Architectural Concrete	Burnished/Ground Face	Tex Tral Masonry Cleaner
	Natural Color/Smooth	Tex Tral Masonry Cleaner
	Textured	Tex Clean Masonry Cleaner
Stone Construction	Cast Stone	Tex Tral Masonry Cleaner
	Arriscraft	Tex Tral Masonry Cleaner
	Limestone (Unpolished)	Tex Tral Masonry Cleaner

#### 04 05 00 - Common Work Results for Masonry

- 1.0 Provide color match for existing buildings, including requirement for contractor to construct up to TWO (2) mock-up panels for verification of matching masonry material. "MATCH EXISTING" WILL NOT BE ACCEPTED.
- 2.0 Provide raked mortar joint in masonry walls where painted wainscot provided (typical in CMU corridors).
- 3.0 Provide raked mortar joint and SEALANT where dissimilar masonry materials abut, including horizontal joints (such as cast stone to brick or split face CMU to brick).
- 4.0 Masonry Control Joints
  - 4.1 Review information in Geotechnical Report and consider potential for foundation movement (settlement and potential vertical rise, PVR) when locating masonry expansion and control joints (interior and exterior).
  - 4.2 Maximum spacing is 30 feet at interior masonry walls and at doors and window openings. Verify with current BIA and NCMA recommendations.
  - 4.3 Ensure continuity of control joints in masonry from top to bottom of wall including around sills, lintels, etc. Control joint must be continuous.
  - 4.4 Refer to Appendix for Diagram 04\_03.

#### 04 20 00 – Unit Masonry

- 1.0 Face Brick Manufacturers: Subject to compliance with requirements, provide products of one of the following:
  - 1.1 Meridian Brick
  - 1.2 Glen-Gery
  - 1.3 Summit Brick
  - 1.4 Kansas Brick and Tile.
  - 1.5 Acme Brick Tile & Stone.
  - 1.6 Endicott Brick
  - 1.7 General Shale Brick
- 2.0 Concrete Masonry Units (CMU/Block) Manufacturers: Subject to compliance with requirements, provide products of one of the following:

- 2.1 Featherlite Building Products.
  - 2.2 Texas Building Products, Inc.
  - 2.3 Revels Block & Brick Co., Inc.
  - 2.4 Best Block Construction Materials
- 3.0 Mortar:
- 3.1 Materials: (Unless stated otherwise on Structural Drawings).
    - 3.1.1 Portland Cement: ASTM C150, Type 1.
    - 3.1.2 Hydrated Lime: ASTM C207, TYPE "N", typical. Use TYPE "S" for load-bearing masonry.
    - 3.1.3 Aggregate: Sand conforming to ASTM C144.
    - 3.1.4 Water: Clean and potable.
    - 3.1.5 Admixtures For Mortar:
      - 3.1.5.1 General: Do not use calcium chloride
      - 3.1.5.2 Concrete Masonry Units: Spectrum Mortar Color or Architect approved equal.
      - 3.1.5.3 Face Brick: Spectrum Mortar Color or Architect approved equal.
      - 3.1.5.4 Integral Water Repellant (In mortar of exterior exposed CMU): "Dry-Block Mortar Admixture" integral water repellant admixture as manufactured by Grace Construction Packaging (gcp) or comparable product approved by Architect and FBISD Design Manager. Note: Water repellent block admixture and mortar admixture are not interchangeable.
- 4.0 Reinforcement:
- 4.1 Manufacturers: Subject to compliance with requirements, provide products of one of the following:
    - 4.1.1 Heckmann Building Products.
    - 4.1.2 Hohmann & Barnard, Inc.
    - 4.1.3 Wire-Bond.
  - 4.2 At Solid Multiple Wythe Masonry Walls and Single Wythe Masonry Walls (Interior partitions): use #9 gauge truss type reinforcing. Pre-fab corners and tees shall be used at all wall corners and intersections; width shall be two (2) inches less than nominal thickness of walls.
  - 4.3 At Double Wythe Cavity Walls with Insulation Board: Use Hot-dipped galvanized, #9 gauge truss type with 3/16 inch adjustable pintle wall ties. Width of truss reinforcement shall be 2 inches less than the nominal thickness of wall. 3/16 inch wall tie double eye sections welded at 16 inches O.C. extended as required for insulation thickness. Pre fab corners and tees shall be used at all wall corners and intersections.
  - 4.4 At Masonry Anchored to Steel Spandrel Beam and Columns: Hot-dipped galvanized. Anchors detailed on Structural Drawings supersede.
  - 4.5 At Veneer Brick Anchored to Light Gauge Steel Framing: Hot-dipped galvanized, 2 Seal Tie System utilizing self-tapping screw for steel studs with 5/8 inch barrel length, and 4 inch triangle wire tie for 2 inch cavity. Anchors detailed on structural drawings supersede. Attachment screws shall be corrosion resistant type as recommended by manufacturer to suit application. Adjust wire tie size as required to conform to cavity depth if other than 2 inch.
- 5.0 No FBISD preference for modular vs. king-size. Use of utility and other brick sizes larger than king-size shall be approved by FBISD Design Manager during design development phase.
- 6.0 Consider minimum cuts of standard sizes when designing at exterior applications, including opening sizes and accent banding.

- 7.0 Concrete Unit Masonry:
  - 7.1 No 4" CMU shall be used, except at column wraps. Do not use at chase walls.
  - 7.2 Provide bullnose at all outside corners where interior CMU scheduled (except where additional material intended as final finish, i.e. tile). Factory bullnose block on all exposed exterior corners, excluding door heads, where materials are applied, i.e. tile.
  - 7.3 Factory bullnose block on all exposed exterior corners, excluding door heads or where materials are applied, i.e. tile.
  - 7.4 Provide sound block or acoustic wall panels at gymnasiums. Wall panels preferred, allow for acoustic tuning of space. Coordinate with acoustical consultant.
  - 7.5 Always use starter course to avoid 4" door head.
  - 7.6 Use of split face CMU, smooth face CMU, and burnished CMU for interior veneer applications is acceptable. Confirm intended used with FBISD Design Manager prior to commencing beyond Design Development.
  - 7.7 When utilizing Split Face CMU as water table (base) on exterior of building, reverse bottom course so that concrete sidewalk can be poured evenly against face of building (provide for expansion). Also ensure that flashing and weeps are raised to allow for condensation to escape ABOVE adjacent sidewalks and/or Concrete mow strips.
- 8.0 Vertical Glass Unit Masonry:
  - 8.1 Glass block masonry shall not be used on the exterior of a building.
- 9.0 Multiple-Wythe Unit Masonry:
  - 9.1 Apply dampproofing on inside face at multi-wythe masonry walls having dissimilar materials (CMU and brick).
  - 9.2 Provide sheet metal in lieu of cast stone at screen wall cap to help ensure no efflorescence. If cast stone must be used, ensure positive slope, drip lip with undercut, and continuous flashing between stone and masonry below.
- 10.0 Concrete Form Masonry Units:
  - 10.1 Insulated Concrete Form (ICF) are acceptable only upon approval from FBISD Design Manager. Refer to Division 03 – Concrete for additional information.

#### **04 40 00 – Stone Assemblies**

- 1.0 Stone Masonry Veneer:
  - 1.1 Veneer only. Adhered application acceptable.
  - 1.2 Approved Manufacturers:
    - 1.2.1 Endicott Clay Products.
    - 1.2.2 Acme Brick Tile & Stone.
- 2.0 Architectural Cast Stone:
  - 2.1 All cast stone to be sealed.
  - 2.2 Arriscraft or comparable product approved by FBISD Design Manager.
  - 2.3 Limit Use.
  - 2.4 Coordinate with structural for anchoring.
  - 2.5 Provide integral drip control at overhangs.

#### **04 70 00 – Manufactured Masonry**

- 1.0 Manufactured Stone Masonry:
  - 1.1 Arriscraft or comparable product approved by FBISD Design Manager. Verify all intended use with FBISD Design Manager prior to including within documents.

**END OF DIVISION 04**

## Division 05

# Metals

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### DIVISION 05 - METALS

#### 05 00 00 - General Requirements for Metals

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within the sections below.
  - 1.3 Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations.
      - 1.3.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials.
      - 1.3.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients.
      - 1.3.2.4 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials.
- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other



characteristics that equal or exceed those of the specified product.

3.0 Requirements:

- 3.1 Recommended Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
  - 3.1.1 Where an otherwise qualified fabricator who is not currently certified wishes to submit, they must submit a resume describing plant size, equipment, quality control procedures, personnel, and experience on comparable work in the last three years.
- 3.2 Recommended Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
  - 3.2.1 Where an otherwise qualified installer who is not currently certified wishes to submit, they must submit a resume describing plant size, equipment, quality control procedures, personnel, and experience on comparable work in the last three years.
- 3.3 Recommended Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, or P3 as applicable for exposure or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- 3.4 Recommended Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 3.4.1 Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- 3.5 Consider maintenance access when designing mechanical areas and roof, providing stairs in lieu of ships-ladder or alternating tread devices. Avoid designs requiring full moment connections.
- 3.6 Provide shop drawings for all metals.

4.0 Coordination:

- 4.1 Expansion Joints are addressed in Division 07 – Moisture and Thermal Protection.
- 4.2 If joint runs through slabs, the potential differential movement shall be considered as to maintain compliance with ADA & serviceability.
- 4.3 Submittals:
  - 4.3.1 Product Data: Submit data for miscellaneous metal fabrications and paint, coatings, and grout accessories. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.
  - 4.3.2 Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 4.4 Samples:
  - 4.4.1 For each type of exposed finish required.
  - 4.4.2 Assembled sample of railing/guardrail system, made from full size components. Include sections of each distinctly different railing/guardrail member, including handrails, top rails, posts, balusters and infill panels. Sample need not be full height.
  - 4.4.3 Fittings and brackets.



- 4.4.4 Provide sample connections & other critical aesthetic concerns for all steel indicated (Architecturally exposed structural steel). Show method of connecting and finishing members at intersections.
- 4.5 Contractor's Responsibilities:
  - 4.5.1 Coordinate note with various assemblies. Architect to incorporate the following to the Specifications:
    - 4.5.1.1 As scope and performance documents, the Drawings and Specifications do not necessarily indicate or describe all the work required for the performance and completion of the Work. Contracts will be let on the basis of such documents with the understanding that the Contractor shall furnish and install the items required for proper completion of the Work without adjustment to price or schedule. Work shall be of sound, quality construction and the Contractor shall be solely responsible for the inclusions of adequate labor and materials to cover the proper and timely fabrication and installation of the miscellaneous metal items indicated, described, or implied.
    - 4.5.1.2 As a performance specification, the criteria for the solution of structurally sound miscellaneous metal items indicated on the Drawings or specified herein are the sole purpose of defining the design intent and performance requirements. The details shown are intended to emphasize the acceptable profiles and performance requirements for this Project. To avoid any misunderstanding or lack of interpretation, the Contractor is hereby advised that the responsibility for the miscellaneous metal items are totally theirs and that designs and resolutions proposed in the Contractor's shop drawings, structural calculations, and related documentation shall be demonstrated throughout the Work and warranty period specified or required.
    - 4.5.1.3 Design proposal submissions which follow exactly the details indicated on the Drawings, will not relieve the Contractor of his responsibility for the design, fabrication, erection, or performance of the Work of this Section.
    - 4.5.1.4 In the event of a controversy over the design, the decision of the Architect will take precedence.
    - 4.5.1.5 It shall be the Contractor's responsibility to ensure that all construction loading of the structural decks complies with the metal deck manufacturer's allowable loading criteria. The storage of materials and the use of mechanical lifts or other heavy moveable or stationary equipment utilized on elevated concrete slabs to perform work shall be conducted in a safe manner so as to not cause any damage or deformation to steel decks or other portions of the structure. The Contractor shall take all necessary precautions, including hiring a structural engineer when necessary to evaluate the imposed loadings on elevated slabs from materials, manpower, lifts, and equipment, in order to comply with the deck manufacturer's safe loading criteria and deflection limitations. The Contractor shall be fully responsible for any damage caused to elevated slabs or other portions of the Work as a result of construction-imposed loads utilized in performing the Work. The Contractor shall include adequate provisions in his bid to accommodate any limitations, restrictions, or



additional costs that are necessary to meet the deck manufacturer's requirements for the metal deck type, spans, and materials specified in the bid documents.

#### **05 01 00 - Maintenance for Metals**

- 1.0 All steel products delivered to project site must be stored appropriately, in properly drained area, preferably on concrete paving or slab. Ensure 6-inches clear from ground.
- 2.0 Remove all rust from steel, and re-prime (with zinc rich, galvanizing primer, if appropriate) before installation of additional materials (finish paint, fire-proofing, drywall).

#### **05 05 00 - Common Work Results for Metals**

- 1.0 Exterior steel shall be galvanized , no exceptions (including lintels, handrails, bollards). G90 for roof deck.

#### **05 10 00 – Structural Metal Framing**

- 1.0 General:
  - 1.1 Furnish certification that all bolts are domestic in origin.
  - 1.2 Consider use of tube steel columns or other readily available shapes/sizes to reduce fabrication time (in lieu of S or W Sections).
  - 1.3 Avoid use of non-standard (and non-domestically available) sizes.
  - 1.4 If BIM model prepared, A/E to transfer file to Steel Fabricator to assist with detailing as well as reduce fabrication time. Transfer of BIM files would require release from General and Sub-Contractors AND appropriate credit for detailing labor.
  - 1.5 Structural engineer to provide detail from AISC Design Guide 1, 2<sup>nd</sup> Edition (*Figure 2.4 - Coupling nut detail for extending anchor rod*) in construction drawings to address field situations where installed anchor bolt or rod projections are too short.

#### **05 20 00 – Metal Joists**

- 1.0 General:
  - 1.1 Allow camber of joists, HOWEVER, consider single slope of all joists during roof design to minimize cost and fabrication time.
  - 1.2 All joists with any non-standard loading shall be designed mirrored about the centerline to account for joists which might be accidentally installed reversed (flipped horizontally). This is especially critical for high concentrated loads supported at or near one joist seat (common at high / low roof conditions).
- 2.0 Structural Joist Framing:
  - 2.1 Joists shall be provided with ceiling extensions in areas having ceilings attached directly to joist bottom chord.
  - 2.2 No attachments shall be made to the horizontal legs of the top and bottom chord angles. (No attachment to bottom of joist permitted).

## 05 30 00 – Metal Decking

- 1.0 General:
  - 1.1 Field touch-up all decking with zinc-rich primer at roof deck welds and where galvanizing is damaged.
- 2.0 Steel Decking:
  - 2.1 At roof AND floors, when designing for lightweight insulating or lightweight concrete (support span and gauge), consider installation live load of multiple workers in common structural bay.
  - 2.2 For all conventional floor deck, provide a minimum of 24 gauge with a G90 coating. This is intended to set a minimum performance criterion; this is not intended to dictate design. Where deemed necessary or appropriate by the design professional in due charge of the design of the decking gauge and coating thickness shall be increased as needed.
  - 2.3 For all conventional roof deck (for both wet and dry deck conditions), provide a minimum of 22 gauge with a G90 coating. This is intended to set a minimum performance criterion; this is not intended to dictate design. Where deemed necessary or appropriate by the design professional in due charge of the design of the decking gauge and coating thickness shall be increased as needed.
  - 2.4 Always use vented deck for lightweight insulated concrete at roof.
  - 2.5 Contractor shall be required to string-line the center of joists to mitigate misplaced welds. NO exceptions.
- 3.0 Acoustical Metal Decking:
  - 3.1 Consider use on Gymnasiums and other exposed structure high traffic, high use areas. Refer to Division 03 – Concrete and Division 09 – Finishes for additional considerations.

## 05 40 00 – Cold-Formed Metal Framing

- 1.0 General:
  - 1.1 Shop drawings for CFMF should verify gauge and spacing. Indicate specifically how structural stud tracks are fastened to concrete slab perimeter, including fastener types and spacing.
  - 1.2 Provide for live load expansion and/or deflection (slip track at head).
  - 1.3 Brace all walls to structure.
  - 1.4 Provide bank-rails (4" tube steel with base plate) at all partial height walls and ribbon windows (greater than 8'-0") with framing below.
  - 1.5 The Structural Engineer will need to identify in their drawings the headers that are to be designed to specification 05 40 00 – COLD FORM METAL FRAMING. This specification shall require a 3<sup>rd</sup> party structural design, and require that inspections are performed and acceptable prior to installation of wall board or adjacent ceiling materials. The inspection shall require that the installation is in compliance with the 3<sup>rd</sup> party structural designs provided by the contractor in the submittal.
- 2.0 Cold-Formed Metal Trusses:
  - 2.1 For use on small stand-alone buildings only. Verify intended use with FBISD Design Manager before proceeding beyond Schematic Design.

## 05 50 00 – Metal Fabrications

- 1.0 General:
  - 1.1 All exterior ladders (and those providing direct access to roof or exterior from interior) shall be galvanized, UNPAINTED. All interior ladders providing direct access to the roof to be steel, powder coated, safety yellow.
  - 1.2 Provide paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
  - 1.3 Provide welding certificates.
  - 1.4 Qualification Data: For testing agency.
  - 1.5 Mill Certificates: Signed by manufacturers of stainless steel products certifying that products furnished comply with requirements.
  - 1.6 Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
  - 1.7 Shop Drawings: Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  - 1.8 Sheet metal fabricator to meet ISO 9001.
- 2.0 Sign Posts:
  - 2.1 Accessible Parking Sign Posts: 2-inch galvanized steel tube with integral welded galvanized post cap.
    - 2.1.1 Post Anchor Bolts: Two (2) galvanized ½ inch by 6-1/8 inch Nelson stud anchor bolts welded to steel tube front and back.
    - 2.1.2 Review sign post type/size and location with accessibility requirements.
- 3.0 Steel Ladders: Fabricate from 2-1/2 inch by 3/8-inch flat bar steel stringer with ¾-inch steel rod rungs let into stringers, welded and ground smooth. Provide all angle supports and anchoring devices for bolting to wall, floor, or structure as required. Hot-dip galvanize after fabrication.
  - 3.1 Approved Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 3.1.1 ACL Industries, Inc.
    - 3.1.2 Alco-Lite Industrial Products.
    - 3.1.3 Halliday Products.
    - 3.1.4 O'Keeffe's Inc.
    - 3.1.5 Precision Ladders, LLC.
    - 3.1.6 Thompson Fabricating, LLC.
    - 3.1.7 Lapeyre Stair
  - 3.2 Provide minimum 72 inch (1830 mm) high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.
- 4.0 Warranty:
  - 4.1 Provide 20 year warranty on interior and exterior metal fabrications.
- 5.0 Fabrication Tolerances:
  - 5.1 Squareness: 1/8 inch (3mm) maximum difference in diagonal measurements.
  - 5.2 Maximum Offset Between Faces: 1/16 inch (1.5mm).
  - 5.3 Maximum Misalignment of Adjacent Members: 1/16 inch (1.5mm).
  - 5.4 Maximum Bow: 1/8 inch (3mm) in 48 inches (1.2m).
  - 5.5 Maximum Deviation From Plane: 1/16 inch (1.5mm) in 48 inches (1.2m).
- 6.0 Erection Tolerances:
  - 6.1 Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.
  - 6.2 Maximum Offset from True Alignment: 1/4 inch (6mm).
  - 6.3 Maximum Out of Position: 1/4 inch (6mm).
- 7.0 Steel Finishes:
  - 7.1 Prime paint all steel items.

- 7.1.1 Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
  - 7.2 Prepare surfaces to be primed in accordance with SSPC-SP2.
  - 7.3 Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
  - 7.4 Prime Painting: One coat.
  - 7.5 Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
  - 7.6 Galvanizing of Non-Structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
  - 7.7 All steel exposed to weather, set in concrete shall be painted with cold galvanized zinc, specification of U.S. Navy MIL-P-21035m U.S. Air Force MIL-P-26915A, equal to Hot Dip galvanized in cathodic protection.
- 8.0 Aluminum Finishes:
- 8.1 Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.
    - 8.1.1 Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.
- 9.0 Adjusting and Cleaning:
- 9.1 Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces.
    - 9.1.1 Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
  - 9.2 Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099000.
  - 9.3 Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.
- 10.0 Metal Stairs:
- 10.1 Provide safety cages on all ladders per OSHA 3124 (Generally, bottom of cage 8' from lower level, top of cage 42" from upper level). FBISD Project Manager/Facilities Staff to provide "non-locking clasp".
  - 10.2 Reference <http://www.osha.gov/Publications/osha3124.pdf>.
- 11.0 Pre-Engineered Steel Pan Stairs:
- 11.1 Steel Sheet: ASTM A1011, commercial quality, hot rolled, U.S. Standard gauges listed are for field fabricated stairs, pre-engineered stairs fabricated from sheet steel of gauge recommended by stair manufacturer.
  - 11.2 Nest tread sections into riser sections without exposed connections. Reinforce underside of metal pans with properly sized angle or tee stiffeners spaced to eliminate bouncing and springing action. Provide all necessary supports whether indicated or not.
- 12.0 Metal Railings:
- 12.1 Rail Connections:
    - 12.1.1 Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
    - 12.1.2 Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections whether welding is performed in the shop or in the field.
    - 12.1.3 Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip joint internal sleeve extending 2-inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6-inches (150 mm) of post.



- 12.1.4 Provide brushed aluminum or stainless steel at high traffic interior stairs (in lieu of painted) to reduce maintenance.
- 12.1.5 Provide galvanized, unpainted rail at building's exterior.

13.0 Metal Gratings

- 13.1 Acceptable only at catwalks (including stage rigging, loading platforms, and grid floors), not mechanical mezzanines.

**05 70 00 – Decorative Metal**

1.0 Stainless Steel, Decorative Railing System

- 1.1 Mechanically fastened railing application not acceptable.
- 1.2 Panel System type to be approved by FBISD Design Manager during finish review meeting.
- 1.3 Railing system shall be designed to conform to building code and ADA requirements for openings and stress.
- 1.4 Railing system shall withstand the minimum concentrated loads in accordance with ASTM E935:
  - 1.4.1 Vertical and Horizontal Force: 200 pounds concentrated load at any point without damage or permanent set.
- 1.5 Guardrails posts with side-mounted rail
  - 1.5.1 Material: 2-inch outside diameter stainless steel tube, Type 304.
  - 1.5.2 Height: 42 inches.
  - 1.5.3 Spacing: 4'-0" on center maximum.
- 1.6 Stair Rail Posts with top-mounted handrail.
  - 1.6.1 Material: 2-inch OD stainless steel tube, Type 304.
  - 1.6.2 Height: 34 inches.
  - 1.6.3 Spacing: 4'-0" on center maximum.
- 1.7 Handrails: 1-1/2-inch OD stainless steel tube, Type 304.
- 1.8 Wall Bracket: WB-1051. Stainless Steel Wall Bracket Assembly. 4' 0" Maximum spacing.
- 1.9 Finish: Stainless Steel Handrails and Posts: Circular #4 satin.
- 1.10 Perforated Metal:
  - 1.10.1 Type: Aluminum framed perforated aluminum panels, powder coat finish as selected by Architect from available manufacturer's available list of colors.
  - 1.10.2 Thickness: 1/8 inch.
  - 1.10.3 Style: As selected by Architect

**END OF DIVISION 05**

## Division 06

# Wood, Plastics, and Composites

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### DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

#### 06 00 00 - General Requirements for Wood, Plastics, and Composites

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated with sections below.
  - 1.3 Leadership in Energy and Environmental Design (LEED).
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations.
      - 1.3.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials.
      - 1.3.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients.
      - 1.3.2.4 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials.

- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.
- 3.0 Requirements
  - 3.1 Coordinate plywood at MDF and IDF closets with Division 27 – Communications.
  - 3.2 All Stains/Finishes to be specified with Low-VOC content. Refer to Division 09 - Finishes.
  - 3.3 Hardware for Millwork must
    - 3.4.1 Meet ANSI/BHMA 156.9 Grade 1 – AWS Schools/Hospitals.
    - 3.4.2 Specify Heavy Duty with Satin-brushed finish.
    - 3.4.3 Design, finishes, hardware and all components must meet ADA/TAS Accessibility Guidelines.
    - 3.4.4 All locking cabinets to be keyed with the door. Coordinate with Division 8 – Openings.
- 4.0 Coordination
  - 4.1 Contractor to coordinate keying with Owner. Minimize number of cabinets requiring locks, key to room. Coordination will be needed with hardware specifier and supplier to ensure all items are covered. (Likely locking device by Millwork Sub, with cores, keying, and installation by Hardware Subcontractor.) Refer to Division 8 – Openings.
  - 4.2 Contractor to coordinate with consultant/FBISD Project Manager for delivery and installation of any identified Owner equipment, grommets, etc.

#### **06 05 00 - Common Work Results for Wood, Plastics, and Composites**

- 1.0 Utilize fire retardant wood blocking within building for wall-mounted accessories. Code requirement for this can depend on building type, but it is best to specify for all applications. Exterior grade fire retardant wood (MCA or MCQ treatment) to be used at building exterior and on millwork base (or any location where moisture could be present). Consider susceptibility to termites when locating wood blocking near building perimeter.
- 2.0 Provide wood blocking or 20 gauge galvanized steel strap at the following locations:
  - 2.1 PLAM Wall Panels (6" wide, CL on top and bottom of final panel, coordinated with manufacturer's anchor locations).
  - 2.2 Door Hardware Impact (minimum 12" x 12" where door hardware strikes wall, in event of floor stop failure, or for installation of wall stop).
  - 2.3 Toilet Accessories (in rooms without CMU).
  - 2.4 Upper Cabinet Casework.
  - 2.5 Window shading devices (blinds).
  - 2.6 Toilet Partitions (in rooms without CMU).
  - 2.7 Markerboards.
  - 2.8 Projectors.
  - 2.9 Plaque locations.
  - 2.10 Wall Mounted Monitors or Interactive Displays.

#### **06 06 00 - Schedule for Wood, Plastics, and Composites**

- 1.0 A/E to provide schedule within design documents for all wood beams, wood trusses, and laminated beams to ensure size and configuration match design intent.

## 06 10 00 - Rough Carpentry

- 1.0 General:
  - 1.1 Consider use of galvanized angles around windows in lieu of exterior grade fire resistant wood blocking.
  - 1.2 Roof curbs are premanufactured metal curbs with attached wood nailer strip. Fire treated wood nailers are not needed.
  - 1.3 Provide MCA or MCQ treatment for all exterior rough carpentry.
- 2.0 Heavy Timber Construction:
  - 2.1 A/E to include specific routes for fire suppression, electrical, and plumbing on reflected ceiling plans where exposed wood construction is present.
- 3.0 Sheathing:
  - 3.1 Gypsum Sheathing: If asphalt-impregnated sheathing is encountered within existing facilities, during renovations and/or construction of building addition, it is recommended that areas directly affected by new work be replaced with glass-mat sheathing, as identified below. Coordinate with Division 9 – Finishes.
  - 3.2 Moisture-Resistant Sheathing Board: Provide glass-mat reinforced (paperless) sheathing on outside face of all exterior CFMF walls. Tape all joints. Coordinate with Division 7 – Thermal and Moisture Protection.
  - 3.3 Cementitious Sheathing: Consider for use in soffit applications, in lieu of metal panel. Includes “Hardi-board”, recommended for use on small maintenance and other out-buildings.
  - 3.4 Products not allowed without written approval by FBISD Design Manager:
    - 3.4.1 Foil-Faced Polyisocyanurate Insulating sheathing.
    - 3.4.2 Gypsum Sheathing premanufactured with water-resistive barrier and air barrier
- 4.0 Glued-Laminated Construction:
  - 4.1 Verify all use with FBISD Design Manager before proceeding.

## 06 20 00 – Finish Carpentry

- 1.0 General: Review proposed uses with FBISD Design Manager at Design Development Issue.
- 2.0 Standard Pattern Wood Trim: Review proposed uses with FBISD Design Manager.



## 06 40 00 – Architectural Woodwork

- 1.0 General:
  - 1.1 Refer to Division 12 – Furnishings for additional information on use of Wood Veneer, solid surface, PLAM-Clad casework and countertops.
- 2.0 Plastic-Laminate-Clad Architectural Cabinets (Excluding reception areas):
  - 2.1 All science labs (all grade levels) shall have epoxy resin tops.
  - 2.2 Consider chemical resistant solid phenolic, chemical resistant plastic laminate countertops or butcher block countertop at maker spaces, out classes, and STEM Labs.
  - 2.3 Particleboard and melamine are not acceptable.
  - 2.4 MDF to be used in all locations except adjacent to water sources.
    - 2.4.1 3/4-inch minimum for all MDF or plywood used on cabinet bodies and shelves.
  - 2.5 Provide marine grade plywood core at countertops and within entire body of millwork where sinks present (bottom, back, and sides).
    - 2.5.1 Minimum 7 ply on cabinet bodies and doors.
  - 2.6 Provide only moisture resistant dimensional lumber for toe-kicks and cabinet bases (no plywood).
  - 2.7 Provide 3mm PVC on:
    - 2.7.1 Leading edges of countertops.
    - 2.7.2 Perimeter of doors and drawers.
    - 2.7.3 Top edge of backsplash – NOT REQUIRED.
    - 2.7.4 Leading edges at all open cabinets, including shelves.
    - 2.7.5 All adjustable shelves in closed cabinets (1mm).
    - 2.7.6 Refer to Diagram 12\_02 in Appendix.
  - 2.8 Consider quantity of material needed when selecting color of 3mm PVC edge banding. Some color selections are not readily available and require minimum order. If millwork is of large quantity, custom match is acceptable. If millwork is of small quantity, select from standard available colors.
  - 2.9 No need to laminate back and side edges of unexposed shelving. Clear seal or paint to match shelving color.
  - 2.10 Limit shelf spans to 30". If over 30", increase thickness to 1".
  - 2.11 Only hardwood bottoms allowed on drawers.
  - 2.12 Backpack hooks: Around the border.
  - 2.13 Refer to Appendix for Diagram 12\_02.
- 3.0 Cabinet and Drawer Hardware:
  - 3.1 NO European Style Hinges allowed.
  - 3.2 Preferred Hardware is as follows:
    - 3.2.1 Hinges, 5 knuckle, brushed chrome.
    - 3.2.2 Door and Drawer pulls, 5", brushed chrome.
    - 3.2.3 Drawer Slides – Ball Bearing Type Only.
- 4.0 Plastic-Laminate-Faced Wood Paneling:
  - 4.1 Provide trim on all panels for durability and to facilitate ease in replacement, in lieu of concealed spline joints. All the bases should be treated lumber.
  - 4.2 Consider in lieu of CMU for corridor walls (less labor and construction time, future program flexibility). Provide at lower heights for ES, higher for HS. Consider height of backpacks when determining appropriate height of panels.

**06 80 00 – Composite Fabrications**

- 1.0     Fiberglass Reinforced Paneling (FRP):
  - 1.1     Provide on wall(s) adjacent to mop sinks in Custodial areas. If corner floor sink, install on both walls to nearest inside corner.
  - 1.2     Provide in Food Service areas over steel framing assemblies (where masonry or CMU not provided).
  - 1.3     DO NOT install on exterior walls or on walls between conditioned and non-conditioned spaces (or in any location where condensation due to dew point is possible behind FRP).
  - 1.4     Reference Division 09 – Finishes for additional information.
- 2.0     High Pressure Laminate (HPL):
  - 2.1     Consider through color laminate to be used in high wear or high profile areas.
- 3.0     Fiber-Reinforced Laminates (FRL):
  - 3.1     Upon approval of FBISD Design Manager only. Not to be used at high wear areas.
  - 3.2     Flexural Strength meets ASTM D790 at 20,148 psi.
  - 3.3     Wear Resistance (Cycles) meets NEMA 3.13 at 3500 psi.

**END OF DIVISION 06**

## Division 07

# Thermal & Moisture Protection

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## DIVISION 07 – THERMAL & MOISTURE PROTECTION

### 07 00 00 - General Requirements for Thermal & Moisture Protection

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3 Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 SSc5: Heat Island Reduction
      - 1.3.2.2 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations
      - 1.3.2.3 MRc3: Materials and Resources credit: Building Product Disclosure and

## Optimization - Sourcing of Raw Materials

### 1.3.2.4 MRc4: Building Product Disclosure and Optimization – Material Ingredients

### 1.3.2.5 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials

## 2.0 Comparable Products

- 2.1 As approved by Architect and FBISD Design Manager.
- 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.

## 3.0 Requirements

- 3.1 The following building envelopes must be completely closed:
  - 3.1.1 Thermal Envelope (Protection of Contents and Occupant Comfort).
  - 3.1.2 Moisture Envelope (Protect Interior from Condensation as Result of Dewpoint).
  - 3.1.3 Architectural Veneer Envelope (Shed Moisture).
  - 3.1.4 Consider ease in construction when choosing exterior materials and detailing all exterior walls.
  - 3.1.5 Minimize start-stop time for alternate trades to complete work.
  - 3.1.6 Examples:
    - 3.1.6.1 Consider common thermal protection for entire building (rigid insulation vs. batt).
    - 3.1.6.2 Consider common moisture protection for entire building (membrane vs. applied dampproofing).
- 3.2 General Roof Design
  - 3.2.1 Basis of Design for **new roofs** and full tear-off re-roofs (down to existing decking) shall be Modified Bitumen “Cool Roof” Roofing System. Refer to paragraphs below for more information. Deviation from this basis of design must be explicitly approved by FBISD Design Manager.
  - 3.2.2 Basis of Design for **existing conditions** that require roof recovery (overlay over existing roof system or existing roof insulation) shall be Thermoplastic (TPO and PVC) Hybrid Membrane Roofing. Refer to paragraphs below for more information. Deviation from this basis of design must be explicitly approved by FBISD Design Manager.
  - 3.2.3 Hot mopped asphalt application prohibited at all re-roofs and/or roof recoveries.
  - 3.2.4 Locate roof drains to minimize piping (towards building perimeter). Refer to Diagrams 07\_02 and 07\_03 in Appendix.
  - 3.2.5 Utilize roof edge as overflow as primary design. Scuppers or overflow drains must be provided if roof edge is not attainable. Overflow drains must be daylighted as per plumbing code requirements.
  - 3.2.6 Locate overflows and scuppers in locations AWAY from main entrances and exits.
  - 3.2.7 Scuppers must be 2" off the roof. Refer to Appendix for Diagram 07\_01 and 07\_02.
  - 3.2.8 Ensure access to all locations on roof while minimizing number of roof hatches and scuttle ladders.
  - 3.2.9 No rock ballast is allowed.
  - 3.2.10 Provide walk pads from each equipment to roof access hatches/ladders/doors.
  - 3.2.11 At single ply roofs only, provide walk pads from each equipment to roof access hatches/ladders.
  - 3.2.12 Screen all equipment from view (Refer to AHJ requirements).

3.3 Refer to the following diagrams for more information:

3.3.1 Diagram 07\_04 – Head Flashing – Aluminum Frame

3.3.2 Diagram 07\_05 – Jamb Flashing – Aluminum Frame

3.3.3 Diagram 07\_06 – Exploded Views of Window Flashings (Doors Similar)

## **07 01 00 – Operations and Maintenance for Thermal & Moisture Protection**

- 1.0 Specific warranty durations are noted in each sub-section along with material references. General performance is as follows:
  - 1.1 Twenty (20) years for roof.
  - 1.2 Ten (10) years for flashing (including thru-wall).
  - 1.3 Five (5) years for joint sealants.
- 2.0 Owner reserves the right to provide temporary repair until manufacturer is available to provide permanent solution.

## **07 05 00 – Common Work Results for Thermal & Moisture Protection**

- 1.0 Intention is for Architectural Envelope to be inconsequential, removed without affecting building's ability to protect against extreme temperatures and moisture (both within assembly, condensation/dewpoint, and from outside weather).

## **07 10 00 – Dampproofing and Waterproofing**

- 1.0 General
  - 1.1 Unoccupied below grade areas (such as elevator pits) shall have a passive drainage cavity-type membrane to ensure moisture is 'pulled away' from surface. Occupied spaces below grade (such as Orchestra Pit) shall have reactive moisture-stopping membrane (bentonite).
- 2.0 Dampproofing
  - 2.1 Only to be used at existing conditions.
  - 2.2 General:
    - 2.2.1 Provide at CMU, but also on glass-mat sheathing. Consider use of one material on entire exterior (one trade).
- 3.0 Sheet Waterproofing
  - 3.1 General:
    - 3.1.1 All types below are acceptable for use, provided use ensures protection as outlined in introduction to this section and as indicated elsewhere in Division 07.
- 4.0 Water Repellants
  - 4.1 Verify use of any listed below with FBISD Design Manager. Must be maintained once applied. Most masonry veneers now have integral repellants, ensure.
    - 4.1.1 Acrylic Repellants.
    - 4.1.2 Concrete floor Sealer and Finish.
    - 4.1.3 Silicone Repellants.
    - 4.1.4 Siloxane Repellants.
    - 4.1.5 Stearate Repellants.
- 5.0 Accessories
  - 5.1 Designer to utilize protection board for below grade vertical applications.

## 07 20 00 – Thermal Protection

- 1.0 General:
  - 1.1 Roofing: All thermal insulation for the roof should be incorporated in the roof system and installed above the roof deck (keeping heat from entering the building envelope).
  - 1.2 Exceed minimum requirements of current International Energy Conservation Code (IECC) and ASHRAE 90.1.
  - 1.3 Special Conditions: Batt insulation should not be installed below the roof deck or on the back (top) of a ceiling. Exterior alcoves should be considered as exterior with envelopes closed around them (walls to deck above door and on sides). Provide vented perimeter with sprayed on insulation at deck where conditioned spaces occur above exterior-soffit spaces. Refer to Appendix for Diagram 07\_01 for Completion of Moisture and Thermal Envelopes at Exterior Alcoves.
  - 1.4 Exterior Walls: Due to the large amount of heat transfer through metal studs, installing continuous board insulation on the outside face of the sheathing in conjunction with batt insulation between the studs is the preferred method.
  - 1.5 Ensure wall cavity is not continuous from interior to exterior conditions.
- 2.0 Thermal Insulation
  - 2.1 Follow jurisdiction's energy code.
  - 2.2 Approved Manufacturers:
    - 2.2.1 Dow Chemical Company.
    - 2.2.2 Owens Corning.
    - 2.2.3 CertainTeed Corporation.
    - 2.2.4 Knauf Insulation.
- 3.0 Continuous Exterior Rigid Board Insulation (Foam, Fibrous, Mineral):
  - 3.1 Recommend using continuous board insulation on all areas, provide tight joints between boards, all joints and fasteners to be treated..
  - 3.2 Aluminum faced Polyisocyanurate to be used behind metal wall panels per NFPA 285.
- 4.0 Blanket Insulation
  - 4.1 Uses include: walls, floors and ceilings. between joists, studs and beams with minimal obstructions (Piping, wiring, conduits, etc.)
  - 4.2 Parapets ONLY to be Foamed-in-Place.
  - 4.3 Provide batt insulation at all exterior wall studs per current Energy code (IECC) and International Building Code (IBC).
- 5.0 Foamed-In-Place Insulation
  - 5.1 Only acceptable use is within single wythe masonry wall. To be loose filled.
- 6.0 Sprayed Insulation
  - 6.1 K-13 by International Cellulose Corporation or similar closed cell product to be installed at all stage ceilings, black box ceilings, and other approved areas by FBISD Design Manager.
  - 6.2 Recommended for use on underside of decking at alcove areas with occupied, conditioned spaces above.
- 7.0 Roof and Deck Insulation
  - 7.1 Minimum 200 psi Lightweight insulating concrete with encapsulated EPS insulation. R-Value per current IECC.
  - 7.2 Polyisocyanurate with recovery board for existing conditions and steep slope per code.



- 8.0 Roof Board Insulation
  - 8.1 For use below standing seam metal roofs only.
- 9.0 Fluid-Applied Air Barrier
  - 9.1 Material Warranty: Manufacturer's standard 10 years product warranty from date of Substantial Completion.
  - 9.2 Subcontractor (approved by ABAA and Manufacturer) Installation Warranty: Provide a two (2) year installation warranty from date of Substantial Completion, including all accessories and materials of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of adhesion and failure to cure properly.
  - 9.3 Provide materials with vapor permeance of 10.0 US perms or greater when tested in accordance with ASTM E96 – water method.
- 10.0 Sheet Metal Membrane Air Barriers
  - 10.1 High temp 270°F or higher utilized behind wall panels.
- 11.0 Membrane Air Barriers
  - 11.1 Not Allowed:
    - Modified Bituminous Sheet Air Barriers.
    - Sheet Metal Membrane Air Barriers
    - Plastic Sheet Air Barriers.
    - Board Product Air Barriers.

#### **07 30 00 – Steep Slope Roofing**

- 1.0 Metal Seam roofing preferred for steep slope. Refer to Section 07 40 00.
- 2.0 Slope: Minimum slope of metal roofing 2:12.
- 3.0 Do not use Batten Seam Metal Roofing and Flat Seam Sheet Metal Roofing.
- 4.0 Shingles and Shakes
  - 4.1 General: Limited use, architectural elements only, or out-buildings Asphalt Shingles (Specification Section 07 31 13).
  - 4.2 Utilize 30-year composite shingles for retrofits only.
  - 4.3 Not Allowed:
    - 4.3.1 Metal Shingles.
    - 4.3.2 Mineral Fiber Cement Shingles.
    - 4.3.3 Porcelain Enamel Shingles.
    - 4.3.4 Slate Shingles.
    - 4.3.5 Wood Shingles and Shakes.
    - 4.3.6 Composite Rubber Shingles.
    - 4.3.7 Plastic Shakes.
- 5.0 Roof Tiles
  - 5.1 Not Allowed:
    - 5.1.1 Clay Roof Tiles.
    - 5.1.2 Concrete Roof Tiles.
    - 5.1.3 Metal Roof Tiles.
    - 5.1.4 Mineral Fiber Cement Roof Tiles.
    - 5.1.5 Plastic Roof Tiles.
    - 5.1.6 Rubber Tiles/Panels.

## 07 40 00 – Roofing and Siding Panels

### 1.0 Roof Panels

#### 1.1 General:

- 1.1.1 The recommended standard for steep slope roofing is structural standing seam metal panel roofing with a Kynar finish and a 20-year weather tightness warranty and a 20-year finish warranty.
  - 1.1.1.1 The entire roof system including all roof panels, flashings, curbs, interior gutters, etc. shall be warranted by the Manufacturer against leaks for a period of 20 years.
  - 1.1.1.2 Durability of the roof panels due to rupture, structural failure or perforation shall be warranted for a period of 20 years by the Manufacturer.
  - 1.1.1.3 The exterior color finish for painted roof panels shall be warranted by the Manufacturer for 20 years against chalking, blistering, peeling, cracking, flaking, checking and chipping.
- 1.1.2 For maximum protection and extended warranty, metal roofing should be applied over a membrane (100% deck coverage). Basis of Design: WR Grace's "Ice and Water Shield" HT. 45 mil minimum.
- 1.1.3 Provide striations to prevent oil-canning. 24 gauge or heavier.
- 1.1.4 Curved elements to be avoided with metal roof. If used, panels must be tapered for max weather-tightness.
- 1.1.5 Double lock standing seam and/or "T" roof panel.
- 1.1.6 Manufacturer to provide full length panels to prevent head laps.

#### 1.2 Not Allowed:

- 1.2.1 Wood Roof Panels.
- 1.2.2 Plastic Roof Panels.
- 1.2.3 Composite Roof Panels.
- 1.2.4 Fabricated Roof Panels.

### 2.0 Metal Wall Panels

- 2.1.1 Finish Warranty: Twenty (20) years from date of Substantial Completion
- 2.1.2 R-Panel, U-Panel, S-Panel, mechanically seamed. Concealed fastened systems only.
- 2.1.3 Pre-insulated panels are acceptable with approval of FBISD Design Manager. Other profiles are acceptable, subject to FBISD Design Manager approval.
- 2.1.4 Do not rely on metal wall panels for thermal and moisture protection. Design as a rainscreen to shed water only with thermal and moisture layers covered by means indicated elsewhere in Division 07.
- 2.1.5 Provide closure treatment to prevent rodent and pest intrusion.
- 2.1.6 Metal panels are to be used as accents (no greater than 10% of exterior envelope) on exterior unless otherwise approved by the FBISD Design Manager.

### 3.0 Metal Composite Wall Panel Systems: Provide factory-formed and -assembled, metal modular material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, concealed fastened, panel stiffeners, and accessories required for weathertight system.

#### 3.1 Basis of Design Manufacturer / Design: Centria Architectural Systems. Other approved manufacturers:

- 3.1.1 Alucoil North America
- 3.1.2 Citadel Architectural Products, Inc.
- 3.1.3 Benchmark by Kingspan Insulated Panels



- 4.0 Aluminum Faced Modular Wall Panels: Smooth surface coil-coated sheet, ASTM B209, 3105-H14 Alloy.
  - 4.1 Basis of Design Manufacturer: Centria Architectural Systems. Other approved manufacturers:
    - 4.1.1 Alucoil North America.
    - 4.1.2 Citadel Architectural Products, Inc.
    - 4.1.3 Metl-Span
    - 4.1.4 MBCI Metal Roof & Wall Systems
- 5.0 Metal Wall Panel Warranty
  - 5.1 Finish Warranty: Twenty (20) years from date of Substantial Completion.
  - 5.2 Panel Finishes: Written warranty signed by manufacturer in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
    - 5.2.1 Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      - 5.2.1.1 Color fading more than 5 Hunter units when tested according to ASTM D2244.
      - 5.2.1.2 Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      - 5.2.1.3 Cracking, checking, peeling, or failure of paint to adhere to bare metal.

## **07 50 00 – Membrane Roofing**

- 1.0 General
  - 1.1 Coordinate with FBISD Design Manager on modifications and/or repairs to existing roofs that do not comply with standards below. Depending on cost and specifics of project, some roofs may be completely replaced to comply with new standards, and others repaired to match existing.
- 2.0 Warranty for all approved membrane roofs below:
  - 2.1 Provide for 20 year No Dollar Limit (NDL) Warranty on all new roof, no exceptions. Goal is to minimize maintenance by selecting roof types according to requirements below, designing and detailing roofs according to General Requirements in 07 00 00, with a warranty covering most problems typically encountered over the life of the roof.
  - 2.2 Further, it is the goal of FBISD ISD to select roof types that will not need replacement prior to maturity of bonds being sold to fund construction of them.
- 3.0 Thermoplastic (TPO and PVC) Hybrid Membrane Roofing:
  - 3.1 Approved manufacturers:
    - 3.1.1 Sarnafil (60 Mil PVC).
    - 3.1.2 Johns Manville (60 Mil PVC).
    - 3.1.3 Carlisle Syn-Tec (60 Mil PVC).
    - 3.1.4 GAF EverGuard (60 Mil PVC).
    - 3.1.5 Soprema (60 Mil PVC).
    - 3.1.6 Elevate by Holcim (80 Mil TPO).
  - 3.2 Utilize a heavy-duty base sheet with high performance modified bitumen base ply consisting of a reinforcing mat impregnated and coated with high quality modified bitumen and capped with a fleeceback thermoplastic membrane which is uniform and flexible.
  - 3.3 Bonding Adhesive: As recommended by thermoplastic sheet manufacturer's printed instructions to develop a bond between the membrane and the substrate to which the membrane is to be attached. Ultraply Bonding Adhesive or approved equal.
  - 3.4 Sealants: Membrane manufacturer's approved sealant shall be used to seal penetrations through the membrane system and at miscellaneous sealant applications that come in contact with roof systems components.

- 3.5 Liquid Applied Flashings: Two-component polymethyl methacrylate-based (PMMA) material by Roofing Manufacturer. Must be included within twenty (20) year NDL warranty.
- 3.6 Miscellaneous Accessories: Provide pourable sealants, performed cone and vent sheet flashings, pre-formed inside and outside corner sheet flashings, T-joint covers, termination reglets, and other accessories as recommended by roofing system manufacturer for intended use.
- 4.0 Thermoplastic (TPO and PVC) Single Ply Membrane Roofing:
- 4.1 Approved manufacturers:
- 4.1.1 Sarnafil (60 Mil PVC).
  - 4.1.2 Johns Manville (60 Mil PVC).
  - 4.1.3 Carlisle Syn-Tec (60 Mil PVC).
  - 4.1.4 GAF EverGuard (60 Mil PVC).
  - 4.1.5 Soprema (60 Mil PVC).
  - 4.1.6 Elevate by Holcim (80 Mil TPO)
- 4.2 Only used for overlay of existing low-sloped pre-engineered metal roofs and over existing modified bitumen roofs. Utilize fleeceback membrane for overlays over modified bitumen system.
- 4.3 Bonding Adhesive: As recommended by thermoplastic sheet manufacturer's printed instructions to develop a bond between the membrane and the substrate to which the membrane is to be attached. Ultraply Bonding Adhesive or approved equal.
- 4.4 Sealants: Membrane manufacturer's approved sealant shall be used to seal penetrations through the membrane system and at miscellaneous sealant applications that come in contact with roof systems components.
- 4.5 Liquid Applied Flashings: Two-component polymethyl methacrylate-based (PMMA) material by Roofing Manufacturer. Must be included within twenty (20) year NDL warranty.
- 4.6 Miscellaneous Accessories: Provide pourable sealants, performed cone and vent sheet flashings, pre-formed inside and outside corner sheet flashings, T-joint covers, termination reglets, and other accessories as recommended by roofing system manufacturer for intended use.
- 5.0 Modified Bitumen "Cool Roof" Roofing System
- 5.1 Warranty Period: 20-year manufacturer NDL (No Dollar Limit) warranty and 5-year installer workmanship warranty.
- 5.2 ASCE-7 Wind uplift requirements for geographical area.
- 5.3 Approved Manufacturers:
- 5.3.1 Siplast, Inc.
  - 5.3.2 Soprema.
  - 5.3.3 Johns Manville.
  - 5.3.4 Elevate by Holcim.
- 5.4 Modified Base Sheet: A fiberglass reinforced, Styrene-Butadiene-Styrene (SBS) modified asphalt coated sheet, having an average weight of 28 pounds per square.
- 5.5 Modified Bitumen Base Ply: A Approximately 120 mil high performance modified bitumen base ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality modified bitumen.
- 5.6 Modified Bitumen Finish Ply: Approximately 140 mil high performance modified bitumen "cool roof" reflective white finish ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality Styrene-Butadiene-Styrene (SBS) modified bitumen.
- 5.7 Contractor option for installation. System can be torched, use asphalt or cold process.

6.0 **None of the roofing types indicated below will be allowed** on FBISD Projects:

- 6.1 Elastomeric Membrane Roofing
- 6.2 Chlorinated-Polyethylene Roofing.
- 6.3 Chlorosulfonate-Polyethylene Roofing.
- 6.4 Ethylene-Propylene-Diene-Monomer Roofing.
- 6.5 Polyisobutylene Roofing.
- 6.6 Copolymer-Alloy Roofing.
- 6.7 Ethylene-Interpolymer Roofing.
- 6.8 Nitrile-Butadiene-Polymer Roofing.
- 6.9 Protected Membrane Roofing.
- 6.10 Built-Up Bituminous Protected Membrane Roofing.
- 6.11 Modified Bituminous Protected Membrane Roofing.
- 6.12 Elastomeric Protected Membrane Roofing.
- 6.13 Thermoplastic Protected Membrane Roofing.
- 6.14 Fluid-Applied Protected Membrane Roofing.
- 6.15 Vegetated Protected Membrane Roofing.
- 6.16 Fluid-Applied Roofing.
- 6.17 Coated Foamed Roofing (Sprayed Polyurethane Foam).
- 6.18 Roll Roofing.
- 6.19 Flashing and Sheet Metal.
- 6.20 Sheet Metal Roofing.

**07 60 00 – Flashing and Sheet Metal**

- 1.0 Warranty Period: The entire roof assembly shall be warrantied with a 20 year weather-tightness warranty as a complete system from the date of substantial completion.
- 2.0 Roof Related Sheet Metal
  - 2.1 Pre-finished metal or shop-broke metal allowed. Shop broke metal must provide ES-1 Accredited certification(s) and approved certified details with all fastening information at time of submittal.
  - 2.2 Manufacturer's standard 30-year Kynar 500 or Hylar 5000 FACTORY applied Finish. Wind Warranty up to 140 MPH Blow Off Resistance, 20 Year. 5-year contractor workmanship warranty. All warranties to begin from date of Substantial Completion.
  - 2.3 Metal types:
    - 2.3.1 Sheet metal to be 0.040" aluminum pre-coated (one flash through metal edge/fascia, gutters, & downspouts.)
    - 2.3.2 Sheet lead to be 4 pounds minimum (pipe stack penetration).
    - 2.3.3 Stainless steel to be minimum 24-gauge 302/304 soft temper No. 2D finish (Through-wall Trays, Counter-flashings, Expansion Joint covers, Splash Pans).
    - 2.3.4 Back-paint all concealed metal surfaces with bituminous paint where in contact with cementitious materials or dissimilar metals.
    - 2.3.5 All exposed sheet metal work shall have a premium, factory-applied/baked paint finish on .040" aluminum.
      - 2.3.5.1 Shop-fabricate all work to greatest extent possible. Touch up painting is only allowed for seams and is to be minimally used on-site to prevent rusting. All other color should be shop fabricated and powder coat.
- 3.0 Flexible Flashings
  - 3.1 Metal Flashings: Minimum ten (10') foot lengths
    - 1. Through wall Receiver Tray: Minimum 24-gauge stainless steel, through wall receivers shall not extend past the face of the exterior veneer more than ¾".
    - 2. Counterflashing: Minimum 24-gauge stainless steel.
  - 3.2 Flashing
    - 3.2.1 Copper Laminated Flashing at unsupported locations.

- 3.2.2 Flashing: A full sheet of copper weighing five (5) ounces per square foot coated or bonded on both sides with one (1) of the following:
  - 3.2.2.1 Modified asphalt compound coated.
  - 3.2.2.2 Asphalt saturated, waterproof glass fiber laminated fabric.
- 3.3 Approved Manufacturers
  - 3.3.1 Advanced Building Products, Inc.
  - 3.3.2 Hohmann & Barnard, Inc.
  - 3.3.3 Sandell Manufacturing Company, Inc.
  - 3.3.4 York Manufacturing, Inc.
- 3.4 Mastic: Manufacturer recommended asphalt troweled mastic for sealing copper laminated flashings.
- 3.5 Glass fabric scrim bonded to a full sheet of copper for general thru-wall flashing as an alternative to asphalt coated copper specified above and where sealant compatibility is required. Provide manufacturers approved seam tape.
- 3.6 Membrane Flashing
  - 3.6.1 Self-Adhered Flexible Flashing: 40-mil, rubberized asphalt adhesive reinforced flashing with a high-density cross laminated polyethylene film. Provide compatible substrate primer as instructed by manufacturer.
  - 3.6.2 Per air barrier manufacturer or Approved Products / Manufacturers:
    - 3.6.2.1 "Perm-A-Barrier" manufactured by W.R. Grace & Co.
    - 3.6.2.2 "Blueskin TWF" manufactured by Henry Co.
    - 3.6.2.3 "Bitu-Rap" manufactured by Nervastral, Inc.
    - 3.6.2.4 "Air-Shield" manufactured by W.R. Meadows, Inc.
- 3.7 Weathering Flange. Refer to Appendix.

## **07 70 00 – Roof and Wall Specialties and Accessories**

- 1.0 Manufactured Roof Expansion Joints
  - 1.1 Raised profile is preferred.
  - 1.2 RedLine by Situra - Low profile acceptable if raised wood expansion joint cannot be utilized.
  - 1.3 Locate away from major building entries and do not design to where water flows over expansion joint.
- 2.0 Roof Accessories
  - 2.1 Warranty Period: 1 Year warranty against becoming unserviceable.
- 3.0 Roof Curb
  - 3.1 Approved Manufacturers:
    - 3.1.1 Custom Curb, Inc.
    - 3.1.2 Roof Products, Inc.
- 4.0 Frames
  - 4.1 Material: ASTM A 653 G90 hot-dipped galvanized steel.
    - 4.1.1.1 Minimum 18 gauge, and as engineered by manufacturer.
    - 4.1.1.2 Minimum 18 gauge for curbs supporting HVAC units.
    - 4.1.1.3 Minimum 20 gauge for expansion joint curbs.
    - 4.1.1.4 Corners: Mitered and welded (welds are micro sealed and prime painted after fabrication). Bolted connections not accepted.
    - 4.1.1.5 Base Plates: Integral to frame and welded.



- 4.1.1.6 Internally reinforced with galvanized 1 inch by 1 inch by 12-gauge angles for curbs exceeding 3 foot length. Reinforce internal bulkhead at equipment curbs to support lateral loads.
- 4.1.1.7 Wood Nailers: Factory installed, pressure treated. Size and width as suitable for support of items installed on curbs.
- 4.1.1.8 Provide sealed engineering drawings for each curb type.

## 5.0 Portable Pipe Supports

### 5.1 Approved Manufacturers:

- 5.1.1 Miro
- 5.1.2 PHP
- 5.1.3 Mapa
- 5.1.4 Advance Support Products

5.2 Roller type support with polypropylene base with protective traffic pads at each support.

5.3 All piping to be minimum of 12" above the finish elevation of the roof and shall be located to not allow visibility from the ground.

## 6.0 Relief Vents

6.1 Required at large spaces such as gymnasiums (refer to HVAC) ridge vents.

6.2 If Maintenance Buildings are not air conditioned, relief vents may be required.

6.3 Provide minimum number but locate so that access to ALL PORTIONS OF ROOF are possible.

## 7.0 Roof Hatches

7.1 Fall Protection Safety Rail to be provided.

7.2 Hasp lock and door contact are required.

## 8.0 Smoke Vents

8.1 Ensure easily accessible from roof and from below, for maintenance, testing, and reset.

## 9.0 Wall Specialties

9.1 Refer to Division 8 – Openings and Diagram 08\_01 for information on Louvers and Vents.

## 07 80 00 – Fire and Smoke Protection

- 1.0 Applied Fireproofing
  - 1.1 General: Design facilities to avoid need for substantial fire proofing. Consider fire walls. Where fire proofing is provided, no primer is required on steel.
  - 1.2 Warranty Period: Two years from date of Substantial Completion.
  - 1.3 Approved Manufacturers:
    - 1.3.1 Isolatek International.
    - 1.3.2 Carboline Company; a subsidiary of RPM International.
    - 1.3.3 Grace Construction Products.
    - 1.3.4 Southwest Fireproofing Products Co.
- 2.0 Intumescent Fireproofing
  - 2.1 FBISD recognizes that architectural exposed steel is desired at times, however, minimal use of this as primary means of fire protection is preferred. FBISD Design Manager approval required.
  - 2.2 Approved Manufacturers
    - 3.2.1 Isolatek International, CAFCO SprayFilm WB 4 System.
    - 3.2.2 Albi Manufacturing; a division of StanChem, Inc.
    - 3.2.3 Carboline Company; a subsidiary of RPM International.
- 3.0 Cementitious fireproofing can be used when applicable.
- 4.0 Firestopping and Fire Safing
  - 4.1 Approved Manufacturers:
    - 4.1.1 Hilti, Inc.
    - 4.1.2 Nelson Firestop Products.
    - 4.1.3 RectorSeal Corporation (The).
    - 4.1.4 Specified Technologies, Inc.
    - 4.1.5 3M; Fire Protection Products Division.
    - 4.1.6 USG Corporation.
    - 4.1.7 Tremco Commercial Sealants and Waterproofing.

## 07 90 00 – Joint Protection

- 1.0 General
  - 1.1 Movement of dissimilar materials is expected and design of building to control movement is also expected. Consider long term maintenance when selecting materials to fill control and expansion joints.
  - 1.2 5 year warranty, minimum, is expected on all joint protection.
  - 1.3 For exterior use, select materials appropriate for that application, including ones that are resistant to pests (non-organic, non-cellulose).
- 2.0 Compression Seals
  - 2.1 Utilized at horizontal concrete planks or similar. Use on joints over  $\frac{3}{4}$ ".
- 3.0 Joint Sealants
  - 3.1 Silicone Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
    - 3.1.1 Use: Precast Concrete Joints between metals, glass and plastics (Single component sealants).
    - 3.1.2 Utilize double backer rod and sealant.
    - 3.1.3 Properties: Performance: Nonstain, nonbleed, nonstreaking to sealed and adjacent substrates.
    - 3.1.4 Approved Manufacturers:
      - 3.1.4.1 BASF Building Systems.
      - 3.1.4.2 Dow Corning Corporation.

- 3.1.4.3 GE Advanced Materials.
    - 3.1.4.4 Sika Corporation, Construction Products Division; SikaSil-C995.
  - 3.2 Polyurethane Sealants: ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O.
    - 3.2.1 Use: Typical Wall and Floor Joints (Two part polyurethane sealants).
    - 3.2.2 Properties: Performance: Nonstain, nonbleed, nonstreaking to sealed and adjacent substrates.
    - 3.2.3 Approved Manufacturers:
      - 3.2.3.1 BASF Building Systems; MasterSeal NP 2.
      - 3.2.3.2 Pecora Corporation.
      - 3.2.3.3 Sika Corporation.
- 4.0 Allow for several colors if needed to match different exterior materials.
- 5.0 Expansion Control
  - 5.1 At interior joints, aluminum expansion cover.
  - 5.2 At roof expansion joints, 24 gauge stainless steel to be used.
- 6.0 Expansion Joint Cover Assemblies
  - 6.1 Minimize by considering layout during design.
  - 6.2 Avoid awkward alignments where specialty joints are required and multiple covers are needed.
  - 6.3 Locate within wall chases when possible, only cross corridors, not aligned with them.
  - 6.4 Not required in acoustic ceilings.
  - 6.5 All aluminum, design basis. No vinyl component.
  - 6.6 Floor type expansion joint covers shall be flat plate.

#### **END OF DIVISION 07**

## Division 08

# Openings

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### DIVISION 08 - OPENINGS

#### 08 00 00 - General Requirements for Openings

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3 Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations.
      - 1.3.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials.
      - 1.3.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients.
      - 1.3.2.4 EQc1: Enhanced Indoor Air Quality Strategies.
      - 1.3.2.5 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials.
      - 1.3.2.6 EQc7: Daylight.





- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.
- 3.0 Requirements
  - 3.1 Window Security Screens: Design to provide separation between window system and security screen to prevent moisture or water from trapping between systems.
  - 3.2 Allowances are not used, items to be specified.
  - 3.3 Keying to be coordinated with FBISD Project Manager. Architect to schedule a keying meeting prior to Door Hardware approval submittal.

#### **08 01 00 - Maintenance for Openings**

- 1.0 Refer to Sub-Divisions.

#### **08 05 00 – Common Work Results for Openings**

- 1.0 Refer to Sub-Divisions.

#### **08 06 00 - Schedules for Openings**

- 1.0 Door Schedule within drawings should include space for:
  - 1.1 Keying (left blank, to be added by FBISD during construction).
  - 1.2 Hardware Set Number (added by A/E).
  - 1.3 Proposed Owner Room Number (for fabrication of room signage).

#### **08 10 00 - Doors and Frames**

- 1.0 Metal Doors and Frames
  - 1.1 Provide plastic laminate doors at all interior locations except for hollow metal (HM) doors (painted) at all mechanical rooms, interior and exterior.
  - 1.2 Provide sound seals at all interior mechanical rooms, Refer to 08 70 00. Touch up paint on all doors (including top and undercut) after fitting.
  - 1.3 At Black Box, provide laminate on corridor-side door face to match other doors. Install black plastic laminate on Black Box side (matte).
  - 1.4 Provide larger doors at the following locations:
    - 1.4.1 Interior Mechanical Rooms, provide (2) 4'-0" x 7'-0" doors with a removable mullion.
    - 1.4.2 Exterior Mechanical Rooms, provide (2) 4'-0" x 7'-0" doors with a removable mullion. Provide air-tight seals.
    - 1.4.3 At commercial laundry in field house, and at band, orchestra and choir (exterior and interior) rooms, provide 4'-0" x 7'-0" door.
    - 1.4.4 At A/V storage room off library and at chair storage off commons, provide 3'-6" x 7'-0" door.
    - 1.4.5 Behind stage and at drama access points, provide larger and wider doors. Consult with FBISD Design Manager.
    - 1.4.6 At stairs, the door can be 3'-0" x 7'-0"; at ramp, the door should be a 4'-0" x 7'-0".
    - 1.4.7 At band, orchestra, and dance equipment storage, provide 4'-0" x 7'-0" doors to accommodate movement of large pieces of equipment.
  - 1.5 Coordinate location of door lites and view panels with FBISD Educational Specifications and FBISD Design Manager. Ensure coordinated with hardware installation (allow adequate room for installation).
  - 1.6 Metal stops at door lites to match hollow metal frame color.
  - 1.7 Doors intended to receive RhinoWare door barricade hardware shall have a minimum 10" bottom rail to receive the hardware.
  - 1.8 Approved Manufacturers:

- 1.8.1 Ceco Door Products.
  - 1.8.2 Curries Company; an Assa Abloy Company.
  - 1.8.3 Door Pro Systems.
  - 1.8.4 Steelcraft; a division of Allegion.
  - 1.8.5 Pearland Industries
  - 1.8.6 Masonite Architectural
- 2.0 Hollow Metal Doors and Frames
- 2.1 Frames shall be custom made, fully welded seamless units with integral trim.
  - 2.2 Frame throat to be fabricated to wrap all interior wall construction thicknesses. At masonry wall openings, fabricate frames to suit masonry opening with 2 inch head member.
  - 2.3 Hot dip zinc coated frames at exterior and wet areas per ASTM A653.
  - 2.4 All Frames to be the following:
    - 2.4.1 Interior Openings:
      - 2.4.1.1 Less than 4 feet-0 inches in Width: 16-gauge.
      - 2.4.1.2 Greater than 4 feet-0 inches in Width: 14-gauge.
    - 2.4.2 Exterior Openings: 14-gauge.
  - 2.5 Doors to be flush panel 1-3/4".
  - 2.6 Knockdown (KD) frames are not permitted.
  - 2.7 Mullions shall be key locked removable type.
  - 2.8 Detail all hollow metal windows to accept a blind that is mounted inside the frame. Coordinate with Division 12 – Furnishings.
  - 2.9 Approved Manufacturers:
    - 2.9.1 Ceco Door Products.
    - 2.9.2 Curries Company; an Assa Abloy Company.
    - 2.9.3 Door Pro Systems.
    - 2.9.4 Steelcraft; a division of Allegion.
    - 2.9.5 Pearland Industries
- 3.0 Aluminum Doors and Frames
- 3.1 Consider for use in lieu of steel in CMU walls where prolonged exposure to weather during construction is likely. Confirm with FBISD Design Manager.
  - 3.2 Approved Manufacturers:
    - 3.2.1 Ceco Door Products.
    - 3.2.2 Curries Company; an Assa Abloy Company.
    - 3.2.3 Door Pro Systems.
    - 3.2.4 Steelcraft; a division of Allegion.
    - 3.2.5 Pearland Industries
- 4.0 Stainless Steel Doors and Frames
- 4.1 Natatorium use only, including all spaces serving this area (chemical storage, general storage, mechanical, electrical).
  - 4.2 Approved Manufacturers:
    - 4.2.1 Ceco Door Products.
    - 4.2.2 Curries Company; an Assa Abloy Company.
    - 4.2.3 Door Pro Systems.
    - 4.2.4 Steelcraft; a division of Allegion.
    - 4.2.5 Pearland Industries
- 5.0 Do not use the following:
- 5.1 Bronze Doors and Frames.
  - 5.2 Metal Screen and Storm Doors and Frames.
  - 5.3 Metal Screen Doors and Frames.
  - 5.4 Metal Storm Doors and Frames.
  - 5.5 Sliding Metal Fire Doors.
  - 5.6 Sliding Metal Grilles.

- 6.0 Metal Frames
  - 6.1 No knock down door frames in new construction, allowable in renovations only, with approval of FBISD Design Manager.
  - 6.2 When installing new frames in existing walls, be sure to properly brace frame to prevent movement.
  - 6.3 Refer to 08 71 00 – Door Hardware for additional information, including Hardware requirements and coordination.
- 7.0 Hollow Metal Frames
  - 7.1 Hot Dip Galvanized at exterior. Provide full depth stop at center of frames to receive removable mullions, so that top of mullion seats flush with frame.
- 8.0 Interior Aluminum Frames
  - 8.1 No curtain walls or storefront to the ground. Base detail must allow for thru-wall flashing.
  - 8.2 Detail all exterior curtain wall and storefront to accept a blind that is mounted inside the frame.
  - 8.3 Wide stile (minimum 10" top and bottom with 5" side) door to allow for compliance and coordination to conceal door hardware. Full glass doors to have intermediate mullion at panic hardware.
- 9.0 Stainless Steel Frames
  - 9.1 See above for information related to Natatoriums/Pools.
- 10.0 Do not use the following
  - 10.1 Bronze Frames.
  - 10.2 Wood Doors.
  - 10.3 Carved Wood Doors.
- 11.0 Flush Wood Doors
  - 11.1 PLAM Clad Only, NO WOOD VENEER DOORS.
  - 11.2 Hardwood, Painted edges (NO PLAM). Hardwood Edges will allow for adjustments without damage to laminate.
  - 11.3 No Attic Stock of Laminate required.
  - 11.4 Do not install doors and other finish materials until spaces are dried-in and conditioned.
  - 11.5 Clad Wood Doors (Metal-Faced, PLAM-Faced, Molded-Hardwood-Faced).
  - 11.6 Approved Manufacturers:
    - 11.6.1 Door Pro Systems.
    - 11.6.2 Marshfield Doors Systems.
    - 11.6.3 Oshkosh Architectural Door Company.
    - 11.6.4 VT Industries.
- 12.0 Plastic Laminate Faced Wood Doors
  - 12.1 Vertical door edges shall be plastic laminate to match door. Top and bottom to be painted or stained accordingly to match plastic laminate.
  - 12.2 Glass in plastic laminate doors should not interfere with door hardware. All door hardware should be concealed by the door or rail.
  - 12.3 Accessories – Provide a peep site in exterior kitchen delivery doors.
  - 12.4 Approved Manufacturers:
    - 12.4.1 Door Pro Systems.
    - 12.4.2 Marshfield Doors Systems.
    - 12.4.3 Oshkosh Architectural Door Company.
    - 12.4.4 VT Industries.
- 13.0 Prefinished Wood Doors – THE FOLLOWING IS NOT ALLOWED:
  - 13.1 Stile and Wood Rail Doors.
  - 13.2 Wood Screen Doors.
  - 13.3 Sliding Wood Doors.
  - 13.4 Bi-folding Wood Doors.

- 13.5 Plastic Doors.
- 13.6 Composite Doors.
- 13.7 Integrated Door Opening Assemblies.

## 08 30 00 – Specialty Doors and Frames

- 1.0 Access Doors and Panels
  - 1.1 Note that major equipment and valves will not be installed in areas where access panel would have to be installed to maintain. If unavoidable, install access panels of appropriate size and location, include on reflected ceiling plans.
  - 1.2 If coiling doors installed in bulkheads, provide access panel to motor, or size and location appropriate to ENSURE maintenance and motor replacement access (including access to reset/test).
  - 1.3 Approved Manufacturers:
    - 1.3.1 Acudor Products, Inc.
    - 1.3.2 The Bilco Company.
    - 1.3.3 J.L. Industries, Incorporated.
    - 1.3.4 Nystrom Building Products, Inc.
- 2.0 Sliding Glass Doors
  - 2.1 Only use is display cabinets.
- 3.0 Coiling Doors and Grilles
  - 3.1 Interior coiling doors at reception counter, weight rooms, corridors, and attendance office to be clear anodized aluminum solid slat type. Electric operation. Coordinate keying with FBISD Project Manager and refer to 08 70 00.
  - 3.2 Interior lock-down gates to be clear anodized aluminum ladder type door for security (view through gate). Keyed switch, interlocked to fire alarm. Coordinate keying with FBISD Project Manager and refer to 08 70 00. Gates should fail open. Electric operation.
    - 3.2.1 If electric gates are in egress corridor, disable or remove throw bolts and cylinder locks.
    - 3.2.2 Coordinate with FBISD Life Safety if electric gates are desired in corridors for security purposes in new construction.
  - 3.3 All exterior coiling doors to be electric operation if over 5'-0" in height or over 6'- 0" in width. All interior doors to be manually assisted operation unless of large size as noted above. Review use with FBISD Design Manager.
  - 3.4 Interior coiling doors to be provided between Serving Area and Dining Room:
    - 3.4.1 Electrical operator with emergency egress.
    - 3.4.2 Keyed Controls for gate to be located where actual gate is visible.
  - 3.5 Approved Manufacturers:
    - 3.5.1 Clopay Building Products.
    - 3.5.2 Cookson Company.
    - 3.5.3 Overhead Door Company.
    - 3.5.4 McKeon Door Company, Inc.
- 4.0 Overhead Coiling Doors
  - 4.1 Provide key operators keyed to Owner's master key system on both sides of door. Coordinate keying with FBISD Project Manager and refer to 08 70 00.
  - 4.2 Provide door contacts, tied to security system.
  - 4.3 Approved Manufacturers:
    - 4.3.1 Clopay Building Products.
    - 4.3.2 Cookson Company.
    - 4.3.3 Overhead Door Company.
    - 4.3.4 McKeon Door Company, Inc.
- 5.0 Coiling Counter Doors
  - 5.1 Manual Operated (push-up) Coiling Counter Door:

- 5.1.1 The door curtain shall be constructed of interconnected 0.050 extruded aluminum No. 8 (1-5/16 inch high by 3/8 inch deep) slats. The curtain shall receive a 204-R1 clear anodized finish.
  - 5.1.2 Brackets: 1/8-inch thick steel plate.
  - 5.1.3 Locking Mechanisms: The push-up doors shall be secured by means of a concealed sliding bolt deadlock in the bottom bar operated by a cylinder lock. Locate one (1) at each jamb, to be operated from inside the door.
    - 5.1.3.1 Provide key operators keyed to Owner's master key system on both sides of door. Coordinate keying with FBISD Project Manager and refer to 08 70 00.
  - 5.1.4 All counter doors to have coil above ceiling height and door extended as required – this removes the need for a hood and unsightly motors exposed and visible.
- 5.2 Approved Manufacturers:
  - 5.2.1 Clopay Building Products.
  - 5.2.2 Cookson Company.
  - 5.2.3 Overhead Door Company.
  - 5.2.4 McKeon Door Company, Inc.
- 6.0 Fire Rated Overhead Rolling Doors
  - 6.1 Provide ceiling access adjacent to motor.
  - 6.2 Locking mechanisms to be located on both sides of the door. Coordinate keying with FBISD Project Manager and refer to 08 70 00.
- 7.0 Automatic Closing Device for Fire-Rated Doors: Equip each fire rated door with an automatic closing device or holder release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism.
- 8.0 Chain Operated Insulated Rolling Service Doors
  - 8.1 Finish on door curtain shall consist of the following:
    - 8.1.1 Factory applied Thermosetting Powder Coating applied with a minimum thickness of (2) mils. The color shall be selected by the Architect and shall be chosen from manufacturer's standard color chart.
  - 8.2 Provide key operators keyed to Owner's master key system on both sides of door. Coordinate keying with FBISD Project Manager and refer to 08 70 00.
  - 8.3 Weatherseals for Exterior Doors: Equip each exterior door with weather stripping gaskets fitted to entire exterior perimeter of door for weather resistant installation unless otherwise indicated.
    - 8.3.1 At door head, use 1/8 inch (3 mm) thick, replaceable, continuous sheet baffle secured to inside of hood or field installed on the header.
    - 8.3.2 At door jambs, use replaceable, adjustable, continuous, flexible, 1/8 inch (3 mm) thick seals of flexible vinyl, rubber, or neoprene.
  - 8.4 Provide cylinder for each side of door operator.
  - 8.5 Provide door contacts, tied to security system if exterior.
- 9.0 Motor Operated Fire Rated Rolling Doors
  - 9.1 Provide key operators keyed to Owner's master key system on both sides of door. Coordinate keying with FBISD Project Manager and refer to 08 70 00.
  - 9.2 Finish: Factory.
  - 9.3 Weatherseals for Exterior Doors: Equip each exterior door with weather stripping gaskets fitted to entire exterior perimeter of door for weather resistant installation unless otherwise indicated.
    - 9.3.1 At door head, use 1/8 inch (3 mm) thick, replaceable, continuous sheet baffle secured to inside of hood or field installed on the header.
    - 9.3.2 At door jambs, use replaceable, adjustable, continuous, flexible, 1/8 inch (3 mm) thick seals of flexible vinyl, rubber, or neoprene.
  - 9.4 Provide cylinder for each side of door operator.
  - 9.5 Provide door contacts, tied to security system if exterior.
- 10.0 Overhead Coiling Grilles
  - 10.1 Provide key operators keyed to Owner's master key system on both sides of door. Coordinate keying with FBISD Project Manager and refer to 08 70 00.
  - 10.2 Provide ceiling access adjacent to motor.

- 10.3 Locking mechanisms to be located on both sides of the door.
- 10.4 Should be specified with cordless safety edge.
- 10.5 Automatic Opening feature activated by central smoke / fire alarm system or power failure.
- 11.0 Special Function Doors
  - 11.1 Sound Control Doors – Music areas if required. Coordinate with FBISD Design Manager. Acoustic hollow metal type.
- 12.0 Sound Control Door Assemblies
  - 12.1 Located at all band, choir, orchestra, performing arts centers and ensemble and practice rooms.
  - 12.2 Manufacturers listed below who produce equivalent products to those specified are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.
    - 12.2.1 Acoustic Systems.
    - 12.2.2 Krieger Steel Products.
    - 12.2.3 Overly Door Company.
    - 12.2.4 Protective Door Industries ("Sonicbar").
    - 12.2.5 Wenger Corporation.
- 13.0 Folding Doors and Grilles
  - 13.1 See Division 10 for Operable Partitions and Accordion folding partitions.

#### **08 40 00 – Entrances, Storefronts, and Curtain Walls**

- 1.0 Entrances and Storefronts
  - 1.1 Steel stabilizer bar (painted to match aluminum) required in center astragal of double aluminum storefront door systems to fortify lock area. Coordinate with hardware specification.
  - 1.2 Storefront system must be thermally broken.
  - 1.3 No custom colors; clear and anodized frames preferred. Architect to check local requirements and coordinate with FBISD Design Manager if AHJ requires (or suggests) non- standard colors.
  - 1.4 Stiles to be wide enough to accommodate hardware; do not use narrow stile profiles. Use metal frames.
  - 1.5 Ensure thickness of door is sufficient to accept current district standard cylinders. Coordinate with hardware specification.
  - 1.6 Important to coordinate all hardware with supplier and hardware specifier (i.e. closer, electric transfers, control systems, lock etc.)
  - 1.7 Provide current district standard cylinder dog-down on all panic hardware, including where electric access is provided on the door. Confirm locations with FBISD Design Manager.
  - 1.8 Provide full width stop at center of frames to receive removable mullions. Top of mullion should seat flush with frame.
- 2.0 Aluminum Framed Entrance and Storefront
  - 2.1 Basis of Design Manufacturer and Product:
    - 2.1.1 Interior Applications: Kawneer Trifab VG 451
    - 2.1.2 Exterior Applications: Kawneer Trifab VG 451T
    - 2.1.3 Exterior Impact Resistant Applications: Kawneer IR501T
  - 2.2 Approved Manufacturers:
    - 2.2.1 EFCO Corporation.
    - 2.2.2 Oldcastle Building Envelope.
    - 2.2.3 Tubelite, Inc.
    - 2.2.4 Vistawall International.
    - 2.2.5 YKK AP America
  - 2.3 Top and bottom stile to be 10", side stiles to be 5" to conceal all closer and panic hardware (Wide stile).
  - 2.4 Flush bottom rail required in order to meet accessibility standards.
  - 2.5 Aluminum Sun Shade
    - 2.5.1 Aluminum: Extruded aluminum shall be 6063-T5



- 2.6.2 Description: aluminum sunshade consisting of outriggers, louvers, and fascia that is anchored directly to the vertical curtain wall mullions.
- 2.6.3 Basis of Design Product/Manufacturer: 1600 SunShade by Kawneer; ThermaShade by YKK AP America Inc.; or Architect approved equal.
- 2.7 Warranty Requirements
  - 2.7.1 Written warranty signed by Manufacturer, Contractor, and Installer in which manufacturer agrees to repair or replace components of aluminum framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 2.7.2 Failures include, but are not limited to, the following:
    - 2.7.2.1 Structural failures including, but not limited to, excessive deflection.
    - 2.7.2.2 Noise or vibration caused by thermal movements.
    - 2.7.2.3 Water leakage through fixed glazing and framing areas.
    - 2.7.2.4 Failure of operating components.
    - 2.7.2.5 Warranty Period: Two (2) years from date of Substantial Completion.
  - 2.7.3 Finish Warranty: Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
    - 2.7.3.1 Warranty Period: Ten (10) years from date of Substantial Completion.
- 3.0 Entrances:
  - 3.1 Entrance Doors: Glazed entrance doors for manual swing operation.
    - 3.1.1 Door Construction: 1-3/4 inch (44.5 mm) overall thickness, with minimum 0.125 inch (3.2 mm) thick, extruded aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
    - 3.1.2 Door Design: Nominal width of 6 inch (152.4 mm) vertical stiles and 6-1/2 inch (165.1 mm) bottom rail.
    - 3.1.3 Verify wide stile doors since medium stile doors are not large enough to support a closer and drop plates are needed.
    - 3.1.4 At pairs of exterior doors, provide compression type weather stripping retained in adjustable strip and mortised into door edge.
    - 3.1.5 At exterior doors, provide weather sweeps applied to door bottoms.
- 4.0 Curtain Wall and Glazed Assemblies
  - 4.1 It is recommended that Curtain Wall construction be avoided. Approval required by FBISD Design Manager.
  - 4.2 Designer to consider limits of traditional storefront while sizing exterior fenestration, including requirement to limit all glazing sizes to less than 4'-0" X 8'-0" as noted elsewhere in these standards.
  - 4.3 Provide sill extension in lieu of sill pan at all curtain wall systems.
    - 4.3.1 Basis of Design Manufacturer and Product: Kawneer 1600 Wall System™1
  - 4.4 Approved Manufacturers:
    - 4.4.1 EFCO Corporation.
    - 4.4.2 Oldcastle Building Envelope.
    - 4.4.3 Tubelite, Inc.
    - 4.4.4 Vistawall International.
    - 4.4.5 YKK AP America
  - 4.5 Warranty Requirements
    - 4.5.1 Assembly Warranty: Written warranty signed by manufacturer, Contractor, and Installer in which the manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
    - 4.5.2 Failures include, but are not limited to, the following:
      - 4.5.2.1 Failure to meet performance requirements.
      - 4.5.2.2 Structural failures including, but not limited to, excessive deflection
      - 4.5.2.3 Glass breakage due to defective design.
      - 4.5.2.4 Noise or vibration created by wind and thermal and structural movements.
      - 4.5.2.5 Deterioration of metals, metal finishes, and materials beyond normal weathering.

- 4.5.2.6 Water penetration through fixed glazing and framing areas.
- 4.5.2.7 Deterioration of materials and finishes beyond normal weathering.
- 4.5.2.8 Failure of insulating glass.
- 4.5.2.9 Noise or vibration created by wind and thermal and structural movements.
- 4.5.2.10 Failure of operating components.
- 4.5.3 Warranty Period: Ten (10) years from date of Substantial Completion.

## 5.0 Translucent Wall and Roof Assemblies

- 5.1 Clerestory windows preferred over roof assemblies
- 5.2 Refer to 08 60 00 for more information.
- 5.3 FBISD Design Manager approval required due to concern for life expectancy and water tightness.
- 5.4 Approved manufacturers:
  - 5.4.1 CPI International.
  - 5.4.2 Kalwall Corporation & Structures Unlimited.
  - 5.4.3 Major Industries.
  - 5.4.4 Skywall Translucent Systems.
- 5.5 Warranty Requirements
  - 5.5.1 Manufacturer's standard warranty of ten (10) years for product.
  - 5.5.2 Manufacturer's standard warranty for five (5) years for electrical parts.

## 08 50 00 - Windows

### 1.0 General

- 1.1 Inside mullions (those within the frame perimeter) are to be recessed from perimeter frame to accommodate the installation of inside mounted blinds. Inset to be approximately 1 ½" to accommodate blind.
- 1.2 Place glass stop to corridor side.
- 1.3 Do not place windows down to slab level due to problems with water infiltration, including at areas with large overhang where the windows are more protected. Provide minimum 4" curb.
- 1.4 Use wired glass only where necessary by codes, etc.
- 1.5 Architect to detail sill flashing ensuring that watertight end dams are provided. End dams should be welded or sealed with curtain wall sealant at vertical corner of end dam joint.
- 1.6 Indicate windows to receive window coverings in drawings (window elevations or schedules), no general "catch-all" notes.
- 1.7 Confirm with the FBISD Design Manager if the 3M or equal glass window film product will be required on glazing to enhance and increase the structural integrity of the glass unit.
- 1.8 Keep windows a minimum 12" from top of roof edge to allow for flashing. Windows to be a minimum 16" above roof at sill condition.
- 1.9 Refer to Diagram 07\_06 for more information.

### 2.0 Metal Windows:


- 2.1 Approved Manufacturers:
  - 2.1.1 Arcadia, Inc.
  - 2.1.2 EFCO Corporation.
  - 2.1.3 Kawneer North America; an Alcoa company
  - 2.1.4 Peerless Products, Inc
  - 2.1.5 Wausau Window and Wall Systems; Apogee Wausau Group.

### 3.0 The Following is not to be used:

- 3.1 Wood Windows.
- 3.2 Plastic Windows.
- 3.3 Composite Windows.
- 3.4 Pressure-Resistant Windows.
- 3.5 Special Function Windows.



## 08 60 00 - Roof Windows and Skylights

- 1.0  Tubular day-lighting devices or solartubes are recommended for getting light to interior spaces, without direct access to exterior.
- 2.0 Use of roof windows, plastic framed skylights, and unit skylights – whether domed, pyramidal, or vaulted is prohibited in new structures. For existing conditions, obtain approval for metal framed skylights from FBISD Design Manager.
- 3.0 Skylight Protection and Screens (provide at Tubular Devices) per OSHA 29 CFR 1910.23(a)(4). Provide wire guards on all devices.
- 4.0 Impact Resistant Skylights:
  - 4.1 Translucent Fiberglass Sandwich Panel Skylights with high impact exterior face sheets to meet or exceed 200 lb impact per UL 972. Tested and certified in accordance with ASTM E 1886 and ASTM E 1996, Rated for Wind Zone 3, Missile Level C, Cycle Pressure +50 / -50.
  - 4.2 Approved Manufacturers:
    - 4.2.1 Kalwall Corporation & Structures Unlimited
    - 4.2.2 CPI International
    - 4.2.3 Major Industries
    - 4.2.4 Skywall Translucent Systems
  - 4.3 Warranty Requirements
    - 4.3.1 Manufacturer's standard warranty of ten (10) years.

## 08 70 00 – Hardware

- 1.0 General
  - 1.1 Note: drawings typically depict doors at 90 degrees doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
  - 1.2 Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.
  - 1.3 Adjust hardware for smooth operation.
  - 1.4 Use templates and fasteners provided by hardware item manufacturer.
  - 1.5 Use sex bolts to attach panic devices to wood doors and all closers.
  - 1.6 Hardware installer shall be an entity that specializes in hardware installation and must have a minimum of ten years' experience and provide five reference jobs of similar scope. Submit references with hardware submittals/shop drawings.
  - 1.7 Hardware installer must be certified by manufacturer for installation of that product (no installation by general contractor laborer(s) is allowed without this certification, regardless of experience).
  - 1.8 Hardware installer is required to send all personnel that will install on this job shall attend a pre-installation meeting with the manufacturer's representative to review the install instructions
  - 1.9 Contractor will install permanent cores and turn all keys over to the district.
  - 1.10 Architect required to have a keying conference prior to approval of door hardware submittal.
  - 1.11 Knox Box: Refer to Division 10.
- 2.0 Summary
  - 2.1 Hardware for hollow steel and plastic laminate doors.
  - 2.2 Thresholds.
  - 2.3 Weather-stripping, seals and door gaskets.
- 3.0 Related Sections
  - 3.1 Section 08 11 00 – Metal Doors and Frames.
  - 3.2 Section 08 14 00 – Wood Doors.
  - 3.3 Section 08 33 00 – Coiling Doors and Grilles.
  - 3.4 Section 08 34 00 – Special Function Doors.
  - 3.5 Section 08 40 00 – Entrances, Storefronts, and Curtain Walls.

- 4.0 References
  - 4.1 ADA – Americans with Disabilities Act, Accessibility Guidelines.
  - 4.2 ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
  - 4.3 NFPA 80 – Fire Doors and Windows.
  - 4.4 AWI – Architectural Woodwork Institute – Quality Standards.
  - 4.5 NFPA 101 – Code for Safety to Life from Fire in Buildings and Structures.
  - 4.6 NFPA 252 – Fire Tests of Door Assemblies.
  - 4.7 TAS – Texas Accessibility Standards.
  - 4.8 UL 10B – Fire Tests of Door Assemblies.
  - 4.9 UL 305 – Panic Hardware
  - 4.10 UL 1784 – Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives.
- 5.0 Submittals
  - 5.1 Submit under provisions of Section 01 33 00.
  - 5.2 Shop Drawings: Indicate locations and mounting heights of each type of hardware.
  - 5.3 Submit manufacturer's parts lists and templates.
  - 5.4 Manufacturers Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
  - 5.5 All templates will be included with submittal documents to be turned over to door supplier.
  - 5.6 All Finish Hardware to be reviewed with FBISD Facilities prior to approval and return to contractor. Coordinate with FBISD Project Manager.
- 6.0 Project Record Documents
  - 6.1 Submit under provisions of Section 01 70 00.
  - 6.2 Record actual locations of installed cylinders and their master key code.
- 7.0 Operation and Maintenance Data
  - 7.1 Submit under provisions of Section 01 70 00.  
Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- 8.0 Quality Assurance
  - 8.1 Perform work in accordance with the following requirements:
    - 8.1.1 ADA.
    - 8.1.2 ANSI A117.1.
    - 8.1.3 NFPA 101.
    - 8.1.4 NFPA 80.
    - 8.1.5 NFPA 252.
    - 8.1.6 TAS.
- 9.0 Qualifications
  - 9.1 Hardware Supplier Company specializing in supplying commercial door hardware with five years documented experience.
  - 9.2 Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.
- 10.0 Regulatory Requirements
  - 10.1 Conform to applicable code for requirements applicable to fire rated doors and frames.
  - 10.2 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.
- 11.0 Delivery, Storage, and Handling
  - 11.1 Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
  - 11.2 Package hardware items individually; label and identify each package with door opening code to match hardware schedule.
  - 11.3 Deliver keys to Owner by security shipment direct from hardware supplier.
- 12.0 Coordination



- 12.1 Coordinate work under provisions of Section 01 03 90.
- 12.2 Coordinate the work with other directly affected sections involving manufacturer or fabrication of internal reinforcement for door hardware.
- 13.0 Warranty
  - 13.1 Provide five year warranty under provisions of Section 01 70 00.
  - 13.2 Warranty: Include coverage for door closers.
- 14.0 Maintenance Materials
  - 14.1 Provide maintenance materials under provisions of Section 01 70 00.
  - 14.2 Provide special wrenches and tools applicable to each different or special hardware component.
  - 14.3 Provide maintenance tools and accessories supplied by hardware component manufacturer.
- 15.0 Hinging Methods
  - 15.1 Conventional Hinges: Steel or stainless steel pins and concealed bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.
    - 15.1.1 Three hinges per leaf to 7 foot, 6 inch height. Add one for each additional 30 inches in height, or any fraction thereof.
    - 15.1.2 Extra heavy weight hinges on doors over 3 feet, 5 inches in width.
    - 15.1.3 Extra-heavy weight hinges on doors with panic hardware or fire exit devices.
    - 15.1.4 Outswinging exterior doors: non-ferrous with non-removable (NRP) pins
    - 15.1.5 Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
    - 15.1.6 Provide shims and shimming instructions for proper door adjustment.
    - 15.1.7 All hinges to be ball bearing type on high use or doors with closers. Plain Bearing hinges are acceptable for any door that is not high traffic without a closer.
    - 15.1.8 Acceptable Manufacturers: Ives, PBB, Hager.
  - 15.2 Continuous Hinges
    - 15.2.1 Pin and barrel stainless steel at all entry and high traffic doors.
    - 15.2.2 Geared-type aluminum at all interior high traffic doors.
    - 15.2.3 Heavy-duty, extra-bearing units for doors over 3 foot, 5 inches in width.
    - 15.2.4 Heavy-duty, extra-bearing units for doors with panic hardware or fire exit devices.
    - 15.2.5 Use wide-throw units where needed for maximum degree of swing, advise architect if commonly available hinges are insufficient.
    - 15.2.6 Acceptable Manufacturers: Ives, Markar, Pemko.
- 16.0 Locksets, Latchsets, Deadbolts
  - 16.1 Extra Heavy Duty Mortise Locks and Latches
    - 16.1.1 Chassis: cold-rolled steel. All functions must be available in one body. Case must be multi-function, minimum 10 functions in one case, able to be opened and worked on without voiding the warranty. Functions will be changed by changing the cam on the back of the cylinder. Latch must be all steel. Pot metal on the latch will not be accepted.
    - 16.1.2 Latchbolts: 3/4 inch throw, 2 piece stainless steel anti-friction type.
    - 16.1.3 Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
      - 16.1.3.1 Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
      - 16.1.3.2 Install handles where screws are accessible from secure side of door.
    - 16.1.4 Thumbturns: accessible design not requiring pinching or twisting motions to operate.
    - 16.1.5 Deadbolts: stainless steel 1-inch throw.
    - 16.1.6 Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
      - 16.1.6.1 ANSI A156.13, 2017 Grade 1 Operational, Grade 1 Security.
      - 16.1.6.2 ANSI/ASTM F476-84 Grade 31 UL Listed.
  - 16.2 On renovations smaller than 20 doors, FBISD Project Manager to consult district lock shop for direction on appropriate hardware.

- 16.3 Basis of design: Schlage L9000series - Only locks meeting or exceeding these standards only will be accepted.
- 17.0 Keying Requirements
- 17.1 Key System: All cylinders, in both swinging doors and millwork doors, will be keyed into the district's patented restricted existing small format interchangeable core key system. Cylinders must be compatible across small format interchangeable core and conventional format cylinders keyed to existing district A2 system. A vertical traveling pin will be used for a patent and placement shall be near the front of the cylinder for easy drilling of damaged cores. A restricted order verification system must currently in place to verify orders. A minimum of 5 keyways must be available in the system. Cores must be warrantied in any manufacturer's hardware. All keyways in the family must be able to be operated by one key. System must be patented until 2029. Key system must be UL437 capable. A preliminary key meeting will be held to establish guidelines for the system and a secondary key meeting will be held to review the proposed key system. All cores will be shipped directly to the district lock shop to be installed. A construction key system will be in place during the construction period. Three control keys for the construction key system will be turned over to the district for installation of the permanent cores. Bitting list must be provided in Excel spreadsheet format from the manufacturer to be directly input by file transfer into Sitemaster. Contractor will be responsible for installing permanent cores.
- 17.2 Basis of Design: Schlage Everest 29r - Only key systems meeting or exceeding these standards only will be accepted.
- 18.0 Exit Devices/ Panic Hardware
- 18.1 General features:
- 18.1.1 Independent lab-tested 1,000,000 cycles. Must meet ANSI-156.3 – 2014.
- 18.1.2 Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated.
- 18.1.3 Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function. Center case must be constructed of pressed steel, CAST STEEL ZINC DICHROMATED WILL NOT BE ACCEPTED. Six screws minimum will be required to fasten the center case.
- 18.1.4 Releasable in normal operation with 15-lb. maximum operating force, and with 32 lb. maximum pressure under 250-lb. load to the door.
- 18.1.5 Extruded aluminum grooved body.
- 18.1.6 Motorized quiet electronic latch retraction must be available.
- 18.2 Specific features
- 18.2.1 Supply rim devices with key removable mullion at all entrances. Concealed and surface vertical rod exit devices WILL NOT be accepted.
- 18.2.2 Non-Fire Rated Devices: cylinder dogging.
- 18.2.3 Lever Trim: Breakaway type, forged brass or bronze escutcheon min .130" thickness, compression spring drive, match lockset lever design.
- 18.2.4 Exterior Trim: Stainless steel vandal resistant trim thru-bolted to device with plastisol coated grip. Night latch function retracts latch with use of key.
- 18.2.5 Fire-Labeled Devices: UL label indicating "Fire Exit Hardware".
- 18.2.6 Delayed Egress Devices: Function achieved within single exit device component, including latch, delayed locking device, request-to-exit switch, nuisance alarm, remote alarm, key switch, indicator lamp, relay, internal horn, door position input, external inhibit input plus fire alarm input. NFPA 101 "Special Locking Arrangement" compliant.
- 18.2.7 Electrically Operated Devices: Single manufacturer source for quiet electric latch retraction devices, electrically controlled trim, power transfers, power supplies, monitoring switches and controls.

- 18.2.8 Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.
- 18.2.9 All classroom devices will be NL function trim with cylinder dogging.
- 18.3 Basis of design: Von Duprin 99 – only exit devices meeting or exceeding these standards only will be accepted.
- 19.0 Closers
  - 19.1 Surface Closers:
    - 19.1.1 Full rack-and-pinion type cylinder with molded plastic cover and cast iron body. Pinion must be  $\frac{3}{4}$ ". Bearings must be full compliment. Arms must be forged steel. Minimum .625" bearing height required. Body must be powder coated, not spray lacquer. Size adjustment must be verified by visual aid on the end of the cylinder with a numeric dial. Snap on covers are to be standard with added screw specified.
    - 19.1.2 Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
    - 19.1.3 Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
    - 19.1.4 Opening pressure: Exterior door 8.5 lb, interior doors 5 lb, labeled fire doors 15 lb.
    - 19.1.5 Separate adjusting valves for closing speed, latching speed and backcheck
    - 16.1.6. Parallel Rigid arms (PR) at exterior doors scheduled with parallel arm units.
    - 19.1.7 Exterior doors do not require seasonal adjustments in temperatures from 120°F to – 30°F, furnish data on request.
    - 19.1.8 Pressure Relief Valves (PRV): unsafe, not permitted.
    - 19.1.9 Permanent metal templates must be available for installation.
  - 19.2 Basis of design: LCN 4040 series - only closers meeting or exceeding these specifications will be accepted.
- 20.0 Low Energy Power Assist Door Operations
  - 20.1 Basis of Design: LCN 9500 Series – Only power operators meeting or exceeding these specifications will be accepted.
  - 20.2 ANSI/BHMA A156.10
- 21.0 Other Hardware
  - 21.1 Automatic Flush Bolts: Low operating force design, "LBR" type where scheduled.
  - 21.2 Surface Bolts: Shall be used at pairs of doors from non-fire rated Mechanical rooms for the inactive leaf.
  - 21.3 Overhead Stops: Stainless steel (100 series). Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
  - 21.4 Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
  - 21.5 Door Stops: Provide stops to protect walls, casework or other hardware.
    - 21.5.1 Unless otherwise noted in Hardware Sets, provide wall type Ives WS402 with appropriate fasteners. Where wall type cannot be used, provide floor type. ( Ives FS18S exterior and FS436 Interior) If neither can be used, provide overhead type.
    - 21.5.2 Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg deadstop. Note degree of opening in submittal.
  - 21.6 Seals: Finished to match adjacent frame color. Resilient seal material: polypropylene, nylon brush, or solid high-grade neoprene. UL label applied to seals on rated doors. Substitute products: certify that the products equal or exceed specified material's thickness and durability. Proposed substitutions: submit for approval.
    - 21.6.1 Solid neoprene: MIL Spec. R6855-CL III, Grade 40.

- 21.6.2 Non-corroding fasteners at in-swinging exterior doors.
- 21.6.3 Exterior pairs of mechanical room doors: Doors shall be equipped with appropriate seals, astragal, threshold, drip cap and sweeps to prevent the intrusion of rain water. Provide astragals at all interior pairs of doors to mechanical rooms.
- 21.6.4 Sound control openings: Use components tested as a system using nationally accepted standards by independent laboratories. Ensure that the door leafs have the necessary sealed-in-place STC ratings. Adhesive mounted components not acceptable. Fasten applied seals over bead of sealant.
- 21.6.5 Fire-rated Doors, Resilient Seals: UL10C / UBC Standard 7-2 compliant. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements. Where rigid housed resilient seals are scheduled in this section and the selected door manufacturer only requires an adhesive-mounted resilient seal, furnish rigid housed seal at minimum, or both the rigid housed seal plus the adhesive applied seal. Adhesive applied seals alone are deemed insufficient for this project where rigid housed seals are scheduled.
- 21.6.6 Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C / UBC Standard 7-2. Where required, Intumescent seals vary in requirement by door type and door manufacture -- careful coordination required. Adhesive-applied Intumescent strips are not acceptable, use concealed-in-door-edge type or kerfed-in-frame type.
- 21.6.7 All exposed exterior doors not under a cover are to have a rain drip to extend four inches outside the width of the door.
- 20.7 Automatic door bottoms: low operating force units. Doors with automatic door bottoms plus head and jamb seals cannot require more than two pounds operating force to open when closer is disconnected.
- 20.8 Thresholds: As scheduled and per details. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
  - 20.8.1 Exteriors: Seal perimeter to exclude water and vermin. Use butyl-rubber or polyisobutylene sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Non-ferrous 1/4inch fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).
  - 20.8.2 Acoustic openings: Set units in full bed of Division-7-compliant butyl-rubber or polyisobutylene sealant, leave no air space between threshold and substrate.
  - 20.8.3 Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
- 20.9 Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.
- 20.10 Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Omit where adhesive mounted seal occurs. Leave no unfilled/uncovered pre-punched silencer holes.
- 20.11 Wall- & Floor-mounted electromagnetic door holders: LCN's SEM series or approved equivalent. Incorporate into U.L.-listed fire & life-safety system, doors release to allow closure and latching when door's zone is in alarm state. Use minimum projection required to allow door to open as widely as allowed by wall conditions and projection of door hardware.
- 20.12 Basis of design: Ives.
  - 20.12.1 Approved equals include but are not limited to:
    - 20.12.1.1 Trimco
    - 20.12.1.2 Hager
    - 20.12.1.3 Rockwood
- 20.13 Door Barricade Hardware: RhinoWare by Campus Safety Products shall be the sole source provider and installer.



- 20.13.1 RhinoWare has been selected by the FBISD Police Department/ Life Safety Department for use on all classrooms, art rooms, band rooms, dance rooms, temporary building classrooms, and any other rooms where attendance is taken.
- 20.13.2 Verify barricade hardware locations with the Life Safety Department during Design Development meeting.
- 20.13.3 Doors Receiving RhinoWare must have a minimum 10" height bottom rail in order to properly receive RhinoWare.

## 22.0 Hardware Finishes

- 22.1 Generally BHMA 626 Satin Chromium
  - 22.1.1 Areas using BHMA 626 to have push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.
- 22.2 Door closers shall be factory powder coated to match other hardware, unless otherwise noted.
- 22.3 Aluminum items shall match predominant adjacent material.
- 22.4 Seals to coordinate with frame color.

## 08 80 00 – Glazing

- 1.0 Security review meeting required during Design Development. Coordinate with FBISD Project Manager.
- 2.0 Glass should be recommended based on required performance requirements.
- 3.0 Basis of Design: Guardian Industries Corp.
  - 3.1 Other approved manufacturers:
    - 3.1.1 Oldcastle Building Envelope
    - 3.1.2 Viracon
    - 3.1.3 Pilkington North America
- 4.0 General Warranty
  - 4.1 Written warranty, executed by glass manufacturer agreeing to repair or replace glass units that fail in materials and workmanship or deteriorate within warranty period. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to decorative glass manufacturer's published instructions.  
Warranty Period: Five (5) years from date of Substantial Completion.
- 5.0 Coated Glass Products
  - 5.1 Warranty: Written warranty signed by manufacturer in which glass manufacturer agrees to replace coated glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating. Warranty Period: Ten (10) years from date of Substantial Completion.
- 6.0 Insulating Glass:
  - 6.1 Warranty: Written warranty signed by manufacturer in which manufacturer agrees to replace insulating glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass. Warranty Period: Ten (10) years from date of Substantial Completion.
- 7.0 Glazing Surface Films
  - 7.1 Solar Control Films

- 7.1.1 Only for use on renovated facilities provided that building model shows significant affect to energy costs.
- 7.2 Warranty: Written warranty signed by glass film manufacturer and installer in which manufacturer and installer agree to replace glass film that crack, peel, delaminate, discolor, change appearance, or failure to meet solar criteria within specified warranty period. Warranty Period: Five (5) years from date of Substantial Completion.
- 8.0 Mirrors (Glazing)
  - 8.1 Information on Unit Mirrors for use in Toilet Rooms included with Toilet Accessories.
  - 8.2 Dance Room mirrors.
    - 8.2.1 Mirrors should cover one wall, mounted 4" off the floor.
    - 8.2.2 Mirror sections to be mounted vertically, 4 feet in width by 7 feet in height
    - 8.2.3 Coordinate with ballet bar installation so that joints align with mounts.
  - 8.3 For additional locations and requirements for mirrors, refer to FBISD Facility Educational Standards.
- 9.0 Security Glazing:
  - 9.1 Security Glazing is either laminated glazing OR existing glazing with surface applied Safety & Security Film is required in multiple locations.
  - 9.2 The purpose of the security glazing is not to provide any ballistic resistance, but to delay entry into the building through a glazed opening.
    - 9.2.1 New security glazing shall be laminated glass
      - 9.2.1.1 All laminated glass used for security purposes shall consist of 1/4" annealed – .090" PVB (polyvinyl butyral) – 1/4" annealed.
      - 9.2.1.2 Warranty: Written warranty signed by manufacturer in which manufacturer agrees to replace laminated glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
        - 9.2.1.2.1 Warranty Period: Ten (10) years from date of Substantial Completion.
    - 9.2.2 Existing glazing that must be retrofitted to become security glazing shall have Safety & Security Film applied to the surface of the interior or secure side.
      - 9.2.2.1 Basis of Design: 3M Safety S80 (SH8CLARL) at 8 mil (0.008") thickness OR 3M Safety S140 (SH14CLARL) at 14 mil (0.014") thickness.
        - 9.2.2.1.1 Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.
        - 9.2.2.1.2 Warranty Period: Ten (10) years from date of Substantial Completion.
      - 9.2.2.2 Security Film Installation:
        - 9.2.2.2.1 Installation of security film to glazing within a standard window or storefront frame: Install security film from glass edge to opposite glass edge on interior or secure side of glass. Film must be anchored to frame with silicone structural sealant. Must achieve a minimum of 3/4-inch contact between silicone structural sealant bead and the window/storefront frame and a minimum 3/4-inch contact between structural sealant bead and the security film. Apply BondKap product over silicone structural sealant joint.



- 9.2.2.2.2 Installation of security film to glazing within a storefront door: Install security film from glass edge to opposite glass edge on interior or secure side of glass. Apply structural sealant under caps/stops to adhere film-to-frame-to-cap/stop.
- 9.2.2.2.3 Follow silicone structural sealant manufacturer's recommendations for allowable substrate materials and proper substrate preparation. If substrate material is unallowable, consider replacing substrate material, or propose an alternate film-to-frame anchoring method.

9.2.2.3 Security Film Manufacturers:

- 9.2.2.3.1 3M
- 9.2.2.3.2 Llummar
- 9.2.2.3.3 Madico
- 9.2.2.3.4 Comparable product approved by Architect and FBISD Design Manager.

9.2.2.4 Silicone Structural Sealant Manufacturers:

- 9.2.2.4.1 Dow - Dowsil 995
- 9.2.2.4.2 Comparable product approved by Architect and FBISD Design Manager

10.0 Areas to be Secured with Security Glazing

10.1 Secure Entry Vestibules

- 10.1.1 Secure entry vestibules create an additional barrier between visitors entering the school and the student population by slowing the movement of a potential adversary. Creating a vestibule may require the addition of walls and doors in existing schools. A secure entry vestibule should consist of the follow general architectural attributes:
- 10.1.2 Locked Doors with Card Reader and Remote Release: Doors and door hardware shall be specified as required in the Design Standards. Where multiple doors access the same space, only one door shall have electronic hardware with a card reader (typical). A remote release is required to:
  - 10.1.2.1 Allow access from the exterior into the secure entry vestibule
  - 10.1.2.2 Allow access from the secure entry vestibule into the secure area of the school.
- 10.1.3 Clear Visual Sightlines from the Reception Desk: Natural line of sight should be maximized for the administration staff to see the front exterior entry from the reception desk/counter. Consider adding additional windows.
- 10.1.4 Exterior Storefront/Curtain Wall and Door glazing of Secure Entry Vestibule below the 7'-0" level at Front Entrance shall be security glazing.
- 10.1.5 Interior Storefront/Curtain Wall and Door glazing between the Secure Entry Vestibule and the secure areas of the school below the 7'-0" level shall be security glazing.
  - 10.1.5.1 If retrofitting existing glazing to become security glazing at this location, increased thickness 14 mil Safety & Security Film to be used.
- 10.1.6 Sliding Transaction Window in Secure Entry Vestibule at Reception Desk or Attendance Office:
  - 10.1.6.1 The application of a sliding window at the reception desk/counter is intended to prevent a potential adversary from climbing over the reception desk/counter and into the secured area. The window is not motorized, but rather is self-closing and lockable from the secure side.
  - 10.1.6.2 A sliding window is required between the public in the secure entry vestibule and the receptionist on the secure side of the counter. One or two sliding

- windows are typical dependent on the layout and use of the reception area.
- 10.1.6.3 Aluminum framed service window – one or two sliding windows “Drive-Thru” type.
- 10.1.6.4 Minimum opening size of 20 ¼” wide x 29” tall is preferred.
- 10.1.6.5 Non-powered, self-latching, self-closing sliding window with magnetic hold-open.
- 10.1.6.6 All glass shall be new security glazing (laminated glazing).
- 10.1.6.7 Adjoining storefront in the same plane as the sliding window shall also be provided by the sliding window manufacturer as a single unit, also with new security glazing.
- 10.1.6.8 One or both sliding windows shall be at the proper elevation to comply with ADA requirements.
- 10.1.6.9 Hook dead bolt lock.
- 10.1.6.10 Offset bottom guide to prevent push-in of window from a potential adversary.
- 10.1.6.11 Manufacturer labels shall not be visible from the public side of the window.
- 10.1.6.12 Basis of Design: QuikServ Corp - Model SC-4040 or SCDS-6056
  - 10.1.6.12.1 Ready Access
  - 10.1.6.12.2 Comparable product approved by FBISD Design Manager
- 10.2 Classrooms
  - 10.2.1 All classroom glass adjacent to corridors below 7'-0” level is required to be security glazing.
  - 10.2.2 Glazing between classrooms and the exterior is not required to be security glazing.
- 10.3 Cafeteria
  - 10.3.1 Glazing between the cafeteria/commons and the exterior of the building shall be security glazing if the exterior at that location is not within perimeter security fencing.
  - 10.3.2 Glazing between the cafeteria and other interior rooms is not required to be security glazing.
- 10.4 All Exterior Entrances
  - 10.4.1 All exterior storefront style doors and frames with adjacent sidelights shall contain security glazing.
- 11.0 Special Function Glazing
  - 11.1 Use of all below should be avoided. If need arises, present need to FBISD Design Manager for approval prior to incorporating into documents. Include alternatives to use along with intended use:
    - 11.1.1 Fire Resistant Glazing.
    - 11.1.2 Hurricane-Resistant Glazing.
    - 11.1.3 Transparent Mirrored Glazing.
    - 11.1.4 Pressure-Resistant Glazing.
    - 11.1.5 Security Glazing.
    - 11.1.6 Ballistics-Resistant Glazing.

## 08 90 00 – Louvers and Vents

- 1.0 Provide fully welded plenum boxes for all wall louvers, positive slope to exterior, refer to Diagram 08\_01 on Appendix for additional information.
- 2.0 Do not provide sealant at base of louver, ensure drainage. Provide bird screens and rain protection/drip.



- 3.0 Operable louvers to be approved by FBISD Design Manager.
- 4.0 Coordinate with Division 23 – Mechanical (HVAC) Systems for mechanical louvers.
- 5.0 Fixed, Heavy Duty Design Basis Product: Ruskin, 6" deep. Other approved manufacturers:
  - 5.1 Airolite Company, LLC.
  - 5.2 Construction Specialties.
  - 5.3 Greenheck Fan Corporation.
- 6.0 Prefinished Aluminum Louvers
  - 6.1 Specified to accommodate all RAL colors for selection.
  - 6.2 Specified to include bird screens, minimum 16 gauge.
  - 6.3 Factory finish Kynar type.
- 7.0 Door Louvers
  - 7.1 Install in galvanized steel doors leading into unconditioned spaces, such as outdoor equipment storage, fire rise rooms, grounds and maintenance spaces/buildings.
- 8.0 Louvered Equipment Enclosures
  - 8.1 Consider at areas where low cost concealing of equipment needed (due to requirements of Authority having Jurisdiction).
- 9.0 Soffit Vents
  - 9.1 Refer to Cement Plastering Section in Division 09 - Finishes for additional information on installation of vents in that material.
  - 9.2 Refer to Metal Panel Section in Division 07 for additional information on installation of vents in that material.

**END OF DIVISION 08**

# Division 09


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# Finishes

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## DIVISION 09 - FINISHES

### 09 00 00 – General Requirements for Finishes

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3  Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations.
      - 1.3.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials.
      - 1.3.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients.
      - 1.3.2.4 EQc1: Enhanced Indoor Air Quality Strategies.
      - 1.3.2.5 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials.
      - 1.3.2.6 EQc7: Daylight.
- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.

### 3.0 Requirements

- 3.1 Information contained within this section relates to interior finish materials of all types. Due to high abuse in a K-12 setting, finish requirements within this section generally include material selections and details of a high-impact, low maintenance nature. The introduction of materials not included within section by A/E is allowed, but durability requirements must be proven prior to incorporation into design documents.
- 3.2 All materials must be asbestos free.
- 3.3 A/E to meet with FBISD Design Manager during Design Development to review all interior and exterior finishes to develop the Finish Board Presentation for superintendent approval. Final approved Finish Boards to be comprehensive of all the finishes throughout building for new schools, additions and major renovations. Approval of finishes must be completed and incorporated into construction documents prior to bidding.
- 3.4 Within Room Finish Schedule, include remarks, or references to details provided elsewhere, for surfaces (wall or floor) having multiple finishes.
- 3.5 Include accent wall selections within Finish Schedules.
- 3.6 FBISD prefers to minimize use of flammable interior finishes, including those with higher flame spread characteristics, even if allowed by code.
- 3.7 Refer to Appendix for Diagram 09\_01 - FBISD Elementary School Finish Schedules and Diagram 09\_02 - FBISD Middle and High School Finish Schedules. The typical finish schedule is generic and needs to be aligned with the specific information found within Divisions 9 and 11.

### 09 05 00 - Common Work Results for Finishes

- 1.0 Transitions in wall finishes to occur at inside corners as much as possible.

### 09 21 00 – Gypsum Board

#### 1.0 General:

- 1.1 Provide control joints at all openings (doors, windows, cased) in drywall partitions to allow for differential movement without significant damage to finishes. Ensure fire rating is maintained behind control joints in fire rated partitions (Refer to UL for options).
- 1.2 The maximum recommended control joint spacing for walls and ceilings without perimeter relief is 30 feet. With perimeter relief the maximum recommended control joint spacing is 50 feet. Architect and FBISD Design Manager to review locations prior to final placement.
- 1.3 Provide 4" offset between drywall ceilings/bulkheads and lay-in ceiling (DO NOT ALIGN) at each corner of openings.
- 1.4 Coordinate with Electrical – Provide two 4" conduit within drywall furring or above ceiling at high volume corridors or other areas where access is limited (for future technology, security F/A, other electrical, etc.).
- 1.5 Wall to Deck Requirements:
  - 1.5.1 Provide wall to deck plan separate from code review plan. Use of only General Notes in design documents that indicate which walls are to extend to deck is NOT ACCEPTABLE.
  - 1.5.2 Ensure all penetrations in the wall are sealed.
  - 1.5.3 Specific locations where walls are to extend to deck and other spaces where special acoustic or security requirements exist are indicated below. Information below is general for all types of spaces. A/E to verify with FBISD Design Manager.
- 1.6 Extend walls to deck and provide sound attenuation blankets for acoustics, security, and/or privacy at Classrooms, Offices, Conference Room, Corridors, Storage Rooms,

Toilet Rooms.

- 1.7 Electrical and Mechanical Rooms – All walls shall extend to deck, as these spaces typically have no ceilings.
- 1.8 MDF/IDF Rooms - All walls shall go to deck. When walls are drywall they shall be double layered drywall on both sides to help reduce the risk of unauthorized entry. All walls shall be painted from floor to deck.
- 1.9 Consider topping out CMU walls to deck (8" to 12" above ceiling) with drywall, conserve cost and allow for less intrusive installation for MEP.
- 1.10 Provide minimum Level 4 finish on all painted drywall partitions.
- 1.11 Do not use gypsum board in exterior situations where it will be exposed to the weather, such as soffits.
- 1.12 Do not use 1/2" gypsum board in new construction.
- 1.13 Studs to be mechanically fastened top and bottom, both sides. (If using deflection track, do not attach at top).
- 1.14 Provide access panels under all mechanical equipment in suspended gypsum board ceilings, HOWEVER, it is preferred that all equipment, including valves or other items requiring maintenance access, be relocated from gypsum board ceiling areas to adjacent lay-in ceiling areas. Refer to Division 23 – "Heating, Ventilating, and Air Conditioning (HVAC)."
- 1.15 Moisture resistant gypsum tile backer (dry areas).
  - 1.15.1 Approved Manufacturers/Products:
    - 1.15.1.1 Gold Bond eXP; National Gypsum
    - 1.15.1.2 Securock; United States Gypsum Company
- 1.16 Cement tile backer (wet areas) – entire restroom and corridor walls.
  - 1.16.1 Approved Manufacturers/Products:
    - 1.16.1.1 Durock Brand Cement Board; United States Gypsum Company
    - 1.16.1.2 National Gypsum

## 2.0 Gypsum Board Moisture Guard

- 2.1 Provide 1/2" minimum PVC extruded base to be used at typical gypsum board walls.
- 2.2 Provide 1 3/4" extruded base at corridor walls.
- 2.3 PVC extruded base must match wall thickness.
- 2.4 Basis of Design Product: Waterguard; <https://www.waterguard-usa.com>, (800) 653-8785 or comparable product approved by Architect and FBISD Design Manager.
- 2.5 Acceptable alternate is Hardie Board as manufactured by James Hardie Building Products, Inc.

## 09 24 00 – Cement Plastering

- 1.0 Cement Plastering (Adobe, Cement Stucco, Cement Parging):
  - 1.1 Accessories: Provide vented perimeter at all exterior plaster, ensure walls to deck around ALL exterior plaster areas with thermal and moisture envelopes complete on all sides (Refer to Division 07 for additional information).
    - 1.1.1 Vents at exterior plaster bulkheads to be set back 4" to 6" from edge to allow for installation of framing.
    - 1.1.2 Venting requirement for plaster is that ALL horizontal surfaces must have at least one opening for ventilation.
  - 1.2 Utilize traditional lathe and Portland cement plaster system with Acrylic based top coat so that system is integrally colored and more weather-resistant than traditional plaster topcoat. Application(s) as recommended by manufacturer.
  - 1.3 ZINC-COATED for exterior suspended plaster.
  - 1.4 Utilize traditional lathe and Portland cement plaster system with acrylic based top coat

so that system is integrally colored and more weather-resistant than traditional plaster topcoat. Application(s) as recommended by manufacturer.

- 1.5 Exterior Insulation Finish Systems (EIFS), NOT ALLOWED.
- 1.6 Plaster control joints should be spaced approximately every 15' to minimize cracking (or closer if recommended by the installer or industry standard practice or manufacturer, etc.). A/E to indicate recommended control joint layout on Reflected Ceiling Plans.
- 1.7 The bottom plaster casing bead/plaster stop should be notched to the same profile as the control joint to allow for deflection of the control joint on the horizontal casing bead/plaster stop and to allow water to shed onto the flashing assembly.
- 1.8 Plaster wall assembly should be detailed so that some movement of the different materials is allowed without major cracking. The glass-matt sheathing substrate should be installed with 1/8" gaps to allow for expansion and there should be some type of separation/slip sheet assembly between the plaster and the substrate to facilitate movement.
- 1.9 Ventilation: Provide natural – ventilated screed with screen or mechanical means if approved by architect and FBISD Design Manager, of ventilation to properly ventilate interior spaces after portland cement plaster has cured.
- 1.10 Portland cement plaster with factory mixed 100% pure acrylic finish coat with integral color.
- 1.11 Control joints to be coordinated to not allow water infiltration into wall assembly.
- 1.12 Provide appropriate number of access panels 18"x18" prefinished to match adjacent plaster or stainless.

## 09 30 00 - Tiling

### 1.0 General

- 1.1 Provide sealant joint at all inside corners on wall tile, NO EXCEPTIONS, regardless of substrate (masonry or drywall).
- 1.2 Provide sealant between wall/floor tile and door frames, do not install grout in these locations. Allow for movement of dissimilar materials.
- 1.3 Add the following to the flooring finishes' specifications: Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products. Contractor shall provide certified moisture testing results per ASTM F2170 (*Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes*) to Architect and Owner prior to floor installation. Acceptable moisture content of concrete sub floor shall be within approved manufacture limits or lower prior to installation. Refer to Division 3 – Concrete.
- 1.4 Relative Humidity – 95% level. Refer to Division 3 – Concrete.
- 1.5 Follow manufacturer's installation guidelines including relative Humidity, Temperature, etc.
- 1.6 At tile wainscot installation, ensure moisture barrier is installed prior to tile installation.
- 1.7 Per the 2018 TCNA edition, medium bedding floor flatness requirement is 1/4 inch per 10 feet.
- 1.8 Grout to be light in color required on floors and walls in food areas, beverage areas, utensil areas, restrooms, and mop closets. Slate Gray or Sterling Silver are both acceptable colors. The darkest allowable shade is Slate Gray

### 2.0 Restrooms

- 2.1 Wall tile for all student restrooms to extend full height. At single toilet rooms, tile to extend to a minimum of 7'-0". At CMU walls, tile can be reduced to 7'-0".

### 3.0 Drinking Fountains

- 3.1 Provide porcelain floor tile under all drinking fountain areas, wall tile behind and to each side (regardless of floor or wall material). Walk-off mats as an alternative. Refer to 09 60 00 Section.

### 4.0 Miscellaneous

- 4.1 Per health department requirements, all tile grout to be sealed in restrooms, kitchens, kitchenettes, water fountain areas, concessions or any wet areas.
- 4.2 Slope all floors to drains, not just slope 36" from drains. Ensure that no slope exceeds allowable per ADA/TAS requirements. Refer to Division 03 – Concrete for more information.
- 4.3 At all ceramic or quarry floor tile, provide a marble threshold to transition to alternate flooring material.

### 5.0 Ceramic Tile

- 5.1 Approved Manufacturers:
  - 5.1.1 Dal-Tile Corp.
  - 5.1.2 American Olean.
  - 5.1.3 Crossville Ceramics
- 5.2 Provide aluminum trim at all outside corners in lieu of bullnose.
  - 5.2.1 Basis of Design: Schluter Systems, [https://www.schluter.com/schluter-us/en\\_US/](https://www.schluter.com/schluter-us/en_US/)
  - 5.2.2 Schluter strips to be used at all outside corners or at any tile wainscot.



Bullnose tile to be used at wall termination. Other manufacturers are to be approved by FBISD Design Manager.

### 5.3 Products – Interior Tiles

All grout to be gray or light in color (refer to comment regarding grout in the general section) to be approved by FBISD Design Manager.

## 6.0 Shower Stall Waterproofing:

- 6.1 Provide at individual shower stalls, not in lieu of gang.
- 6.2 Lap membrane minimum two (2) inches and seal joint throughout its length.
- 6.3 Where drain penetrates membrane, make opening snug and seal in accordance with manufacturer's instructions.

## 7.0 Quarry Tile

- 7.1 Basis of Design Manufacturer: American Olean QueStep, unglazed with treads in color approved by FBISD Design Manager.
- 7.2 Approved Manufacturers:
  - 7.2.1 Quetread by Daltile
  - 7.2.2 Metro Tread by Metropolitan Ceramics
- 7.3 Quarry tile to be mudset or thickset in new construction allowing for depression in slab with installation of membrane.
- 7.4 Grout epoxy type, refer to comment in the general section
- 7.5 Quarry tile only used to match existing in floor renovation with epoxy grout.
- 7.6 Epoxy grout to be used at Kitchens' locations.
- 7.7 Sandy grouts in all rooms. Non-sandy grout elsewhere.

## 8.0 Porcelain Tile

- 8.1 Approved Manufacturers:
  - 8.1.1 Dal-Tile Corp
  - 8.1.2 American Olean
  - 8.1.3 Crossville Ceramics
- 8.2 Epoxy grout in all kitchen standard floor and non-sand walls. Refer to comment in the general section
- 8.3 24-inches x 24-inches or smaller tile is acceptable by FBISD Design Manager. Any other size must be explicitly approved by FBISD Design Manager.
- 8.4 Porcelain tile is encouraged for use as impact resistant wainscot where required.
- 8.5 All porcelain tile to be through body.
- 8.6 All floor tile to be porcelain.

## 09 50 00 - Ceilings

- 1.0 Acoustical Ceilings and Suspension Systems
  - 1.1 Approved Manufacturers:
    - 1.1.1 Armstrong World Industries
    - 1.1.2 Rockfon North America
    - 1.1.3 USG Corporation
    - 1.1.4 CertainTeed Corporation
  - 1.2 All square lay-in, no tegular ceiling tiles. Any special shape considerations to be approved with FBISD Design Manager.
  - 1.3 2'-0" x 2'-0" is the standard size. No substitutions.
  - 1.4 Provide smooth face vinyl faced drywall tiles at kitchen, food prep areas, and restrooms.
- 2.0 Acoustical Ceiling Assemblies
  - 2.1 Acoustical Suspension System
    - 2.1.1 Basis of Design Manufacturer: Armstrong World Industries. 15/16-inch exposed T, no concealed spline, always white except for at Black Box (non-reflective black paint). No special colors or finishes allowed unless approved by FBISD Design Manager.
    - 2.1.2 Approved Manufacturers
      - 2.1.2.1 CertainTeed Corporation.
      - 2.1.2.2 Rockfon, a Chicago Metallic Corporation company.
      - 2.1.2.3 USG Corporation.
  - 2.2 Acoustical Panel Ceilings
    - 2.2.1 Acoustical Panel Type 1
      - 2.2.1.1 Basis of Design Product: School Zone Fine Fissured No. 1713 by Armstrong World Industries.  
Or  
Radar ClimaPlus tile with the USG Donn grid system with a warranty of 30 years to be free from manufacturing defects and the occurrence of 50% red rust on grid.
      - 2.2.1.2 Typical Location: Primary learning areas and classrooms.
    - 2.2.2 Acoustical Panel Type 2
      - 2.2.2.1 Basis of Design Product: Fine Fissured Humiguard with BioBlock tile with the Prelude grid system by Armstrong or equal with a warranty of 15 years against sag and warpage and the occurrence of 50% red rust on grid.
      - 2.2.2.2 Typical Location: Music rooms, performing arts rooms & Library.
    - 2.2.3 Acoustic Panel Type 3
      - 2.2.3.1 Basis of Design Product: Clean Room VL No. 868 by Armstrong World Industries.
      - 2.2.3.2 Typical Location: Kitchen and food preparation areas.
    - 2.2.4 Acoustic Panel Type 4
      - 2.2.4.1 Basis of Design Product: Clean Room VL No. 870 by Armstrong World Industries.
      - 2.2.4.2 Typical Location: Restrooms.

- 2.2.5 Acoustic Panel Type 5: IMPACT Resistant
  - 2.2.5.1 Basis of Design Product: Armatuff No. 861 or Fire Rated Fire Guard Armatuff No. 862 by Armstrong World Industries.
  - 2.2.5.2 Typical Location: Elementary Gymnasium.
- 2.2 Specialty Ceilings
  - 2.2.1 Consult with Acoustical Engineer for requirements at Auditoriums, Cafeteriums, Band, Music, Library, and other Performance Spaces. Provide absorbent and/or reflective tiles as recommended.
- 3.0 Integrated Ceiling Assemblies
  - 3.1 NO NEW, ONLY in renovations where ALREADY INSTALLED and must be maintained with MINOR renovations.
- 4.0 Mark all equipment and technology devices above the ceiling on the grid. Reference Division 23 – “Heating, Ventilating, and Air Conditioning (HVAC).”
- 5.0 Warranty
  - 5.1 Sag Resistant Ceiling Panels: warrant products to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of fifteen (15) years from the date of Substantial Completion.
  - 5.2 Standard Suspension System: Suspension systems shall be warranted to be free from defects in material or factory workmanship and shall not incur 50 percent red rust as defined by ASTM B117 test procedures for a period of fifteen (15) years from the date of Substantial Completion.
- 6.0 All ceiling sprinkler heads are to be concealed. Refer to Division 21 – “Fire Suppression.”

## **09 60 00 - Flooring**

- 1.0 General:
  - 1.1 Floor finishes to be utilized per space, new and existing facilities, are indicated within this section. Refer to Appendix for Finish Schedules.
  - 1.2 For renovations on campuses with existing VCT to remain, provide new VCT as requested.
  - 1.3 Carpet tiles are acceptable at auxiliary facilities only. Coordinate with FBISD Design Manager.
  - 1.4 This Section contains information regarding details, manufacturers, warranty, maintenance, and other installation instructions for flooring.
  - 1.5 For transitions from one flooring material to another, use of rubber is acceptable, however, consider more durable transitions where more durable floor finishes uses, such as metal transitions or thresholds at tile and terrazzo flooring. Essentially, consider equipment used for cleaning, providing more durable transitions where heavier equipment required to maintain adjacent flooring.
  - 1.6 Concrete stage base, no wood framing unless existing.
  - 1.7 Add the following to the flooring finishes' specifications: Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacturer approved moisture barrier prior to installation of all flooring products. Contractor shall provide certified moisture testing results per ASTM F2170 (Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes) in new construction or ASTM F1869 (Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride)

in renovations to Architect and Owner prior to floor installation. Acceptable moisture content of concrete sub floor shall be within approved manufacture limits or lower prior to installation. Refer to Division 3 – Concrete.

- 1.8 Relative Humidity – 95% level. to Division 3 – Concrete.
- 1.9 Follow manufacturer's installation guidelines including relative humidity, temperature, adhesive, etc.

## 2.0 Specialty Flooring at Weight Rooms

### 2.1 Middle and High Schools:

- 2.1.1 Basis of Design: Sport Impact Flooring - Ramflex by Mondo. Minimum 3/8" thickness, smooth texture, and manufacturer's standard color range.
- 2.1.2 Other approved manufacturers:
  - 2.1.2.1 Connor Sports.
  - 2.1.2.2 Tuflex Rubber Flooring.
  - 2.1.2.3 Rexcourt as manufactured by Shaw Industries.
  - 2.1.2.4 Robbins, Inc.

### 2.2 Materials:

- 2.2.1 Leveling Compound: As approved by manufacturer to correct minor subfloor deviations.
- 2.2.2 Adhesive: Type recommended and supplied by flooring manufacturer.
- 2.2.3 Flooring:
  - 2.2.3.1 Size: 27 inches x 27 inches.
  - 2.2.3.2 Gauge (Thickness): 3/8 inch.

### 2.3 Reducer Strip: Provide reducer strips at edges as required for juncture with adjacent floor surfaces of type and size recommended by manufacturer.

### 2.4 Provide other materials, not specifically described but required for a complete and proper installation.

## 3.0 Wood Flooring

### 3.1 General Requirements:

- 3.1.1 Concrete subfloors on or below grade shall be adequately waterproofed beneath and at the perimeter of the slab and on the earth side of below grade walls by concrete contractor. Sand-poly-sand slab construction is not an acceptable construction. Provide under slab vapor barrier per section 03 30 00 – Cast-in-Place Concrete.
- 3.1.2 Provide recessed slab for subfloor system so wood floor is flush with adjacent finish floor.

### 3.2 Gymnasium Wood Flooring

- 3.2.1 Flooring: 25/32 inch thick by 2-1/4 inches wide, northern hard maple Second & Better; continuous tongue and groove, end-matched RL or FJ, kiln dried, MFMA grade marked.
- 3.2.2 Sub-floor: two continuous layers of engineered 3-ply (minimum) 15/32 inch (4 feet by 8 feet) APA structural rated plywood sheathing, CDX Exterior Grade, stapled and adhered together with construction adhesive using Box X pattern.
- 3.2.3 Resilient Cushion/Pads: 3/4 inch high, EPDM, (poly) urethane, natural rubber, or Architect's approved equivalent; 55-70 durometer for primary use as basketball court with multi-use capabilities as instructed by manufacturer. PVC is not acceptable.
- 3.2.4 Wall Base: Three (3) inch by Four (4) inch vented cove base with premolded outside corners.
  - 3.2.4.1 Basis of Design: Johnsonite Vent Cove Wall Base or comparable product

approved by FBISD Design Manager.

#### 3.2.4.2 Color: Black.

#### 3.2.5 Finish:

3.2.5.1 Sealer: One (1) coat oil modified polyurethane sealer and finish.

3.2.5.2 Game Line Paint: Oil type paint compatible with floor finish in colors scheduled on drawings or selected by Architect. Smooth finish.

3.2.5.3 Finish: Three (3) coat oil modified polyurethane finish, as recommended by MFMA and manufacturer. Total finish shall match Architect's approved sample.

#### 3.2.6 Accessories

3.2.6.1 Adhesive: Type recommended by manufacturer to adhere layers of plywood subfloor.

3.2.6.2 Tape: 4 inch wide type recommended by manufacturer for sealing vapor barrier edges.

3.2.6.3 Continuous Extruded Aluminum Threshold/Sill Plates: C/S Group, Div. of Conspec Systems, Inc., Muncy, PA (717) 546-5941 ("Model No. GYMF"), or equal by Pemko Manufacturing Co., or National Guard Products, Inc., (NGP); of size and shape as indicated on drawings or required.

#### 3.2.7 Middle Schools

3.2.7.1 Provide cushioned sleeper floor system, Northern Hard Maple Strip Flooring, third grade and better, tongue and groove and end matched, 23/32" x 1 1/2" on fir or pine sleepers and cushion pads, Bio-Cushion Classic as manufactured by Robbins, Action Floor Systems LLC "Action Concorde", or comparable product approved by FBISD Design Manager.

#### 3.2.8 High Schools

3.2.8.1 Provide cushioned sleeper floor system, Northern Hard Maple Strip Flooring, first grade and better (in court area) and third grade or better (perimeter area), tongue and groove and end matched, 23/32" x 1 1/2" on fir or pine sleepers and cushion pads, Bio-Cushion Classic with 3/4" black pad as manufactured by Robbins, Red Neo-Shok as manufactured by Connor or comparable product approved by FBISD Design Manager.

3.2.9 All exterior doors that enter into a gym, need to have a concrete pad that floats back to the door with abrasive action walk-off mat. Refer to Walk-off mats in Division 09.

3.2.10 Provide same grade of wood, inside and outside of main basketball courts, all grade levels (middle school and high school).

3.2.11 Refer to Appendix for Diagram 09\_03B Court Flooring Pattern Plan – Middle and High Schools.

3.2.12 Provide 1 inch gap between intersections of colors on all gym striping to allow for separation of colors AND to assist with re-painting when floors periodically re-finished by FBISD Maintenance staff.

3.2.13 Striping paint shall be compatible with floor finish, including acceptability for use on wood substrate. Provide information on compatibility within submittal. For colors of court striping for different sports, please refer to Appendix.

3.2.14 The school colors are to be matched as closely as possible to the true Pantone values and will be reviewed by FBISD Design Manager and FBISD Athletics.

3.2.15 School Logos will be permitted at center court on HS and MS gym floors only.

3.2.16 Refer to Division 10, Signage and Graphics, for more information on gymnasium logos and graphics.

- 3.3 Stage Wood Flooring (All Grade Levels).
  - 3.3.1 Stage flooring (oak, pine, and masonite). Consider the following:
    - 3.3.1.1 Drama Department likes to apply tape and nail things to the floor.
    - 3.3.1.2 Drama Department wants flat black everywhere, and will cover oak in front of curtain for some presentations. Reference 09 90 00 – Paintings and Coatings.
  - 3.3.2 Provide mat to cover high quality finish for special performances where thrust (or full) stage required.
  - 3.3.3 Provide safety edge protection as required by code, either raised edge at front of stage without orchestra pit or at the edge of pit filler, or with photo-luminescent strip or lighting. To utilize “thrust stage” created by infill of Orchestra Pit, floor must be level from back of stage to audience side edge.
  - 3.3.4 Elementary Schools
    - 3.3.4.1 For steps and for stage area to centerline of stage curtain, provide 1 x 4, tongue and groove, center matched, southern pine No. 1 select grade wood flooring on wood nailers and 3/4-inch plywood subfloor system. Remainder of stage, behind curtain, to be resilient flooring.
  - 3.3.5 Middle Schools
    - 3.3.5.1 Stage flooring to be masonite on a bonded plywood subfloor system. At front of stage, provide Oak, tongue and groove end matched select grade red oak milled and graded, 3/4-inch x 2 1/4-inch. From centerline of front curtain to back of stage, provide masonite floor assembly. Stain black. Provide any transitions required at doors to comply with ADA, etc.
  - 3.3.6 High Schools
    - 3.3.6.1 Stage flooring to be a bonded 3/4-inch plywood subfloor system. Provide masonite floor assembly full length of the stage. Stain black. Masonite sheets to be screwed into subfloor.
- 3.4 Black Box at High schools
  - 3.4.1 Bonded plywood subfloor system, provide masonite floor assembly full length of the stage. Stain black. Masonite sheets to be screwed into subfloor. Provide recessed slab for subfloor system so Masonite is flush with adjacent finish floor.
  - 3.4.2 Color: Flat Black, non-reflective paint surface.
  - 3.4.3 Vapor Barrier Materials: Six (6) mil polyethylene film.
  - 3.4.4 Subfloor:
    - 3.4.4.1 Lower Layer - 4' x 8' x 3/4" Class A Fire-Rated A-C plywood - stagger joints 16" each row, 1/8" gaps. Secure 16" o.c. w/ #8 x 1 1/2" decking screws counter sunk flush.
    - 3.4.4.2 Upper Layer - 4' x 8' x 3/4" Class A Fire-Rated A-C plywood - stagger joints 9" each row, 1/8" gaps. Offset and stagger joints 9" both ways from previous layer. Secure 12" o.c. w/ #8 x 1 1/2" decking screws counter sunk flush.
  - 3.4.5 Flooring: 4' x 8' x 1/4", tempered pressboard (sierra pine medite fr), 1/8" gaps. Offset and stagger joints 10" both ways in an alternate direction from previous layer. Two layers to be provided. Secure 12" O.C. w/ #8 x 1" black decking



screws counter sunk flush.

3.4.5.1 Fasteners: Staples of type, size and finish recommended by the flooring manufacturer to suit application. Other fasteners, if any, shall be of type, size and finish recommended by the flooring manufacturer to suit application.

3.4.5.2 Finishing Materials: Sealer and paint as recommended by the flooring manufacturer with black non-gloss, non-slip finish.

### 3.5 Dance Room Flooring at High Schools

3.5.1 Fully-floating triple sandwich floor system, Harlequin Activity Sprung Floor with Cascade vinyl mat surface.

3.5.2 Provide recessed slab for subfloor system so sprung system is flush with adjacent finish floor.

3.5.2.1 Basis of Design: American Harlequin Corporation,  
<http://www.harlequinfloors.com/us/en/index.php> 800.642.6440

3.5.2.2 Other equal manufacturer: O'Mara Sprung Floors,  
<http://www.sprungfloors.com/> with "Marley" Type vinyl mat manufactured by Alvas or Rosco or comparable product approved by FBISD Design Manager.

### 4.0 Resilient Athletic Flooring for Gymnasium at Elementary Schools

4.1 Basis of Design: Tarkett Omnisports Multi-Use 6.2mm or comparable product approved by FBISD Design Manager.

4.2 Refer to Diagram 09\_03A in Appendix for gym floor striping and colors.

4.3 Approved Manufacturers:

4.3.1 Patcraft

4.3.2 Mondo

### 5.0 Resilient Flooring

5.1 Luxury Vinyl Tile (LVT):

5.1.1 Luxury Vinyl tile is preferred over Vinyl Composite Tile.

5.1.2 Minimum of 20 mil thick enhanced urethane wear layer with adhesive to function at a minimum of 98% RH concrete moisture level resistance - ASTM F2170-1.

5.1.3 20 year warranty with no finish requirements to maintain the warranty.

5.1.4 Approved Manufacturers:

5.1.4.1 Patcraft with ExoGuard+™ Finish

5.1.4.2 Mohawk with M-Force™ Finish

5.1.4.3 Tarkett with Techtonic™ Finish

5.1.4.4 Comparable product approved by FBISD Design Manager.

5.2 Luxury Vinyl Tile (LVT) with Cushion Backing (Specialized Education Classrooms A-D):

5.2.1 Minimum of 20 mil thick with enhanced urethane wear layer, non-skid backing, and glue-free installation.

5.2.2 20 year warranty with no finish requirements to maintain the warranty.

5.2.3 Approved Manufacturers:

5.2.3.1 Gerflor

5.2.3.2 Mohawk

5.2.3.3 Comparable product approved by FBISD Design Manager.

5.3 Vinyl Composition Tile (VCT):

5.3.1 Size: 12" x 12" x 1/8" thick.



### 5.3.2 Approved Manufacturers:

5.3.2.1 Patcraft

5.3.2.2 Mohawk

5.3.2.3 Mannington

5.3.2.4 Comparable product approved by FBISD Design Manager.

### 5.4 Extra Stock:

5.4.1 Furnish extra materials matching products installed and packaged with protective covering for storage and identified with labels describing contents.

5.4.1.1 Resilient Tile Flooring: 2 percent of quality installed or 2 full unopened containers, whichever is greater.

5.5 Provide maximum of two colors in each room. Additional colors and patterns to be approved by FBISD Design Manager.

5.6 Consider providing contrasting color at emergency shower in science labs.

5.7 Subcontractor to use matching color caulk to caulk LVT & VCT to all door and window unit frames and other metal pieces.

## 6.0 Terrazzo Flooring

### 6.1 Approved Manufacturers

6.1.1 Southern Tile & Terrazzo Co, Inc.

6.1.2 Continental Terrazzo Supply, Inc.

6.1.3 Comparable product approved by NTMA (National Terrazzo & Mosaic Association, Inc.) and FBISD Design Manager.

6.2 Always use sand bed on ground floor.

6.3 Polyacrylate recommended for second floor applications with expansion joints and control joints coordinated with inside and outside corners, structural corners, and heavy use live load areas (stairways).

6.4 On first floor applications, use sand-bed cementitious terrazzo. No epoxy terrazzo is allowed on first floor due to moisture problems. In some instances, the logo is allowed to be in epoxy terrazzo. Polyacrylate terrazzo may be considered in a renovation; consult with FBISD Design Manager.

6.5 At middle and high schools, accommodations for a logo of approximately four feet in diameter (or 4 feet x 4 feet square) and of moderate complexity (amount of detail in design of logo and number of colors used), should be included in the bid documents.

6.6 Metal divider strips to be spaced at 4 - 5 foot both directions, maximum, to help minimize cracking.

## 7.0 Fluid-Applied Flooring (Science preferred option)

7.1 Includes troweled on epoxy quartz, can be used in locker rooms and science labs at secondary schools, turn this material up on wall as base.

7.2 Provide bond break at control joints in concrete flooring where this material scheduled for installation. Movement in control joints will communicate through where not treated correctly prior to installation.

7.3 In facilities where movement anticipated, provide control joints in epoxy quartz flooring aligned with concrete control joints (coordinate with Geotechnical Survey and Structural Engineer).

### 7.4 Approved Manufacturers:

7.4.1 Rust-Oleum.

7.4.2 Key Resin Company.

7.4.3 Stonhard.

7.4.4 Dex-O-Tex.



## 8.0 Resinous Flooring:

- 8.1 All flooring specifications shall include verbiage that requires that the sub-floor moisture content and/or relative humidity must meet manufacturer's requirements or appropriate moisture barrier must be provided by General Contractor. Refer to Division 3 – Concrete.
- 8.2 Relative Humidity – 95% level. Refer to Division 3 – Concrete.
- 8.3 Basis of Design: "DL-2 System" impact resistant flexible epoxy resin flooring as manufactured by PolySpec L.P.; Houston, TX (218) 397-0033. Other approved manufacturers:
  - 8.3.1 Dex-O-Tex.
  - 8.3.2 Stonhard.
- 8.4 Light to medium grit, grey is standard color. Grey matrix.
- 8.5 Integral cove base.

## 9.0 Carpeting:

- 9.1 All flooring specifications shall include verbiage that requires that the sub-floor moisture content and/or relative humidity must meet manufacturer's requirements or appropriate moisture barrier must be provided by General Contractor. Refer to Division 3 – Concrete.
- 9.2 Carpet tiles are acceptable at auxiliary facilities only. Coordinate with FBISD Design Manager.
- 9.3 Relative Humidity – 95% level. Refer to Division 3 – Concrete.
- 9.4 Basis of Design: Tarkett – Powerbond broadloom. All carpet to be Powerbond Vinyl Cushion back, "peel and stick" RS pre-applied micro- encapsulated adhesive back. FBISD Design Manager approval required for equal products.
- 9.5 Warranty of twenty (20) years is required and must be provided within submittal information as well as within closeout documents.
- 9.6 Walk-Off Carpet:
  - 9.6.1 Basis of Design: "Abrasive Action" as manufactured by Tarkett.
  - 9.6.2 Permanent walk-off mats to be used at all exterior doors, minimum 6'-0" depth from opening and width of doorway plus one foot either side/width of corridor at that location.
  - 9.6.3 Consider walk-off mats below sinks at restrooms and at drinking fountains.

## 10.0 Base:

- 10.1 Type I rubber base with matching end stops and molded corner units. Height 4", minimum 72" lengths. Standard color. Miter all inside and outside corners if not using molded corner units.
- 10.2 At all wood floors, provide 3" x 4" ventilating resilient cove base. Miter all inside and outside corners. Refer to Gymnasium Wood Flooring section for basis of design product.
- 10.3 Preferred colors are Black, Black/Brown, and Taupe. For small renovations on campuses with existing base to remain, match existing.

## 11.0 Trim strips, Transition strips:

- 11.1 Resilient Reducer Type, 1" wide x 1/8" thick, vinyl or rubber, tapered or bullnose edge. Standard color.

## 12.0 Stair Covering:

- 12.1 Molded synthetic rubber treads, landings, and risers as manufactured by Roppe or equivalent, nominal 1/8" thick. Treads to be "Vantage" low profile raised disc pattern and of one-piece construction with molded round or square nose. Landings to be standard profile raised circular disc pattern on 19-11/16" square tiles.
- 12.2 Exception at monumental stairs, products to be reviewed and approved by FBISD Design Manager prior to bidding.

## 09 70 00 – Wall Finishes

- 1.0 Vinyl Wall Covering:
  - 1.1 Approved Manufacturers:
    - 1.1.1 Koroseal.
    - 1.1.2 MDC Wallcoverings.
    - 1.1.3 Tri-Kes.
  - 1.2 Preference is that there is no vinyl wall covering on exterior walls. If vinyl wall covering is to be used on exterior walls, then it must be perforated.
  - 1.3 Provide only self-healing, mildew inhibitor vinyl wall covering.
  - 1.4 Tackable vinyl wall surfaces in classroom is required on minimum two walls.
  - 1.5 No exposed edges. Termination at ceiling or with transition.

## 09 80 00 – Acoustic Treatment

- 1.0 Acoustic Wall Panels:
  - 1.1 Provide recommendations from Acoustical Consultant in the following spaces, for review with FBISD Design Manager prior to incorporation with design and construction documents:
    - 1.1.1 Auditorium and all Auxiliary Support Spaces.
    - 1.1.2 Band, Choir, and Orchestra Halls.
    - 1.1.3 Band Practice and Ensemble Areas, Gymnasiums and Indoor Play Areas.
    - 1.1.4 Cafeteria/Commons (including Cafeteriums).
    - 1.1.5 Library.
    - 1.1.6 Percussion Rooms.
    - 1.1.7 Theatre Classrooms.
  - 1.2 Acoustical recommendations by A/E alone are NOT ALLOWED unless qualified to provide such recommendations.
  - 1.3 Generally, provide 2" on drywall, 2" on CMU, to be verified by Acoustical Engineer.
  - 1.4 Provide air space behind wall panels, see Appendix for Diagram 09\_04.
  - 1.5 Include testing of space after installation and prior to substantial completion in accordance with acoustical engineer recommendations; required modifications must be complete prior to occupancy.
  - 1.6 At areas subject to impact, provide impact resistant panels.
  - 1.7 At practice rooms in fine arts areas, install acoustical wall panels on two adjacent walls with a chair rail at the bottom of the panel to prevent damage to panel.
- 2.0 Acoustical Panels, Fabrics and Diffusers:
  - 2.1 Approved Acoustical Panels Manufacturers:
    - 2.1.1 Armstrong World Industries.
    - 2.1.2 MBI Products Company.
    - 2.1.3 Sound Concepts.
  - 2.2 Approved Pre-assembled Wood Panels Manufacturers:
    - 2.2.1 Architectural Components Group.
    - 2.2.2 Rulon Co.
    - 2.2.3 9Wood, Inc.
  - 2.3 Cementitious Wood Fiber Acoustical Panels
    - 2.3.1 Basis of Design: Tectum as manufactured by Armstrong.
    - 2.3.2 Other approved manufacturers:
      - 2.3.2.1 Acoustical Surfaces.
      - 2.3.2.2 Baux Acoustical Panels.
    - 2.3.3 Material: Aspen wood fibers bonded with inorganic hydraulic cement.

- 2.3.4 Thickness: Two (2) inches.
- 2.3.5 Edge: Long edge beveled.
- 2.3.6 NRC: 0.70.
- 2.3.7 Size:
  - 2.3.7.1 Walls: 47-3/4 inches wide by 8-feet length.
  - 2.3.7.2 Ceilings: 59-3/4 inches by 59-3/4 inches.
- 2.3.8 Frame: 2 inch by 4 inch painted wood at walls only.
- 2.3.9 Finish/Color: Natural finish and field painted in color selected by Architect only. No factory finished products.
- 2.3.10 Mounting Style: Mount on 3/4 inch furring strips at 24 inch on center both ways on walls, and provide unistrut channels and hangers at 24 inches both ways at ceiling attached to steel angles and girders. Type instructed by manufacturer to suit application. Provide all fasteners, and furring strips for a complete single source installation. Fasteners and anchorage accessories shall be corrosive resistant.
- 2.4 For all panels below 8'-0", provide rigid (impact resistant) panels.

## 09 90 00 - Paintings and Coatings

- 1.0 General Requirements:
  - 1.1 Include Schedule for all applications in Project Manual.
  - 1.2 Finishes shall be eggshell on Drywall, semi-gloss on CMU Matte, flat, gloss finishes NOT ALLOWED.
  - 1.3 Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1.4 Provide mock-up for all wall paints on scheduled surface, in scheduled space, for A/E and FBISD Project Design review and approval at Painting Pre-Install Meeting.
  - 1.5 Piping in all exposed areas shall be painted. Provide band (tape/sticker) in public and concealed areas (above ceiling and in walls). Refer to MEP Sections for additional information, including colors for ALL PIPING to be COMPLETELY painted in Mechanical, Electrical, and other Support Areas without ceilings.
  - 1.6 Attic stock: Provide 1 gallon for each accent wall color to remain on campus.
  - 1.7 Alkyd paints have higher durability, but higher VOC, are also more work to re- paint. Some K-12 have excluded use, others retain requirement to use on all trim and in high traffic areas. There are hybrid, durable water based acrylics on the market now that should be considered.
  - 1.8 Add the following to the specification: Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with Finish Schedule, Area Detail designating where each product/color/finish was used, product/color/finish was used, product data pages, Manual Safety Data sheets, care and cleaning instructions, touchup procedures, and color samples of each color and finish used.
  - 1.9 General Paint Schedule:
    - 1.9.1 Corridors: Semi-gloss.
    - 1.9.2 All CMU: Semi-gloss.
- 2.0 Approved Manufacturers:
  - 2.1 Sherwin-Williams.
  - 2.2 PPG Paints.
  - 2.3 Glidden.
  - 2.4 Benjamin Moore
- 3.0 Quality Assurance:
  - 3.1 ASTM-C16 – "Standard Test Method for Load Testing Refractory Shapes at High Temperatures."
  - 3.2 ASTM D2486 – "Standard Test Method for Scrub Resistance of Interior Wall Paint."
  - 3.3 ASTM D2805 – "Standard Test Method for Hiding Power of Paints by Reflectometry."
  - 3.4 ASTM D4828 – "Standard Test Method for Practical Washability of Organic Coatings."

- 3.5 ASTM D3363 – “Standard Test Method for Film Hardness by Pencil Test.”
- 4.0 Items to receive paint:
- 4.1 CMU, metal, piping – semi-gloss finish.
  - 4.2 Gypsum – eggshell finish.
  - 4.3 No painting of outdoor galvanized metal.
  - 4.4 Identify stains/clear polyurethane for wood benches, etc.
- 5.0 Generally, all new items that are normally painted in any typical building, including but not limited to the following list:
- 5.1 All ferrous metal.
  - 5.2 All exterior lintels to match brick.
  - 5.3 All exterior wood.
  - 5.4 All interior wood.
  - 5.5 All prime coated hardware.
  - 5.6 All exposed conduit, outlet boxes and electrical cabinets, except those located in mechanical or electrical rooms.
  - 5.7 All exposed pipe, plumbing, and ductwork, including those located in mechanical rooms and outdoors.
  - 5.8 All metal grilles, except aluminum, unless otherwise indicated.
  - 5.9 All exposed gypsum board surfaces, including all mechanical rooms.
  - 5.10 All exposed concrete masonry units (CMU), including all mechanical rooms.
  - 5.11 Miscellaneous other items which normally require painting or are scheduled to be painted.
  - 5.12 Consult plans, finish schedule, details and specifications for other trades as all items usually field painted or finish will be considered as part of the Contract.
  - 5.13 All exposed mechanical equipment and electrical equipment.
  - 5.14 Mechanical Room piping and interior and exterior condenser water piping whether insulated or not insulated.
  - 5.15 All spray applied fireproofing in Mechanical Rooms.
  - 5.16 All cementitious wood fiber decks and exposed structure scheduled or noted to receive paint. Protect exposed wood structure from overspray.
  - 5.17 Traffic lanes and parking spaces including fire lanes and crosswalks. Identify colors
  - 5.18 Rolling doors.
  - 5.19 Bollards. – Safety yellow
  - 5.20 Loose lintels.
  - 5.21 Color coding of mechanical room, central plant, and service yard pipes. Refer to MEP Divisions.
  - 5.22 No handrails to be painted. Refer to Division 05 – Metals
- 6.0 Interior Paint in wet areas - Epoxy (typically on kitchen walls, wet areas and elsewhere, where indicated).
- 7.0 General Paint Schedule:
- 7.1 Corridors: Semi-gloss.
  - 7.2 All CMU: Semi-gloss.
  - 7.3 Wet areas (including toilet rooms, showers, and kitchen: Epoxy (See Below).
  - 7.4 Gypsum board: Acrylic latex, eggshell, except as noted above.
  - 7.5 Traffic Line Marking Paint – Refer to Division 32.
  - 7.6 Finish required behind super graphics: Refer to Division 10 – Specialties.
- 8.0 Exterior Low-Luster Acrylic Paint: Factory-formulated low-sheen (eggshell) acrylic-latex paint for exterior application.
- 9.0 Exterior Full-Gloss Urethane Alkyd Enamel: Factory-formulated full-gloss alkyd enamel for exterior application.
- 10.0 Interior Low-VOC Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
- 10.1 Sherwin-Williams; Pro Green 200 Low VOC Interior Latex Enamel.  
B20W600 Series: Applied at a dry film thickness of not less than 1.7 mils.

- 11.0 Interior Semi-gloss Zero VOC Enamel: Factory-formulated semi-gloss enamel for interior application.
  - 11.1 Sherwin-Williams; Pro Industrial 0 VOC Acrylic Semi-gloss, B66W650: Applied at a dry film thickness of 2.5 – 4.0 mils.
- 12.0 Interior Dryfall Finish Coat: Factory-formulated acrylic finish coat for exposed roof structure, roof deck, and cementitious wood fiber planks.
  - 12.1 Sherwin-Williams: Waterborne Acrylic Dryfall, B42 Series.
- 13.0 Interior Semigloss Epoxy: Factory-formulated, two-component, water based, catalyzed epoxy resin for high performance applications.
  - 13.1 Sherwin-Williams: Water based Catalyzed Epoxy B70-200 Series: Applied at a dry film thickness of not less than 2.5 mils.
- 14.0 Staining and Transparent Finishing:
  - 14.1 Refer to Division 06 for additional information on where to apply these finishes.
  - 14.2 HS Auditorium floor coating on concrete under seating: Euclid Super Floor Coat, colored or Owner-approved equal.
- 15.0 Marine Coatings:
  - 15.1 Not needed if Epoxy used (Training Rooms and Walk-In Coolers).
- 16.0 Elastomeric Coatings:
  - 16.1 Provide on inside face of Service Area screen walls and Dumpster Enclosures IN LIEU of Standard Exterior Paints.
- 17.0 Epoxy Coatings:
  - 17.1 Provide in all wet areas, including shower rooms, CMU walls, toilet rooms, and kitchen walls.
- 18.0 Special Coatings:
  - 18.1 Marker wall paint – Suggested use of this alternate material will be considered by FBISD, verify locations and intent with FBISD Design Manager prior to including within design documents.
    - 18.1.1 Basis of Design: IdeaPaint by Sherwin Williams or comparable product approved by FBISD Design Manager.
  - 18.2 Video Paint - Green Paint Basis of Design: Rosco Chroma Paint floor and wall or comparable product approved by FBISD Design Manager.

#### **END OF DIVISION 09**


## Division 10

# Specialties

General Requirements for Specialties		10 00 00
Operation and Maintenance of Specialties		10 01 00
Informational Specialties		10 10 00
Interior Specialties		10 20 00
Safety Specialties		10 40 00
Storage Specialties		10 50 00
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### DIVISION 10 - SPECIALTIES

#### 10 00 00 - General Requirements for Specialties

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3  Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations.
      - 1.3.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials.
      - 1.3.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients.
      - 1.3.2.4 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials.
- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function,

dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.

- 3.0 Coordination
  - 3.1 Coordinate markerboard installation with Division 27. Contractor to provide classroom mockup of markerboard and A/V installation for coordination prior to completing installation.
- 4.0 General Clarifications Regarding Specialties:
  - 4.1 Information provided within this section relates to specialty equipment and furnishings, including specific preferences of FBISD with regards to these specialty products. Model numbers, manufacturers, and installation methods are listed, where appropriate, with details, photos and cut sheets (where available).
  - 4.2 A/E to verify wall conditions and ceiling heights in relation to size, location and installation requirements. Require contractors to confirm the above prior to installation.
  - 4.3 Reference FBISD Facility Educational Standards for quantities and locations.
  - 4.4 Refer to Division 6 for blocking requirements.

### **10 01 00 - Operation and Maintenance of Specialties**

- 1.0 Common Work Results for Specialties
  - 1.1 Consider durable items with long-term (low) maintenance in mind.
- 2.0 Schedules for Specialties
  - 2.1 Signage Schedule should be provided (along with Door Schedule), INCLUDE in design documents prior to bidding. Allowance will NOT be permitted for building signage (interior or exterior).
  - 2.2 For toilet and bath accessories, clearly indicate on enlarged toilet plans and provide schedule indicating OFCI vs CFCI. DO NOT rely on general notes.

### **10 10 00 – Information Specialties**

- 1.0 Visual Display Units
  - 1.1 Markerboards
    - 1.1.1 Basis of Design: Claridge Products and Equipment, Inc.
    - 1.1.2 Other Approved Manufacturers:
      - 1.1.2.1 ADP Lemco Incorporated.
      - 1.1.2.2 Best Rite Manufacturing.
      - 1.1.2.3 PolyVision (Previously Marsh Industries, Inc.)
    - 1.1.3 In lieu of visual display units at flex areas, consider products listed in Division 09 – Finishes.
    - 1.1.4 Boards must be magnetic; low gloss, white. No Grey Allowed.
    - 1.1.5 All boards to be 5 feet high, maximum 12 feet in length, unless approved by FBISD Design Manager.
    - 1.1.6 Refer to Facility Educational Standards for information on location, quantity, and sizes per space.
    - 1.1.7 Installed only after wall finishes have been completed. Allow only clips or similar methods of installation to allow removal of the board without significant damage to walls. Refer to Division 06 for blocking requirements.
    - 1.1.8 Mounting Height must be coordinated with AV systems.
    - 1.1.9 Indicate mounting heights on Drawings, as indicated by Division 27 41 00 - 1.11 of these guidelines.



- 1.1.10 Install clear silicone caulk along entire top edge of all markerboards and tackboards where they meet the wall.
- 1.1.11 Allow for 2 feet between edge of markerboard and entry door frame (for switch, etc., installation). Do not install behind doors.
- 1.1.12 Provide two flag holders per room (not per board).
- 1.1.13 Provide blocking in wall for map rail/tack strip to accommodate weight of maps, especially in social studies rooms.
- 1.1.14 Provide two 18 inch box-type aluminum chalk trays with slanted front and cast aluminum end closures at each board 8 feet or longer. Provide continuous box-type aluminum chalk tray at boards shorter than 8 feet.
- 1.1.15 Do not provide chalk tray at Gymnasiums, if markerboard provided.
- 1.2 Tackboards
  - 1.2.1 Tack boards to be 1/4-inch cork laminated over 1/4-inch hardboard in an extruded aluminum frame with a fabric-backed vinyl surface.
  - 1.2.2 All boards shall be 5-feet in height.
- 1.3 Visual Display Rails
  - 1.3.1 Tack strip: Provide No. 74 Deluxe Display Rail as manufactured by Claridge. Strip to be 2" overall width with flat end stops at all exposed ends. Do not install lower than 7 feet above finish floor.
  - 1.3.2 Solid blade-type aluminum, ribbed sections.
- 1.4 Visual Display Fabrics
  - 1.4.1 For back of display cases (see below for additional information on display cases).
- 1.5 Warranty
  - 1.5.1 Written warranty in which Manufacturer agrees to repair or replace porcelain enamel face sheets that fail in materials or workmanship within specified warranty period.
    - 1.5.1.1 Failures include, but are not limited to, the following:
      - 1.5.1.1.1 Surfaces lose original writing and erasing qualities.
      - 1.5.1.1.2 Surfaces exhibit crazing, cracking, or flaking.
      - 1.5.1.1.3 Noticeable deterioration of finish.
      - 1.5.1.1.4 Writing surface delamination.
      - 1.5.1.1.5 Fabric discoloration, tearing, or delamination.
      - 1.5.1.1.6 Unit releasing from substrate.
    - 1.5.1.2 Warranty Period: Five (5) years from date of Substantial Completion.
- 2.0 Display Cases
  - 2.1 Approved Manufacturers:
    - 2.1.1 ADP Lemco Incorporated.
    - 2.1.2 Claridge Products & Equipment, Inc.
    - 2.1.3 Comparable product approved by Architect.
  - 2.2 Provide as indicated in Facility Educational Standards or as approved by FBISD Design Manager as follows:
    - 2.2.1 Recessed or Wall-Mounted display cases are acceptable.
    - 2.2.2 No Pre-manufactured units.
    - 2.2.3 Sliding glass front, frameless, with lock.
    - 2.2.4 Provide duplex receptacle.



- 2.2.5 Provide LED lighting, switched separately, on same circuit as corridor (to allow for control by building automation system).
- 2.2.6 Provide glass adjustable shelves and brackets with tackboard back (not sides).

### 3.0 Signage

- 3.1 Refer to Diagrams 10\_01, 10\_02, 10\_03, 10\_04, 10\_05, 10\_06 & 10\_07, for signage types.
- 3.2 NO ALLOWANCES. Always include signage, including interior and exterior directional signage in design and construction documents prior to bidding.
- 3.3 Room names and numbers to be approved by FBISD Design Manager during Construction Documents phase.
- 3.4 Room Signs and Directional Signs
  - 3.4.1 Refer to Diagram 10\_03 in Appendix for typical room signage standard.
  - 3.4.2 Provide wayfinding map at key locations for multi-story buildings in addition to directional signage.
  - 3.4.3 Laminate colors for room signage shall be approved during finish review and incorporated into color board.
  - 3.4.4 At existing where no narrow lite provided, provide Occupied/Unoccupied sign for conference rooms.
- 3.5 Approved Signage Vendors
  - 3.5.1 AGP (Architectural Graphic Products).
  - 3.5.2 South Texas Graphics.
  - 3.5.3 Comparable product approved by FBISD Design Manager.
- 3.6 Policy and Procedure
  - 3.6.1 Graphic (signage) schedule to be prepared by Architect, included within Design and Construction documents prior to bidding.
  - 3.6.2 Renovation work – Coordinate signage numbering system, colors and sign types with campus Principal.
  - 3.6.3 For new construction, signage should use a triple digit numbering system with alpha letters in front. (e.g. A154, D232)
  - 3.6.4 Architect to provide FBISD Project Manager a reproducible floor plan with room numbers on 8 ½" x 11" or 8 ½" x 14" size paper. Room numbers must be legible at this size. If this is a renovation or addition, provide file to FBISD Project Manager to be coordinated by District into one new overall plan. These files will be utilized for Fire Exit plans and other District uses.
  - 3.6.5 Back plate required at glass installations.
  - 3.6.6 Provide "Maximum Occupancy" signage at all Public/Common/Meeting areas with appropriate capacity indicated (verify with Authority Having Jurisdiction and FBISD Design Manager), match size and color of other building signage, with large readily visible text. Refer to Diagram 10\_07 in Appendix.
  - 3.6.7 Avoid mounting on split face masonry.
  - 3.6.8 Room signs must be installed prior to substantial completion for punch list coordination and furniture delivery.
  - 3.6.9 Consider signage at millwork where furrdown is not provided, as required by AHJ. Refer to Diagram 10\_07 in Appendix.
- 3.7 Exterior School Letters
  - 3.7.1 Building name to be located with view from street and front parking lot. Name to be written in all capital letters.

- 3.7.2 Letters shall be a minimum of 14" unless approved by FBISD Design Manager.
- 3.7.3 Font is to be easily readable. An easy to read font is: Myriad Pro Bold. Avoid Times New Roman or other fonts with serifs. Any exterior signage that includes school colors, school logos, or school artwork to be approved by FBISD Design Manager and FBISD Communications Department.
- 3.7.4 Finish to have good contrast with building surface for easy visibility. Provide matte or flat finish only, no semi-gloss or gloss, to reduce glare.
- 3.7.5 Mounting on pilasters, split face and other projections to be avoided.
- 3.7.6 Mounting over building control or expansion joints to be avoided to allow for ease of future maintenance of joint.
- 3.7.7 Verify name with FBISD Design Manager once board approved.
- 3.8 Exterior Signage
  - 3.8.1 Off-site signage and on-site directional signage to be coordinated through traffic engineer and verified with the Principal prior to approval of submittals.
  - 3.8.2 Show all site signage on the site plan, prior to bidding.
  - 3.8.3 Directional signage (Staff Parking, Student Drop-Off, etc.), accessible parking signage, and traffic signage (One-Way, Stop, etc.) to be traffic quality, made of aluminum and mounted on minimum 2" schedule 40 galvanized pipe or square equivalent. Provide bond breaker between dissimilar metals. Pole is to be a minimum of 36" into sub-grade and set in concrete for stability.
  - 3.8.4 NOTE: Signage located within an ADA accessible path that is 24" wide or less is considered a "free-standing object mounted on a post or pylon" and is allowable under the guidelines noted for such in "Protruding Objects". If a sign is wider than 24", it will be treated as a protruding object and should either be mounted on a 2 x 12 post (approx.) so that the edges of the sign are not an obstruction (projecting more than 4") OR it is preferred, if possible, to locate the signage out of the ADA accessible path instead. Verify with current ADA and TAS requirements.
- 3.9 Drama Marquee (interior)
  - 3.9.1 Provide deep recess-mounted painted sheet metal cabinet with steel angle support frame and 3/16" thick translucent plastic face ribbed for placement of individual copy letters. Two at high school auditorium and one at black box locations.
  - 3.9.2 Provide recessed porcelain sockets and LED lighting spaced on approximate 4" centers around perimeter of sign face. Lights controlled by 3- circuit solid state "chaser" unit.
  - 3.9.3 For the main auditorium, flank the main entrances on the left and right side of the lobby.
- 3.10 Food Court Signage (located over each serving line opening in cafeteria)
  - 3.10.1 Sign finish dimensions are approximately 2' high by 10' in length. Camera-ready art work should be provided as 2'-4" x 10'-4" so design 'wraps' edges.
  - 3.10.2 FBISD Project Manager to coordinate each design with school principal and with Director of Child Nutrition. Menu system details and colors to be coordinated with Director of Child Nutrition at the time the shop drawings are submitted.
  - 3.10.3 High School has five lines, two of which are customized with the school's logo. One graphic should be provided per line.
  - 3.10.4 Middle School has three food signs, all standard design. May have school's

logo; verify with FBISD Design Manager.

3.10.5 Elementary has no food court signs.

3.11 Dedication Plaque – Refer to Diagram 10\_08 in Appendix.

3.11.1 Construction: Bronze cast plaque 36" W x 24" L with raised and recessed copy, polished face and inset with leatherette background, dark oxidized finish. Letter style should be Optima and Lydian. Mounting method is the standard type "A" concealed with stainless steel studs included at top and bottom of plaque. Full size layout must be provided for approval prior to casting the plaque.

3.11.2 Shall include the following information:

3.11.2.1 The name of facility.

3.11.2.2 The year it was completed.

3.11.2.3 The names of the Board members at the time the contract for the facility was awarded, and at the time of dedication of the facility.

3.11.2.4 The name of the Superintendent at the time the contract for the facility was awarded, and at the time of dedication of the facility.

3.11.2.5 The name of the Architect or Engineer.

3.11.2.6 The name of the Contractor.

3.12.1 The plaque may include information regarding the city and state. No other information may be included in dedication plaques without Board approval.

## 10 20 00 – Interior Specialties

### 1.0 Toilet Compartments

1.1 Provide solid phenolic partitions.

1.2 Approved Manufacturers:

1.2.1 ASI Accurate Partitions

1.2.2 Columbia Partitions as manufactured by PSISC

1.2.3 Bobrick

1.2.4 Bradley

1.3 For new construction applications, basis of design configuration is Floor-to-Ceiling system with no overhead bracing. Pilasters fastened to structural steel or pre-cast concrete supporting member by means of two heavy hanging studs permitting vertical adjustment between bottom of supporting members and finished ceiling line. The bottoms of all pilasters shall be truly aligned, and the top connection shall be concealed by a 4 inch high, stainless steel pilaster shoe.

1.4 Brace back to rear or side walls. Provide continuous metal brackets and angles for support of all panels.

1.5 Provide all stainless steel hardware and fasteners, including shoes (no chrome or brass); no plastic hardware allowed.

1.6 At secondary schools, provide continuous hinges.

1.7 All fasteners to be vandal-resistant including the wall attachment.

1.8 Provide coat hook on inside of all stall doors.

1.9 Provide astragal on the door edge to provide closure at open joints for the purpose of additional privacy by the user.

### 2.0 Cubicle Curtains and Tracks

2.1 Curtain to be 100% Trivera polyester inherently flame resistant fabric with flame retardant 100% nylon ½" mesh drop as manufactured by General Cubicle Co. or

- comparable product approved by Architect and FBISD Design Manager.
- 2.2 Extend curtain to within 12" of finish floor.
- 2.3 Track to be extruded aluminum continuous track, IFC-100 roller carrier, satin anodized finish, surface mount.
- 2.4 Mounting of track to be coordinated with reflected ceiling plan to avoid conflict with lights, louvers and other ceiling mounted devices.
- 3.0 Partitions
  - 3.1 Wire Mesh Partitions
    - 3.1.1 Mesh to be 3/4" diamond pattern wire of not less than 10 gauge extending from floor to ceiling. Wire mesh doors to be swing type and shall be constructed to prevent the lock release to be tripped by something being stuck through the wire mesh.
    - 3.1.2 Finish to be pre-finished galvanized, verify color with FBISD Design Manager.
  - 3.2 Demountable Partitions
    - 3.2.1 To be provided at existing conditions only.
    - 3.2.2 Ultrawall or equal, no substitutions.
  - 3.3 Accordion Folding Partitions
    - 3.3.1 Not acceptable at new or existing conditions.
  - 3.4 Folding Panel Partitions
    - 3.4.1 Approved Manufacturers:
      - 3.4.1.2 Moderco.
      - 3.4.1.3 Modernfold
      - 3.4.1.4 Comparable product approved by FBISD Design Manager.
    - 3.4.2 STC 52 minimum.
    - 3.4.3 Top supported, continuously hinged paired panels, 3" thick steel construction panels with sound seals all around.
    - 3.4.4 Floor seals shall be of the automatic operating bottom seal type and shall automatically drop into place as each panel is positioned.
    - 3.4.5 Consider markerboard finish at classroom locations.
    - 3.4.6 Large partitions to be electronically operated, keyed to school system, and have recessed bottom support.
  - 3.5 Glass Folding Panel Partitions
    - 3.5.1 Approved Manufacturers:
      - 3.5.1.1 Moderco
      - 3.5.1.2 Modernfold
    - 3.5.2 Consider locking requirements at man door or provide separate door. Coordinate with FBISD Design Manager.
    - 3.5.3 Consider needs for shelter in place at classrooms.
- 4.0 Wall and Door Protection
  - 4.1 Corner Guards
    - 4.1.1 Locate at all outside corners (non-CMU walls) in high-traffic areas. Especially important to use a corner guard on partitions with VWC. No recessed or custom colors.
    - 4.1.2 Options:
      - 4.1.2.1 Snap-on PVC by Korogard or equal.
      - 4.1.2.2 Clear polycarbonate, 2 1/2", verify height with Owner, screw installation.

- Commercial Grade.
- 4.1.2.3 Stainless steel, 4" at kitchen and at areas subject to very high traffic or areas subject to damage by movable equipment.
- 4.2 Impact Resistant Wainscots
  - 4.2.1 No semi-rigid plastic wall protection products shall be allowed for use as interior impact resistant wainscot material.
- 5.0 Toilet, Bath, and Laundry Accessories
  - 5.1 General Requirements
    - 5.1.1 Refer to Facility Educational Standards for locations, below for quantities and installation.
    - 5.1.2 Refer to Appendix Diagram 10\_10 for Owner Provided Toilet Accessory Cut Sheets.
  - 5.2 Toilet Tissue Dispensers: Owner Provided, Contractor Installed.
  - 5.3 Paper Towel Dispenser: Owner Provided, Contractor Installed.
    - 5.3.1 Assume unit is 12" X 12" when laying out toilet rooms.
    - 5.3.2 Provide 8" minimum recess in wall to ensure not protruding object when installed.
  - 5.4 Soap Dispenser: Owner Provided, Contractor Installed.
  - 5.5 No Feminine Product Dispensers are provided.
  - 5.6 Feminine Napkin Disposals: Owner Provided, Contractor Installed.
  - 5.7 Electric Hand Dryer:
    - 5.7.1 Not to be used in elementary schools.
    - 5.7.2 Fix nozzle in downward position in student restrooms in secondary schools.
    - 5.7.3 Provide recess in wall, if semi-recessed units not provided, to ensure not protruding object.
    - 5.7.4 FBISD Design Manager to provide direction on specific product during Design Development.
  - 5.8 The following are the guidelines for determining number of toilet accessories:
    - 5.8.1 Elementary Boys and Girls restrooms:
      - 5.8.1.1 1 paper towel dispenser for 1-2 sinks.
      - 5.8.1.2 2 paper towel dispensers for 3-5 sinks.
      - 5.8.1.3 3 paper towel dispensers for 6 or more sinks.
      - 5.8.1.4 1 soap dispenser at every sink (if sinks are closely spaced, can locate 1 dispenser for use by a sink on either side; always locate soap dispenser at ADA sink).
      - 5.8.1.5 1 toilet tissue dispenser at every toilet.
    - 5.8.2 Elementary Adult restrooms:
      - 5.8.2.1 1 paper towel dispenser (as noted above).
      - 5.8.2.2 1 soap dispenser at every sink.
      - 5.8.2.3 1 toilet tissue dispenser at every toilet.
      - 5.8.2.4 1 sanitary disposal to be shared between 2 toilets (women's restroom and unisex restrooms).
    - 5.8.3 Elementary Art rooms, Science rooms, Workrooms, Lounge, etc.:
      - 5.8.3.1 1 paper towel dispenser per sink (if sinks are nearby each other, a dispenser can be shared).
      - 5.8.3.2 1 soap dispenser at every sink (if sinks are closely spaced, can locate 1 dispenser for use by a sink on either side; always locate soap dispenser at ADA sink).

- 5.8.4 Elementary Kitchen
  - 5.8.4.1 Per health department guidelines but generally: 1 paper towel dispenser at every sink.
  - 5.8.4.2 1 soap dispenser at every sink.
- 5.8.5 Middle School Boys and Girls restrooms
  - 5.8.5.1 1 electric hand dryer (semi-recessed preferred) for 1-2 sinks 2 electric hand dryer (semi-recessed preferred) for 3-5 sinks.
  - 5.8.5.2 3 electric hand dryer (semi-recessed preferred) for 6 or more sinks.
  - 5.8.5.3 1 soap dispenser at every sink (if sinks are closely spaced, can locate 1 dispenser for use by a sink on either side; always locate soap dispenser at ADA sink).
  - 5.8.5.4 1 toilet tissue dispenser at every toilet.
  - 5.8.5.5 1 sanitary disposal to be shared between 2 toilets  
Adult restrooms.
- 5.8.6 Middle School Adult Restrooms
  - 5.8.6.1 1 paper towel dispenser (as noted above).
  - 5.8.6.2 1 soap dispenser at every sink.
  - 5.8.6.3 1 toilet tissue dispenser at every toilet.
  - 5.8.6.4 1 sanitary disposal to be shared between 2 toilets (women's restroom and unisex restrooms).
- 5.8.7 Middle School Art rooms, Science rooms, Life Management
  - 5.8.7.1 1 paper towel dispenser per sink (if sinks are nearby each other, a dispenser can be shared) – Note that if there are upper cabinets, use the 'under-counter' version dispensers so that there are no clearance problems between the millwork. However, if a dispenser can be located near the sink where there is no upper cabinet, then provide one at that location.
  - 5.8.7.2 1 soap dispenser at every sink.
- 5.8.8 Middle School Workrooms, Lounge, Special Education, etc.:
  - 5.8.8.1 1 paper towel dispenser per sink (if sinks are nearby each other, a dispenser can be shared) – Note that if there are upper cabinets, use the 'under-counter' version dispensers so that there are no clearance problems between the millwork. However, if a dispenser can be located near the sink where there is no upper cabinet, then provide one at that location.
  - 5.8.8.2 1 soap dispenser at every sink (if sinks are closely spaced, can locate 1 dispenser for use by a sink on either side; always locate soap dispenser at ADA sink).
- 5.8.9 Middle School Showers
  - 5.8.9.1 Boys: 1 soap dispenser between each two gang shower devices. Locate on perimeter walls and mechanically fasten to wall.
  - 5.8.9.2 Girls: 1 soap dispenser at each shower.
- 5.8.10 Middle School Kitchen:
  - 5.8.10.1 Coordinate with health department for current requirements. General recommendation as follows:
  - 5.8.10.2 1 paper towel dispenser at every sink – Note that if there are upper cabinets, use the 'under-counter' version dispensers so that there

are no clearance problems between the millwork. However, if a dispenser can be located near the sink where there is no upper cabinet, then provide one at that location.

5.8.10.3 1 soap dispenser at every sink.

5.8.11 High Schools:

5.8.11.1 Refer to Middle School requirements. Ensure accessories provided for restrooms and showers in the Field House. Provide accessories for every sink in the building.

## 10 40 00 - Safety Specialties

### 1.0 Emergency Access and Information Cabinets

#### 1.1 Emergency Key Cabinets

- 1.1.1 Indicate location of Knox box at main entry, visible from nearest fire lane, and at vehicular gates at fire lanes. The Knox box is to be purchased by and installed by the Contractor.
- 1.1.2 Include specs for key cabinets and Knox box.

### 2.0 Emergency Aid Specialties

#### 2.1 Defibrillator Cabinets (AED)

- 2.1.1 No cabinet provided in contract, but A/E to locate (niche) on plans in public accessible location as determined by FBISD Design Manager (ensure not protruding object per TAS, hence reason for niche).
- 2.1.2 ES: One per floor, typically located near elevator. MS: One per floor and one at athletics (Three total). HS: Four, locations to be determined.
- 2.1.3 Coordinate additional locations with FBISD Design Manager, as units may be purchased and installed in other locations (adjacent to gymnasiums, for example).

2.2 First Aid Cabinets – To be provided by contract. Refer to Facility Educational Standards for locations. In Science Labs, locate near eye wash and other safety equipment. Indicate location on FF&E plans.

2.3 Bleeding Control Stations – As required by Texas House Bill 496 ensure bleeding control stations are stored in easily accessible areas of the campus as determined by FBISD Design Manager.

<https://capitol.texas.gov/tlodocs/86R/billtext/pdf/HB00496F.pdf#navpanes=0>

### 3.0 Fire Protection Specialties

3.1 Provide Cabinets AND Extinguishers.

3.2 Provide wall-hung extinguishers in all mechanical rooms.

3.3 At all non-supervised areas (for example, corridors, commons, etc.): Provide fully recessed fire extinguisher cabinets. Provide stainless steel non-locking door, magnetic catch, pull handles and solid front panel.

3.4 Provide fire extinguisher for each science lab and prep rooms. Refer to Facility Educational Standards for additional locations.

3.5 Add Initial Tag requirements to the specification.



## 10 50 00 – Storage Specialties

### 1.0 Lockers

#### 1.1 Metal Lockers

- 1.1.1 Minimum gauges are as follows:
  - 1.1.1.1 Non-athletic lockers – 16 ga. Door with 20 ga. Body.
  - 1.1.1.2 Athletic lockers – 14 ga. Door, 16 ga. Upright and 18 ga. Back.
- 1.1.2 Provide piano (continuous) hinges ONLY.
- 1.1.3 All lockers to be quiet operation with a recessed handle. Handles to be stationary type with combination lock and padlock hole. Combination locks are not required on PE athletic and team lockers.
- 1.1.4 All lockers to have all welded frame construction, no knock-down type. All lockers to have a sloped top, including athletic lockers.
- 1.1.5 Provide double contact point latches on double tier lockers and three contact point latches on single tier lockers.
- 1.1.6 Coordinate locker numbering system with FBISD Design Manager. Subcontractor to submit locker numbering system for review based on these criteria:
  - 1.1.6.1 First floor begins with 1001 and continues around the building.
  - 1.1.6.2 Locker 1001 is in the same general area as the lowest classroom number or area and follows the building number sequencing.
  - 1.1.6.3 Second floor lockers begin with 2001 and continue sequentially similar to the first floor.
  - 1.1.6.4 PE lockers begin with 3001 and continue sequentially.
  - 1.1.6.5 HS Field House locker numbers begin with 4001 (freshman lockers) and continue through upper classmen, in order.
- 1.1.7 In a renovation, specify for all lockers to match the existing school master key.
- 1.1.8 In new construction, specify all lockers to have a school master key.
- 1.1.9 All lockers are to have built-in combination locks with five setups.
- 1.1.10 Specify that control chart should be issued to District in both hard copy and electronic format.
- 1.1.11 Key athletic lockers under the same key number as PE lockers.
- 1.1.12 Provide ADA/TAS lockers as required. (Consult codes but generally this means an ADA/TAS acceptable opening mechanism within acceptable reach and a shelf within acceptable reach).
- 1.1.13 Lockers to be set on 4" concrete base, no CMU or wood.
- 1.1.14 Sizes and quantities of lockers are indicated in Facility Educational Standards. Special characteristics of lockers, other than what has been noted above, are as follows:
- 1.1.15 Corridor Lockers. Shop-applied baked enamel finish from standard color line (NO CUSTOM COLORS). Standard louvered door with solid back, divider and end panels and side closure panel.
- 1.1.16 Food Service Lockers. Same type as Corridor Lockers.
- 1.1.17 Athletic Lockers. Shop-applied baked epoxy enamel finish from standard color line (NO CUSTOM COLORS). PE lockers shall have ventilated louver solid front faced doors with solid back, divider and end panels and side closure panels. Team lockers shall have wire mesh fronts.
- 1.1.18 For ALL LOCKERS, provide alternate (second-choice) color selection from a second manufacturer, indicate in Finish Schedule.



- 1.2 Locker Room Benches
  - 1.2.1 Accessible benches in locker rooms MUST BE provided. Provide in EVERY dressing area, including within wire mesh partition athletic areas at high schools.
  - 1.2.2 Provide solid phenolic resin tops with galvanized steel legs.
- 2.0 Storage Assemblies
  - 2.1 Metal Storage Shelving
    - 2.1.1 Four post metal storage shelving with no end panels.
    - 2.1.2 Coordinate location and height with Owner, refer to Facility Educational Standards for Sizes and Quantities.
    - 2.1.2 All shelving to be properly braced and/or attached to wall.
    - 2.1.3 Each shelf to be able to carry a uniform load of 750 pounds.
    - 2.1.4 Each shelving unit should have a shelf as close to the floor as possible for stability purposes.
    - 2.1.5 Color from standard line, NO CUSTOM COLORS.
    - 2.1.6 Do not use metal shelving in science labs or prep rooms.

## 10 70 00 – Exterior Specialties

- 1.0 Pest Control Devices
  - 1.1 Bird Control Devices
    - 1.1.1 Coordinate with FBISD Design Manager for use at Auxiliary buildings.
  - 1.2 Bat Control Devices
    - 1.1.2 Verify need with FBISD Project Manager.
  - 1.3 Consider possible nuisance of all pests above when designing facilities for FBISD.
- 2.0 Flags and Banners
  - 2.1 Owner Furnished from FBISD FF&E Coordinator
  - 2.2 Flag to Flagpole Ratio:
    - 2.2.1 3' x 5' flag size for 15'-20' pole height,
    - 2.2.2 4' x 6' flag size for 25' pole height.
    - 2.2.3 5' x 8' flag size for 30' pole height.
    - 2.2.4 6' x 10' flag size for 35'-40' pole height.
    - 2.2.5 8' x 12' flag size for 45' pole height.
- 3.0 Flagpoles
  - 3.1 Ground-set flagpoles made from aluminum. Cone tapered flagpoles, fabricated from seamless extruded tubing complying with ASTM B241, Alloy 6063.
    - 3.1.1 Finish: Clear Anodic Finish.
  - 3.2 Construct flagpole in one piece.
  - 3.3 Cast metal shoe base made from aluminum with same finish and color as flagpoles for anchor bolt mounting; furnish with anchor bolts.
  - 3.4 Finial ball to be flush seam ball, sized to match flagpole diameter.
  - 3.5 Halyard:
    - 3.5.1 Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless steel cable halyard, and concealed revolving truck assembly with plastic coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

- 3.5.2 Halyard Flag Snaps: Chromium plated bronze or stainless steel or bronze or nylon swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.
- 3.6 Structural performance
  - 3.6.1 Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
- 3.7. Flagpole typical height is 30 feet (9 m). Coordinate with FBISD Design Manager.
- 4.0 Security Mirrors and Domes
  - 4.1 Consider at Clinic and stairwells to ensure no blind spots.
  - 4.2 Goal of A/E should be to design spaces so that these devices are not needed.
  - 4.3 Verify other possible needs with FBISD Design Manager.
- 5.0 Exterior Marquees
  - 5.1 Basis of Design Manufacturer: Republic of Texas, Inc., Daktronics, or comparable product approved by FBISD Design Manager. Submittals to be approved by FBISD Communications and FBISD Design Manager.
  - 5.2 Refer to Appendix for Diagram 10\_09.
  - 5.3 Provide concrete pad for sign. Extend 24 inches beyond edge for maintenance. Pad to drain to adjacent ground.
  - 5.4 Texture Plus Faux Brick Paneling to match the real brick of school building.
  - 5.5 If a Texture Plus Faux Brick Panel color cannot be found to match brick of school building or if the site is located within the city of Missouri City, architect to match brick or masonry of school building as alternative. Coordinate selection with FBISD Design Manager. If masonry is to be used, provide water-resistant cap (slope to drain) and weep hole construction.
  - 5.6 Composition:
    - 5.6.1 Two-view, internally lit.
    - 5.6.2 Elevation of front and back are identical.
    - 5.6.3 19.8 mm pixel pitch consists of 4 lines of 4.4 inch minimum and 1 line of 19 characters minimum.
    - 5.6.4 Monochrome, 1 amber pixel configuration.
    - 5.6.5 Monochrome amber, 6,000 nits.
    - 5.6.6 4,096 shades of amber.
    - 5.6.7 140 degrees horizontal X 60 degrees vertical optimal viewing angle.
    - 5.6.8 160 degrees horizontal x 90 degrees vertical readability angle.
    - 5.6.9 45 feet minimum viewing distance.
    - 5.6.10 100,000+ hours of estimated LED lifetime.
    - 5.6.11 Non-reflective black louvers and module face grooves disperse light for contrast enhancement.
    - 5.6.12 Text graphics, logos, basic animation, video clips, multiple font styles, and sizes for message capability.
    - 5.6.13 Cloud Based Control software furnished by manufacturer.
    - 5.6.14 Power is 120 VAC, 120/240 VAC, single phase.
  - 5.7 Compliance in UL listed, UL-Energy verified, and FCC compliance.
  - 5.8 Provide 1 spare, 2 inch PVC conduit from MDF room in building and stubbed up in marquee for future use. (Confirm with Division 27)
  - 5.9 Warranty: Five (5) years coverage.
  - 5.10 Marquee illumination to be controlled by timer or photo cell sensor.
  - 5.11 Marquee sign frame color to be Durango Grey or color approved by FBISD Design



- Manager.
- 5.12 Follow all architectural signage regulation of local AHJ and obtain all permits prior to construction. Design of exterior marquees to be approved by all applicable HOAs and AHJs.
  - 5.13 FBISD Design Manager to provide camera-ready logo graphics.

**END OF DIVISION 10**

# Division 11

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## Equipment

General Requirements for Equipment		11 00 00
Operation and Maintenance of Equipment		11 01 00
Vehicle and Pedestrian Equipment		11 10 00
Commercial Equipment		11 20 00
Vault Equipment		11 22 00
Residential Equipment		11 30 00
Food Service Equipment		11 40 00
Educational and Scientific Equipment		11 50 00
Laboratory Fume Hoods		11 53 13
Entertainment Equipment		11 60 00
Healthcare Equipment		11 70 00
Other Equipment		11 80 00

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### DIVISION 11 - Equipment

#### 11 00 00 - General Requirements for Equipment

- 1.0 Applicable Standards & Standards
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3  Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations.
      - 1.3.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials.
      - 1.3.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients.
      - 1.3.2.4 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials.

- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- 3.0 Requirements
  - 3.1 Select equipment with long life, high durability, and low maintenance while ensuring lowest possible up-front costs.

## **11 01 00 - Operation and Maintenance of Equipment**

- 1.0 General
  - 1.1 List Special Maintenance Agreements for FBISD in specifications, including providing sample agreement forms and durations. Reference Division 32 – Exterior Improvements.

## **11 10 00 – Vehicle and Pedestrian Equipment**

- 1.0 Coordinate all equipment with FBISD Project Manager and Facilities.
- 2.0 Loading Dock Bumpers
  - 2.1 Provide laminated/stacked recycled tire tread type with galvanized steel angle anchor plates. Anchor to concrete foundation, not to building structure.
- 3.0 Pedestrian Control Equipment
  - 3.1 Verify need for metal detectors with FBISD Project Manager and Police. These come with specific power requirements.

## **11 20 00 - Commercial Equipment**

- 1.0 Vending Equipment
  - 1.1 Information on where to provide Owner-Furnished Vending Equipment is included within Facility Educational Standards.
- 2.0 Ice Machines and Ice Bin
  - 2.1 Undercounter with legs, stainless steel, minimum 425 lbs ice production, chewlet cube type.
  - 2.2. Basis of Design Manufacturer: Manitowoc.
    - 2.2.1 Other approved manufacturers:
      - 2.2.1.1 Follett, LLC.
      - 2.2.1.2 Scotsman.
      - 2.2.1.3 Hoshizaki.
- 3.0 Commercial Laundry Equipment
  - 3.1 Information on where to provide Commercial Laundry Equipment locations are included within Facility Educational Standards.
  - 3.2 Commercial Washer and Dryer - Contractor Furnished, Contractor Installed.
  - 3.3 Laundry Carts - Contractor Furnished, Contractor Installed.
  - 3.4 Washer-Extractor
    - 3.4.1 Construction: Stainless Steel: ASTM A666, Type 304 with No. 4 finish (directional satin finish) on exposed surfaces.
    - 3.4.2 Electric, 480 volts, 3-phase, microprocessor control, 40 lb. capacity, minimum extractor force 140 g-factor.

- 3.4.3 Approved manufacturers:
  - 3.4.3.1 Speed Queen
  - 3.4.3.2 Unimac
  - 3.4.3.3 Huebsch
  - 3.4.3.4 Comparable product approved by FBISD Design Manager.
- 3.5 Dryer
  - 3.5.1 Construction: Heavy duty embossed steel with electrostatically applied baked enamel finish.
  - 3.5.2 Control System: Programmable microprocessor with 8 auto drying cycles, ability to time dry, and to dry to selectable moisture percentage setting, including variable temperature settings and wrinkle free at end of cycle until door opens or maximum of 60 minutes.
  - 3.5.3 Electric preferred, Natural gas coordinate with FBISD Project Manager, 208/240 3 -phase, 55 lb. capacity. Dual, manual timer.
  - 3.5.4 Approved Manufacturers:
    - 3.5.4.1 Speed Queen
    - 3.5.4.2 Unimac
    - 3.5.4.3 Huebsch
    - 3.5.4.4 Comparable product approved by FBISD Design Manager.
- 4.0 Laundry Carts
  - 4.1 Dandux Vinyl-coated (Gloss-tex), 10 bushel, extra duty steel truck with casters and basket or Owner approved equal.
- 5.0 Façade Access Equipment
  - 5.1 Window washing anchors and systems where required. Confirm with FBISD Project Manager.
- 6.0 Photographic Processing Equipment
  - 6.1 Now all digital equipment. Verify Equipment with FBISD Design Manager. Provide adequate power.
- 7.0 Equipment (Computers, Printers, Copiers, Fax Machines)
  - 7.1 By FBISD Purchasing. Refer to Facility Educational Standards for locations to coordinate data and power requirements.

## **11 22 00 – Vault Equipment**

- 1.0 Safe to be Owner Provided, Owner Installed. Refer to Ed Specs for location, but provide in location where visible from entry door (provide partition wall to conceal from view)
- 2.0 All safes are delivered as right-hand reverse. Therefore, placement in the room is of utmost importance. Ensure that there is ample space for the opening of the door.
- 3.0 Elementary schools – Dimensions are 18" w x 16" d x 25" h (inside dimensions), 25" w x 28" d x 32" h (exterior dimensions). Allow minimum 4" clearance around safe for move-in.
- 4.0 Due to weight of safe (1400 pounds approx.), accommodations to slab must be made. Verify exact size and weight of safe with FBISD Design Manager. Confirm with FBISD Business and Finance.
- 5.0 Middle schools – Dimensions are 21" w x 20" d x 45" h (inside dimensions), 28" w x 32" d x 52" h (exterior dimensions). Allow minimum 4" clearance around safe for move-in. Due to weight of safe (2800 pounds approx.), accommodations to slab must be made. Verify exact size and weight of safe with FBISD Design Manager. Confirm with FBISD Business and Finance.

- 6.0 High schools – Dimensions are 28" w x 18" d x 65" h (inside dimensions), 35" w x 30" d x 72" h (exterior dimensions). Due to weight of safe (3600 pounds approx.), accommodations to slab must be made. Verify exact size and weight of safe with FBISD Design Manager. Confirm with FBISD Business and Finance.
- 7.0 All school kitchens – Dimensions are 14" w x 12" d x 18" h (inside dimensions), 21" w x 24" d x 25" h (exterior dimensions). Due to the weight of the safe (950 pounds approx.), accommodations to slab must be made. Verify exact size and weight of safe with FBISD Design Manager. Confirm with FBISD Business and Finance.

## 11 30 00 - Residential Equipment

- 1.0 General
  - 1.1 Refer to Facility Educational Standards for equipment quantities and locations.
  - 1.2 Residential Equipment to be Contractor Furnished, Contractor Installed except as noted. Clearly indicate in drawings and specifications prior bidding.
  - 1.3 Architect to ensure that all appliances are ADA/TAS compliant. Verify current Model numbers provided for reference.
  - 1.4 All finishes for residential appliances to be white unless otherwise noted.
- 2.0 Residential Kitchen Appliances
  - 2.1 Approved Manufacturers:
    - 2.1.1 General Electric.
    - 2.1.2 Whirlpool Home Appliances.
  - 2.2 Refrigerator/Freezer. Model: WRS315SNHW
    - 2.2.1 Basis of Design Manufacturer: Whirlpool
    - 2.2.2 Typical Size: 69-5/8" H x 33-5/8" D x 35-7/8" W.  
Depth with Door Open 90°: 49-5/16"  
Cutout Dimensions: Allow extra 1/2" on sides and top Allow extra 1" on rear
    - 2.2.3 Side-by-Side Refrigerator : Freestanding, two-door unit with LED Interior lighting; Electronic Temperature Controls; Frameless Glass Shelves, Adaptive Defrost, Humidity-Controlled Crispers. 4 Interior Refrigerator shelves and 2 Fixed, 3 Adjustable Refrigerator Door Bins; 4 freezer Shelves, 4 fixed freezer door bins
      - 2.2.3.1 Capacity
        - 2.2.3.1.1 Total volume: 25.1 cubic feet.
        - 2.2.3.1.2 Refrigerator volume: 15.46 cubic feet
        - 2.2.3.1.3 Freezer volume: 9.61 cubic feet capacity.
  - 2.3 Under Counter Refrigerator
    - 2.3.1 Provide keyed lock if located within public area.
    - 2.3.2 Max Height of Unit: 32 1/2".
    - 2.3.3 Approved Manufacturers:
      - 2.3.3.1 AccuCold
      - 2.3.3.2 Summit Appliance
  - 2.4 Wall Oven & Convection Oven
    - 2.4.1 Electric.
  - 2.5 Cooktop
    - 2.5.1 Electric, standard exposed element burner type.
  - 2.6 Exhaust Hood – Provide at ALL cooktops/range. Vent to outside. Provide separate switch. Coordinate fire protection with AHJ. DO NOT USE combination

- hood/microwave unit.
- 2.7 Oven/Range Combination – Electric, unless otherwise approved by FBISD Design Manager.
- 2.8 Microwave – If countertop, Owner Furnished, Contractor Installed. Contractor to coordinate location with electrical. If microwave is mounted within casework, Contractor Furnished, Contractor Installed. Provide adequate clearances. Do not combine with exhaust hood.
  - 2.8.1 For accessibility, coordinate countertop microwave power requirements below upper cabinet microwave.
    - 2.8.1.1 (1.8) cu. ft. capacity; 1100 watts; Electronic touch controls; Electronic clock/ timer; 10 power levels; Revolving turntable; Child lock- out; 120v, 15a.
- 2.9 Under Counter Dishwasher (high temp.)
  - 2.9.1 Bosch 300 series.
    - 2.9.1.1 Coordinate temperature requirement with AHJ and verify ADA compliance.
    - 2.9.1.2 Provide white finish typical except at science or specialty locations provide stainless.
    - 2.9.1.3 Include power and connections for future dishwasher at all science areas.
    - 2.9.1.4 Provide air gap/vent, connect to dishwasher drain line. Ensure located adjacent to sink so that water drains into sink in the event of clog.
- 2.10 Disposal
  - 2.10.1 Provide disposal at sinks located at food prep areas. Coordinate locations with Facility Educational Standards and verify accessibility clearances.
  - 2.10.2 3/4 horsepower.
- 3.0 Residential Laundry Appliances
  - 3.1 Approved Manufacturers:
    - 3.1.1 General Electric.
    - 3.1.2 Whirlpool Home Appliances.
  - 3.2 Residential Washer and Dryer
    - 3.2.1 Contractor Furnished, Contractor Installed
    - 3.2.2 Refer to Facility Educational Standards for locations, type, and quantities.
    - 3.2.3 At stackable units required by Facility Educational Standards, reduced capacity acceptable.
    - 3.2.4 Heavy duty models are to be roughly 17 cu. ft. capacity or greater.
    - 3.2.5 The washer is to be 120V.
    - 3.2.6 The dryer is to be a 208/240 V single phase.

## **11 40 00 - Food Service Equipment**

- 1.0 General
  - 1.1 FBISD Design Manager to coordinate with Child Nutrition department during design. FBISD Design Manager and Child Nutrition to approve any substitutions and/or modifications.
    - 1.1.1 Child Nutrition department to review submittals prior to approval by Architect.
    - 1.1.2 Child Nutrition department to attend health inspection reviews.



- 1.1.3 All food equipment to be stainless steel.
- 1.1.4 Factory startup and final inspection for all Food Service Equipment.
- 1.2 Receiving
  - 1.2.1 In lieu of can wash, install hot and cold water mixing faucet with hose connections within a 3' x 3' area that is depressed 1 ½" with all sides sloped to drain. At perimeter of depressed area, ramp up paving so that an extra 1 ½" height is added. Connect the drain to the grease trap.
  - 1.2.2 Consider COVER over Can Wash.
  - 1.2.3 The drain in the service yard should be located near the kitchen wash-down area.
  - 1.2.4 The receiving door to be provided with a peep hole so the employees can see who is trying to gain access to the facility. Provide door bell and card reader.
  - 1.2.5 The receiving door to be a minimum of 48" wide. No visible outside light can be seen from the inside when the door is shut.
  - 1.2.6 If receiving door has direct access to outdoors, an air screen to be incorporated above the door. Preferably on the outside of the building.
  - 1.2.7 The receiving area to be provided with an audible alarm that can be heard in the manager's office as well as throughout the kitchen area. The push button switch to be located on the exterior of the building next to the receiving door.
  - 1.2.8 A canopy is required above the receiving door. Canopy to be large enough to protect the delivery person and the product from rain, etc.. Bollards to be provided to prevent damage from delivery trucks.
  - 1.2.9 Delivery trucks must have a viable delivery zone. Must have proper clearance for maneuvering around and be able to get within 15' maximum from the receiving door.
  - 1.2.10 Proper lighting is required at the receiving area for employee safety.
  - 1.2.11 The manager's office to be located near the receiving door. Office to have windows to oversee the receiving door as well as the kitchen. The office to be sized to accommodate the number of employees that will be using it.
  - 1.2.12 Restroom and locker area is required. It is required the kitchen staff has a dedicated restroom / locker area within the kitchen. The locker room is for storing personal items only, no changing. A unisex restroom is acceptable. Size of rooms driven by ADA requirements. Reference the Ed Specs for locker quantity and style.
- 1.3 Laundry/ Mop Room
  - 1.3.1 A laundry / mop room is required for kitchen use only. Size to accommodate full size clothes washer and dryer, mop sink, chemical shelving and mop buckets. Broom and mop hangers for a minimum of Twelve (12) hangers to be provided in the contract.
- 2.0 Storage
  - 2.1 Cold storage assembly to be floorless assemblies whenever possible with tiled flooring to match the kitchen floor with a smooth transition and threshold to be smooth and level. Layout to maximize shelving capacity. Shelving to be Four (4) tier high with 74" high posts. Dunnage racks required, quantity is project dependent.
  - 2.2 Dry storage to be tiled to match kitchen floor with a smooth transition and threshold. Shelving layout to be designed for maximum capacity. Provide space for safe (provided in contract) and small desk for counting the money. Shelving to Five (5) tier high with 86" high posts. Dunnage racks required, quantity is project dependent. Coordinate unique, master keying cylinder with FBISD Design Manager.

- 2.3 Non-food storeroom may be required to store breakfast carts. Depending on how the school operates their breakfast program, additional storage may be required for rack storage.
- 3.0 Preparation / Production
- 3.1 Specify the following grades of stainless steel:
- 3.1.1 Working areas: Type 304 14 gauge.
    - 3.1.1.1 Hoods: Type 304 18 gauge.
    - 3.1.1.2 Under and over shelves: Type 304 16 gauge.
    - 3.1.1.3 Legs are also to be stainless steel.
- 3.2 Kitchen disposals:
- 3.2.1 Basis of Design Manufacturer: BusBoy, 2hp or 3hp, 208V, three phase.
  - 3.2.2 Salvador kitchen disposals are not preferred.
- 3.3 Stainless steel bakers tables with Three (3) drawers closed base section with remainder being open for ingredient bins. Minimum of Four (4) ingredient bins
- 3.4 One (1) 60 qt. floor mixer (All Schools) and One (1) 20 qt. mixer with stand (M.S. and H.S.).
- 3.5 Proofer/Heated Cabinet on middle schools and high schools, not required on elementary schools.
- 3.6 Food processors required on middle schools and high schools, not required on elementary schools.
- 3.7 Two compartment sink with disposer and utensil rack. Sink compartments to be minimum of 24" x 26" x 15" deep with "Richlite" sink covers or comparable product approved by FBISD Design Manager. Provide One (1) hose bib assembly and undershelf.
- 3.8 Worktables to have drawer assemblies with locking hasps, undershelves and overshelves (where applicable). Tables with built-in utilities to bolted to floor. Quantity and sizes dependent on room layout.
- 3.9 Exhaust hoods are preferred to be standard exhaust.
- 3.10 District prefers Blodgett convection ovens. Standard to be bakery depth. Typically Two (2) units in the elementary schools, Six (6) units in both the middle schools and high schools. All units to be double stacked. This quantity is subject to population.
- 3.11 Combi Ovens: Typically One (1) unit in the elementary schools, Two (2) units in the middle schools and Three (3) units in the high schools. This quantity is subject to population.
- 3.11.1 Basis of Design Manufacturer: Rational.
- 3.12 All schools require One (1) six burner range. All ranges provided with electronic ignition and flame failure.
- 3.12.1 Basis of Design manufacturer: Southbend.
- 3.13 All schools typically get One (1) tilt braising pan with power tilt feature.
- 3.13.2 Basis of Design manufacturer: Groen.
- 3.14 Trench liners are preferred at tilt braising pans.
- 4.0 Warewash
- 4.1 A three compartment sink is required and to be parallel, "L-shape" configuration is not acceptable. The sink should include a disposer with pre-rinse, all three (3) sinks to be 30" x 26" x 15" deep.
- 4.2 The clean and soiled dishtables to be integrally connected with a rack return track that extends behind the conveyor style dish machine. Rack return to be designed per FBISD's standard requirements. Tray drop to be ADA compliant with stainless steel roll down door. Dishtables to turn down into the dish machine and to be sloped to dish

machine to eliminate standing water on drainboards.

- 4.3 All schools to have a pass-thru window with a trash receptacle. The window to be located next to the tray drop window and is to be trimmed out like the tray drop window.
    - 4.3.1 Silverware chute to be located under the tray drop. Coordinate with Division 11 – Equipment under Library Equipment.
  - 4.4 Ware washrooms to have a wall mounted hose reel or under counter mounted hose bib for wash down.
  - 4.5 Coordinate the heights of the roll-down door opening at the tray wash area, the tray chute, the wash tray, and tray bin. Refer to Appendix for Diagram 11\_01.
    - 4.5.1 14 gauge stainless steel sloping trash chute. 12" wide x 10" high, set into wall opening with the bottom edge at 40" from floor. Chute to be of sufficient length to discharge into trash container and be constructed same as for silver chute.
    - 4.5.2 14 gauge stainless steel sloping silver chute as per drawings.
    - 4.5.3 Silver chute is below the Tray Drop, and the mobile silverware bin is below this. This is what requires coordination as to height of silver chute in wall, below tray drop, and the mobile bin. Refer to Appendix for Diagram 11\_02 for example photo.
- 5.0 Serving
- 5.1 Prefer combination Servo-Lift mobile tray stacking space, round cutlery bins and napkin dispenser station inserts, Model A2TCA-SN-B as basis of design. Trays are 10" x 14" and napkins are 4 ¼" x 7 ½".
  - 5.2 Menu board system:
    - 5.2.1 One menu board per serving line for all school types (minimum of 36 inches).
    - 5.2.2 Coordinate mounting kits required (Ceiling vs. Wall) Coordinate location with FBISD Design Manager and Child Nutrition.
    - 5.2.3 Power and data required in ceiling.
- 6.0 Serving counters; per line.
- 6.1 Refer to Appendix for Diagram 11\_03 for example photo.  
Elementary Schools: Double serving counter with Two (2) Five (5) hot food wells, Two (2) flat area to pass trays, Two (2) fold down work shelves, Two fold down plate shelves, a combination frost tops and two tier dual temperature shelves, flat counter, beverage counter / milk coolers and Two (2) cashier counters.
  - 6.2 Middle Schools: Two (2) Double counters made up of Two (2) Five (5) hot food wells, fold down work shelves, fold down plate shelves, a combination of Four (4) pan refrigerated cold pans and two tier, dual temperature shelves. Provide Two (2) beverage dispensers, Two (2) ice cream dispensers and One (1) double cashier unit. The M.S. also have One (1) snack bar counter that is separate from the traditional counters.
  - 6.3 High Schools: Typically Three (3) double serving counters. Counters to be a mix of hot food wells, fold down work shelves, heated merchandisers, refrigerated cold pans and two tier, dual temperature shelves, flat top counters, ice cream dispensers, beverage dispensers and double cashier units. Counters will be menu driven.
  - 6.4 Middle schools and high schools require stainless steel guide rails to contain and direct student flow throughout the serving area.
  - 6.5 Elementary and middle schools typically have pass-thru holding cabinets with universal angle iron slides on 3" centers. Stainless steel exterior and interiors. Dutch doors with locks on each door. Electrical and thermostats to be located on kitchen side of unit.

- 6.6 High schools have roll through hold cabinets with dutch doors on the serving side. Stainless steel exterior and interiors. Ramps at remodeled schools and recessed slabs for level transition at new construction. Ramps, electrical and thermostat all on kitchen side.
- 6.7 Provide a large ice cream dispensing cabinet behind the elementary counters.
- 6.8 Middle schools and high schools are provided with stainless steel back counters. Coordinate open / closed base construction with individual project needs/design.
- 6.9 High school to be designed with display cooking. Provide one (1) double stacked conveyor oven within visual range of students. A double stacked conveyor oven is required at the middle schools too, but can be located within the production area.
- 6.10 Mobile Serving carts provided at Middle and High Schools. Provide for self-contained, mobile POS, hot or cold service.
- 7.0 Foodservice Storage Equipment
  - 7.1 Refrigerated Food Storage Cases
    - 7.1.1 Cabinets to have stainless steel exteriors and interiors. Dutch doors with locks and field reversible hinges. Stainless steel adjustable feet. Two (2) years parts and labor warranty and Five (5) year compressor warranty. Pass-thru units: controls and electrical connections to be located on kitchen side not facing the students.
  - 7.2 Walk-In Coolers
    - 7.2.1 Units to be sized per population. Exposed exterior to be stainless steel with high diamond tread plate up to 3'-0" AFF. Interior walls to be embossed aluminum. Walls to be white embossed smooth ceiling panels. Inside clearance to be 8'-6" from finished floor. Walk-in to be located within a recess pit with the flooring to match kitchen floor material. Provide a minimum air gap of 2" between walk-in panels and building walls. Provide 50 fc (lm/ft<sup>2</sup>) lighting. All panels must meet local and federal codes.
    - 7.2.2 Basis of Design Manufacturers: American Panel.
    - 7.2.3 Other approved manufacturers:
      - 7.2.3.1 Thermokool.
      - 7.2.3.2 Kolpak.
  - 7.3 Walk-In Freezers
    - 7.3.1 Units to be sized per population. Exposed exterior to be stainless steel with high diamond tread plate up to 3'-0" AFF. Interior walls to be embossed aluminum. Walls to be white embossed smooth ceiling panels. Inside clearance to be 8'-6" from finished floor. Walk-in to be located within a recess pit with the flooring to match kitchen floor material. Provide a minimum air gap of 2" between walk-in panels and building walls. Provide 50 fc (lm/ft<sup>2</sup>) lighting. All panels must meet local and federal codes. Confirm with current codes.
    - 7.3.2 Basis of Design Manufacturers: American Panel.
      - 7.3.2.1 Other approved manufacturers:
        - 7.3.2.1.1 Thermokool.
        - 7.3.2.1.2 Kolpak.
    - 7.3.3 Threshold from cooler floor to kitchen floor to be smooth and leveled.
  - 7.4 Foodservice Shelving
    - 7.4.1 Cold storage shelving to be Four (4) tier high open grid shelving with 74" high posts. Shelving to be high dense polymer with steel re-enforced framing.

Shelving overlays to be dishwasher safe.

7.4.2 Dry storage shelving to be Five (5) tier high open grid shelving with 86" high posts. Shelving to be high dense polymer with steel re-enforced framing. Shelving overlays to be dishwasher safe.

7.4.3 Pot & pan shelving to be four (4) tier high open grid shelving with 62" high posts. Four (4) NSF approved non-marking swivel locking casters. Security screen with locking doors around entire shelving unit. Shelving to be high dense polymer with steel re-enforced framing. Shelving overlays to be dishwasher safe.

## 8.0 Food Preparation Equipment

### 8.1 Food Preparation Appliances

8.1.1 All schools require a 60 qt. floor mixer, Slicer w/ stand, mobile ingredient bins, worktables, can opener, prep sinks and at least One (1) disposer. Refer to above for further information.

### 8.2 Food Preparation Surfaces

8.2.1 All working surfaces to be 14 gauge 304 stainless steel. Overshelves and undershelves to be 16 gauge 304 stainless steel. All legs to be stainless steel and adjustable. Flanged feet to be stainless steel with rust-resistant fasteners securing them to the floor. Radius counter corners. Prep counters with sinks to be marine edge, baker's tables to be equipment with stainless steel flour troughs along the entire front and standard worktables to have 2" square turn downs. Worktables adjacent to walls to have stainless steel backsplashes secured to adjacent wall and sealed.

## 9.0 Food Delivery Carts

9.1 Heavy duty 18 gauge stainless steel utility carts with two (2) swivel casters and two (2) fixed. three (3) shelves, 700 lb capacity with extended perimeter bumpers. Four (4) at the elementary schools, eight (8) at the middle schools and high schools. Confirm final count with FBISD Design Manager and FBISD Child Nutrition for each project.

9.2 Universal angle pan racks, fully welded aluminum framing with four (4) NSF approved non-marking casters - two (2) of which with brakes. Adjustable angle iron slides. Perimeter bumpers and enclosed base. Omit bumpers and provide heat resistant casters on roll-in racks.

## 10.0 Food Cooking Equipment

10.1 All gas equipment to be provided with 4'-0" long dual swivel gas quick disconnect hoses with 3'-0" long wall restraint cables.

### 10.1.1 Commercial Ranges

10.1.1.1 On six (6) burner ranges, provide convection oven base with stainless steel front and sides. Provide 5" high flue at rear.

10.1.1.2 All ranges to be equipment with electronic ignition with flame failure kits. Stainless steel modular bases on ranges too small for oven bases. Stainless steel adjustable legs. Rear gas connection, cap and cover front manifolds.

### 10.1.2 Commercial Ovens

10.1.2.1 Double convection ovens with glass doors, stainless steel front and sides. Five (5) oven racks per oven. Stainless steel adjustable legs.

10.1.2.2 Basis of Design manufacturer: Blodgett.

- 11.0 Food Dispensing Equipment
  - 11.1 Serving counter configuration may change due to building constraints, but the standard components described prior must be incorporated into each design.
- 12.0 Service Line Equipment
  - 12.1 CounterCraft is an approved alternate manufacturer. Stainless steel fold down tray slides and plastic laminate removable front panels. NSF non-marking adjustable swivel casters with brakes. Stainless steel finished end panels. Individual electrical connects, no daisy chains. Single tier with heat lamps and display lights at hot food counters and two tiers with display lights at cold food.
  - 12.2 Breath protectors to meet current code requirements. Integral to counters. Fully adjustable for height and tilt to allow functionality for full service and self-service.
  - 12.3 Basis of Design manufacturer: Mod-U-Serve MCT series counters.
- 13.0 Ice Machines
  - 13.1 Locate a drain under ice machine. Power, drain and water supply must be within 10' of ice machine. Machine must work with all industry standard dispensers and bins; ensure machine and bin provided work together. Provide flake or cube as designated.
    - 13.1.1 Cube:
      - 13.1.1.1 Ice-makers are air-cooled, corrosion-proof, 304 stainless steel inside and out, electro-mechanical controls, R-404A non ozone-depleting refrigerant, classic cube shape.
    - 13.1.2 Bin:
      - 13.1.2.1 Bin is low- profile, insulated, with polyethylene bin liner, and has adjustable legs for leveling.
    - 13.1.3 Kitchen:
      - 13.1.3.1 Elementary and middle schools get One (1) ice maker on model number B-570 ice bin. Ice makers are air-cooled, corrosion-proof, 304 stainless steel inside and out, electro-mechanical controls, R-404A non ozone-depleting refrigerant, half dice cube. Stainless steel adjustable legs. Cord and plug assembly.
      - 13.1.3.2 High schools get One (1) ice maker on ice bin. Ice makers are air-cooled, corrosion-proof, 304 stainless steel inside and out, electro-mechanical controls, R-404A non ozone-depleting refrigerant, half dice cube. Stainless steel adjustable legs. Unit to be hard wired with an adjacent electrical disconnect switch. Provide One (1) stainless steel trench liner in front of unit. Provide One (1) ice caddy with Six (6) totes.
      - 13.1.3.3 All ice makers to come with an pre-filter and water filter system sized for the associated ice maker. The water supply to filter to be hard copper plumbed. Provide a 60" long stainless steel beaded flex hose from water filter to ice maker. Water filter to be in an easily accessible location so that a typical kitchen worker will be able to change the filters.
  - 13.2 Basis of Design Ice Machine and Ice Bin manufacturer: Manitowoc.
  - 13.3 Basis of Design Pre-Filter manufacturer: Everpure.
  - 13.4 Basis of Design Ice Caddy manufacturer: Follett.
- 14.0 Cleaning and Disposal Equipment
  - 14.1 Prep area should have at least one (1) 3hp, 208V, three phase disposer. The Warewash area should have at least one (1) 5hp, 208V, three phase disposer.

- 14.2 Each school should get one (1) Hatco C-30 compact booster heater interconnected to the dish machine. Unit is recommended to be 480V, three phase, but is dependent on field conditions.
- 14.3 Coordinate with FBISD Project Manager on a project by project basis.
- 15.0 Commercial Dishwashers
  - 15.1 Elementary and middle schools require one (1) Hobart Model No. CL44e conveyor with vent cowls. 15 KW tank heater, single point connection 480V, three phase when available, drain tempering kit, table limit switch and vent fan control switch. Chamber height to accommodate sheet pans. Unit to be interconnected to adjacent booster heater.
  - 15.2 High schools require one (1) conveyor with vent cowls. 15 KW tank heater, single point connection 480V, three phase when available, drain tempering kit, table limit switch and vent fan control switch. Chamber height to accommodate sheet pans. Unit to be interconnected to adjacent booster heater.

## **11 50 00 - Educational and Scientific Equipment**

- 1.0 Library Equipment
  - 1.1 General
    - 1.1.1 For locations and quantities for to Facility Educational Standards.
  - 1.2 Book Depositories (Book Drop) & Book Truck
    - 1.2.1 Provide at all book drops except circulation desk.
    - 1.2.2 The depressible booktruck would be used as the standard at all new circulation desks at all ES, MS and HS. For circulation desk book drop, construction to match millwork. The depressible book truck fits under the book drop slot at the circulation desk.
    - 1.2.3 Book Truck to be provided and installed by contractor. Coordinate height of book drop with depressible book truck and circulation desk.
      - 1.2.3.1 Basis of Design Manufacturer: Tesco Industries.
      - 1.2.3.2 Other Approved Manufacturer: Demco, Inc.
    - 1.2.4 Book drop slot to be 18" x 4" minimum. Coordinate interior height of book drop with book truck height.
- 2.0 Audio-Visual Equipment
  - 2.1 FBISD Project Manager to coordinate audio-visual equipment with FBISD IT Department. Size of projection screens to be verified by FBISD IT.
  - 2.2 Projection Screen Sizes
    - 2.2.1 Elementary Schools:
      - 2.2.1.1 For Library: 69 inches x 110 inches.
      - 2.2.1.2 For Cafeteria: 110 inches x 176 inches.
      - 2.2.1.3 For Classrooms: 139 inches x 78 inches with 12 inch black drop.
    - 2.2.2 Middle Schools:
      - 2.2.2.1 For Library: 69 inches x 110 inches.
      - 2.2.2.2 For Cafeteria: 110 inches x 176 inches.
      - 2.2.2.3 For Classrooms: 139 inches x 78 inches with 12 inch black drop.
    - 2.2.3 High Schools:
      - 2.2.3.1 For Library: 69 inches x 110 inches.
      - 2.2.3.2 For Cafeteria: 183.50 inches x 250 inches with 24 inch black drop.
      - 2.2.3.3 For Classrooms: 139 inches x 78 inches with 12 inch black drop.



#### 2.2.3.4 Reference Appendix for Diagram 11\_05.

- 2.3 Projection Screens
  - 2.3.1 Manual projection screens and ceiling-mounted brackets/clips to be provided and installed by Contractor. Coordinate location with FBISD Design Manager. Marker boards shall be used in classrooms at projector screen locations in lieu of projection screens. Please refer to the Facility Educational Standards for locations.
    - 2.3.1.1 Approved manufacturers
      - 2.3.1.1.1 Da-Lite
      - 2.3.1.1.2 Draper.
  - 2.3.2 Motorized projection screen: Ceiling recessed mount.
    - 2.3.2.1 Coordinate location of controls with FBISD Project Manager.
    - 2.3.2.2 At primary and secondary schools, projection screens located at public location shall be keyed.
    - 2.3.2.3 Basis of Design for High School: Professional 295D, Matte White as manufactured by Da-Lite Electrol.
    - 2.3.2.4 Approved Manufacturer: Draper
    - 2.3.2.5 All motorized screens to have a twist lock plug.
- 3.0 Projectors
  - 3.1 Refer to Division 27 as well as Current Facility Educational Standards (Technology Requirements).
- 4.0 Players and Recorders
  - 4.1 Refer to other divisions for sound systems (Division 27).
- 5.0 Audio-Visual Equipment Supports
  - 5.1 Television Bracket, refer to Division 27.
    - 5.1.1 Contractor Furnished, Contractor Installed.  
Coordinate size, type, location, and quantities with FBISD Project Manager and IT Department. Finalize coordination prior to bidding.  
Verify and coordinate accessibility requirements (objects may not protrude more than 4"). Consider furr out under or around TV to eliminate potential violations.
    - 5.1.2 Vertical sliding bracket to be mounted at 27" at lowest position.
- 6.0 Laboratory Equipment
  - 6.1 General
    - 6.1.1 Locate all equipment, including Owner-Furnished Safety Equipment, on plans, for coordination with electrical as well as to ensure proper clearances.
    - 6.1.2 Refer to FBISD Facility Educational Standards for quantities and locations.
  - 6.2 Lab Tables
    - 6.2.1 Owner Furnished, Contractor Installed.
  - 6.3 Eye Wash
    - 6.3.1 Contractor Furnished, Contractor Installed.  
Provide "swing" eye wash fixture at counter-top laboratory application similar to Bradley S19-270B. No hand-held eye wash.
  - 6.4 Emergency Shower
    - 6.4.1 Contractor Furnished, Contractor Installed.  
Provide Combination Drench Shower and Eye/Face Wash Unit similar to Bradley S19-310FW with plastic head and bowl. Consider use of recessed



- fixture.
    - 6.4.2 Do not provide self-closing valves.
    - 6.4.3 Provide floor drain at each emergency shower.
    - 6.4.4 Contractor to provide drench shower tester, Bradley Model # S19-330ST or equal.
  - 6.5 Fire Blanket and Cabinet
    - 6.5.1 Contractor Furnished, Contractor Installed.
    - 6.5.2 Architect to show detail of locations on construction documents so that equipment is installed in order to coordinate fully with utilities, exiting and ADA/TAS clearances and requirements.
    - 6.5.3 Flinn Scientific, Model SE3006.
  - 6.6 Glassware Drying Rack
    - 6.6.1 Contractor Furnished, Contractor Installed.
    - 6.6.2 Coordinate location and quantities with FBISD Project Manager.
  - 6.7 First Aid
    - 6.7.1 Contractor Furnished, Contractor Installed.
  - 6.8. Laboratory Controlled-Environment Cabinets.
    - 6.8.1 Acid Storage and Flammable Storage: Contractor Furnished, Contractor Installed.
      - 6.8.1.1 Flinn cabinets acceptable.
      - 6.8.1.2 Do not vent either cabinet.
      - 6.8.1.3 Acceptable to use flammable/acid storage combination cabinet.
  - 6.9 Biological Safety Cabinets
    - 6.9.1 Goggle Sanitizer: Contractor Furnished, Contractor Installed.
      - 6.9.1.1 Architect to show detail of locations on construction documents so that equipment is installed in order to coordinate fully with utilities, exiting and ADA/TAS clearances and requirements.
      - 6.9.1.2 Design Basis: Flinn Scientific, Model SE1000 with Owner provided Flinn Scientific, Model AP3309 goggles, fog free and vented.

## **11 53 13 - Laboratory Fume Hoods**

- 1.0 Approved Manufacturers:
  - 1.1 Air Master Systems Corporation
  - 1.2 Bedcolab Ltd.
  - 1.3 Hanson Lab Furniture, Inc.
  - 1.4 Mott Manufacturing
  - 1.5 Kewaunee Scientific

## **11 60 00 - Entertainment Equipment**

- 1.0 Theater and Stage Equipment
  - 1.1 This section shall encompass some or all of the following subdivisions depending on the school and the situation. Each company shall be responsible for their work and coordination with others related to the stage equipment, so that the systems shall be integrated with one another.
    - 1.1.1 Recommended Theatrical Systems dealer and installers:
      - 1.1.1.1 Texas Scenic Company, San Antonio, TX.
      - 1.1.1.2 TechLand Houston.
      - 1.1.1.3 JR Clancy.

- 1.1.1.4 StageLight.
  - 1.1.1.5 MainStage Theatrical Supply
  - 1.1.1.6 Comparable product approved by FBISD Design Manager.
- 1.2 This contractor or his representative, fully knowledgeable and qualified in systems operation, shall provide a minimum of eight (8) hours of on-site instruction to the Owner-designated personnel on the use and operation of this System. Instruction shall be provided at each campus separately. For high schools, an additional eight (8) hours of on-site instruction shall be reserved for one year after substantial completion. Designated instruction times shall be arranged through the FBISD Project Manager. One (1) hour of instruction required at Elementary School projects.
- 1.3 Obtain all permits necessary for the execution of any work pertaining to the installation, and conform in all trades with all applicable local codes and with the National Electric Code. Obtain all permits necessary for operation of any equipment by the Owner.
- 2.0 Warranty
  - 2.1 The Contractor shall guarantee all of the work that is performed under this contract, including all materials, and workmanship, for a period of one (1) year from the date of full acceptance of the work. Lamps for lighting fixtures shall be guaranteed against premature failure for thirty (30) days after date of Substantial Completion (excludes lamps left on continuously).
- 3.0 Acoustic Shells
  - 3.1 Goal:
    - 3.1.1 To provide multi-purpose auditorium stages with concert hall like acoustical reflection attributes while also providing a high end look and feel to Concert Performances. The Acoustic Shell system reflects the sound out to the audience and at the same time reflects sound from performers on one side of the stage, to the other, allowing all performers to better hear each other and therefore be in sync with each other.
  - 3.2 General Equipment
    - 3.2.1 General Acoustic Shell Panel Construction
      - 3.2.1.1 Materials
        - 3.2.1.1.1 (3/16") Hardboard skin or 1/4" Veneer Plywood skin (optional)
        - 3.2.1.1.2 (1-1/2") Paper Honeycomb panel core Overall panel thickness 2".
      - 3.2.2 Towers (side walls)
        - 3.2.2.1 Construction and Materials:
          - 3.2.2.1.1 Extruded aluminum frame, with steel connections Self-lubricating nylon hinges.
          - 3.2.2.1.2 Aluminum trim strip width, 4".
          - 3.2.2.1.3 Tower widths available – 10', 12', 14', Custom 6" casters and 6" leveling pads.
          - 3.2.2.1.4 Choose either electric air or wheeled tower mover.
      - 3.2.3 Ceiling Panels
        - 3.2.3.1 Construction and Materials
          - 3.2.3.1.1 Extruded aluminum frame, steel connections and hanger arms.
          - 3.2.3.1.2 Self-lubricating nylon hinges

- 3.2.3.1.3 Lighting to be integrated into ceilings. Quantity of fixtures based on design.
    - 3.2.3.1.4 Lighting Raceway to be integrated into shell design.
    - 3.2.3.1.5 Performance angle to be infinitely adjustable.
    - 3.2.3.1.6 Hanger Arms to be aligned with rigging lines, no set positions.
    - 3.2.3.1.7 Hanger arm attaches with turnbuckle and full batten clamp.
  - 3.2.4 Pre-Approved Manufacturer and Product
    - 3.2.4.1 Wenger Corporation, Owatonna, MN or equal.
      - 3.2.4.1.1 Diva series acoustical shells, five (5) years Warranty.
- 4.0 Folding and Portable Stages and Pit Fillers and Risers
  - 4.1 Choral Risers
    - 4.1.1 Owner Furnished, Owner Installed.
    - 4.1.2 Goal
      - 4.1.2.1 To provide multi-level standing surface, that is easily movable from practice space to performance space, for standing choir performances. Choral Risers are suitable for primary and secondary schools.
    - 4.1.3 General Product Specifications
      - 4.1.3.1 Fold down design, easy for one person to set up.
      - 4.1.3.2 Formed and welded steel construction, black Finish.
      - 4.1.3.3 (18") wide steps.
      - 4.1.3.4 Four step models that easily will fit through standard doorway.
      - 4.1.3.5 Sturdy back rail with child-height crossbar.
      - 4.1.3.6 Optional Side rails.
    - 4.1.4 Pre-Approved Manufacturer and Product
      - 4.1.4.1 Wenger Corporation, Owatonna, MN or comparable product approved by Architect.
        - 4.1.4.1.1 Signature Choral Risers, 5 year Warranty.
  - 4.2 Seating Risers
    - 4.2.1 Owner Furnished, Owner Installed.
      - 4.2.1.1 To provide multi-level seating structures for Black Box, Band, or Choir performances for either on stage or in common multipurpose areas.
      - 4.2.1.2 General Seated Riser Specifications
      - 4.2.1.3 Decks shall be ¾" solid exterior grade plywood with black slip resistant overlay, OR 5/8" plywood core with manufacturer's standard grey carpet.
      - 4.2.1.4 Deck sizes shall be 3'x8' or 3'x6' and have 6 leg sockets locks. Heights shall be in standard 8", 16", 24", 32" Pie shape units are also available.
    - 4.2.2 Options required
      - 4.2.2.1 As required, moving carts are to store decks.
      - 4.2.2.2 Rear and side railings as required for deck design.
    - 4.2.3 Pre-Approved Manufacturer and Product
      - 4.2.3.1 Wenger Corporation, Owatonna, MN or equal.
        - 4.2.3.1.1 Versalite Seated Choral Risers, 5 year Warranty.

- 4.3 Orchestra Pit Fillers
- 4.3.1 Goal
- 4.3.1.1 To provide a stage extension, in front of the stage, or to extend the stage over an orchestra pit. If over an orchestra pit, the pit filler may need the option of lowering to the house level, to extend seating closer to the stage, if there is no knee wall or a removable knee wall.
- 4.3.1.2 Pit Fillers required at all locations where orchestra pit is provided.
- 4.4 General Equipment
- 4.4.1 General Pit Filler Construction
- 4.4.1.1 Brace and Beam construction so pit filler area under deck is more open.
- 4.4.2 General Product Specifications
- 4.4.2.1 Decking shall be honey comb construction.
- 4.4.2.2 Deck shall include acoustically dampening properties.
- 4.4.2.3 Deck shall be manufactured to connect in a simple manner to stage lip.
- 4.4.2.4 Height of pit filler shall be even with the stage floor.
- 4.4.2.5 Deck Corners shall be constructed of glass filled nylon to reduce sharp edges.
- 4.4.2.6 Basic system meets a uniform vertical load of 125 psf (57 kg.)
- 4.4.2.7 System can meet building code standards of L/360
- 4.4.2.8 Deck surface takes a point load of 500lb. on 2" caster w/o leaving permanent marks.
- 4.5 Pre-Approved Manufacturer and Product
- 4.5.1 Wenger Corporation, Owatonna, MN or equal Strata Orchestra Pit Filler.
- 5.0 Stage Rigging
- 5.1 This section includes Dead Hung (non-moving) rigging standards, Counterweight rigging standards, Motorized rigging standards, and Pipe Grids.
- 5.2 General Rigging Equipment Standards
- 5.2.1 All turnbuckles, clips, tracks, chains and other items of incidental hardware shall be furnished plated or painted. Wire rope shall be galvanized. Fasteners, chain, and other miscellaneous hardware shall be either cadmium or zinc plated.
- 5.2.2 All materials used in this project shall be new, unused and of the latest design. Refurbished materials are not permitted.
- 5.2.3 In order to establish minimum standards of safety, a minimum factor of 8 shall be used for all equipment and hardware used on this project. In addition, the following factors shall be used:
- |                     |  |
|---------------------|--|
| Cables and fittings | 8 Safety                               |
| Factor              |  |
| Cable bending ratio | 30 times diameter Tread pressures      |
|                     | 500 lbs. for cast iron                 |
|                     | 1500 lbs. for nylatron                 |
|                     | 750 lbs. for nylatron injection molded |
|                     | 1500 lbs. for nylatron bar stock       |
|                     | 1000 lbs. for steel                    |
| Max. fleet angle    | 1 ½ degrees Steel                      |

1/5 of yield

Bearings - Two times required load at full for 2000 hours

### 5.3 Dead Hung Rigging

#### 5.3.1 Goal

5.3.1.1 To hang stationary equipment over stage. Items include: Curtains (see Curtain section), Lighting (see lighting section), and Scenery (empty) battens. These items do not "Fly" move up and down and therefore do not require manual or motorized rigging. Dead hung rigging will be needed in Elementary Schools, Middle Schools, and some High Schools that do not have or are not scheduled to have, "Fly Space" Pipe Battens.

5.3.2 Pipe battens shall be 1-1/2" in diameter schedule 40 pipe.

5.3.3 All battens shall be painted black to prevent rusting.

5.3.4 Where splicing is required, a pin, 18" long and the same diameter as the inside diameter as the pipe shall be used. This pin shall be held in place with no less than four (4) rivets.

5.3.5 Mark the center of each batten with a 1" wide yellow stripe.

5.3.6 Provide yellow PVC caps to cover the ends of each pipe batten.

### 5.4. Hanging / Trim Chains

5.4.1 Chains shall be 1/4" grade 30 proof coil chain 30" long with a 1/4" rated shackle.

5.4.2 The threaded connector shall be rated at not less than 800 lbs. capacity and shall have the rating stamped on each unit.

5.4.3 Trim chains shall be installed on batten end of each support line, every 10' max spacing on single pipe batten.

### 5.5 Beam Clamps

5.5.1 Welded Steel construction

5.5.2 Custom manufactured to fit the application

5.5.3 Hardware used shall be grade 5 or better

### 5.6 Support Cables and Fittings

5.6.1 All support cables unless otherwise noted shall be 7 x 19 construction, galvanized aircraft cable with a breaking strength of 7000 lbs.

5.6.2 Clips shall be drop forged "Crosby" or "Malleable".

5.6.3 There shall be two cable clips for each lift line tie-off.

5.6.4 Pressed sleeve fittings shall be Nicopress.

5.6.5 Eyes shall be formed over wire rope thimbles of correct size.

5.6.6 All wire rope rigging shall be installed so as to prevent abrasion or rubbing of the wire rope against any part of the building construction or other equipment.

5.6.7 Pre-Approved Manufacturer and Product

5.6.7.1 Texas Scenic Company, San Antonio, TX

5.6.7.2 i-Studio Projects

5.6.7.3 Or comparable product approved by Architect.

### 5.7 Pipe Grid

5.7.1 Goal is to provide a lighting grid for Black Box Theatres and other performance spaces, typically found in High Schools or Middle

Schools. Refer to Facility Educational Standards and consult with FBISD Design Manager.

- 5.7.2 Equipment Description (see General Rigging Requirements Below).
- 5.7.3 Pipe Grid Spacing
  - 5.7.3.1 Pipe grid to be planned out in 4'x4' grid pattern.
  - 5.7.3.2 Pipes to be supported every 8'-0".
  - 5.7.3.3 Pipe grid to start 2'-6" max from the walls.
- 5.7.4 Pipe batten
  - 5.7.4.1 Pipe battens shall be 1-1/2" in diameter. Schedule 40 pipe.
  - 5.7.4.2 All battens shall be painted black to prevent rusting.
  - 5.7.4.3 Where splicing is required, a pin 18" long and the same diameter as the inside diameter as the pipe shall be used. This pin shall be held in place with no less than four (4) rivets.
- 5.7.5 Grid Hanger
  - 5.7.5.1 Grid hanger designed to hang the pipe grid. Must support a 300 lbs, with a 5:1 safety factor.
- 5.7.6 Grid Bracket
  - 5.7.6.1 Formed steel clamp with two (2) rated U-bolts installed at each pipe overlap.
- 5.7.7 Wall Flanges
  - 5.7.7.1 Are pinned inside pipe battens and secured to walls for grid stability.
  - 5.7.7.2 Walls, if not CMU, will need blocking installed prior to drywall covering.
- 5.7.8 Pre-Approved Manufacturer and Product
  - 5.7.8.1 Texas Scenic Company, San Antonio, TX
  - 5.7.8.2 i-Studio Project
  - 5.7.8.3 Comparable product approved by Architect.

## 5.8 Motorized Rigging

- 5.8.1 Motorized Rigging is preferred for all new schools and renovations.
- 5.8.2 Provide motorized moving rigging to "Fly" sets (electrics, utilities, and curtains). Typically found in High School.
- 5.8.3 Equipment Description (see also General Rigging requirements).
- 5.8.4 Line Shaft Set
  - 5.8.4.1 Capacity: 1,500 to 2,500lbs depending on load requirements.
  - 5.8.4.2 Speed: 18-20ft per min fixed speed.
  - 5.8.4.3 Travel: 4' AFF to 1' below grid or line shaft assembly.
  - 5.8.4.4 Frame: steel box frame to connect at least 2 drums together.
  - 5.8.4.5 Shafts: Solid Steel, with Gear flange coupling for safety.
  - 5.8.4.6 Hoists: Mid Traveler and Crossover Blacks to be P1900G-480-8 fixed speed hoists. Hoists for Valances, borders, and legs to be P1300G-480-8.
    - 5.8.4.6.1 No more than 10 variable speed hoists are required at High School Auditoriums. Prodigy V1000S-480-8 of the 10 will be for general scenery line sets.
  - 5.8.4.7 Motor: Single motor, continuous duty, with integral gear box and electric brake. Select motor size appropriate for load requirements.
  - 5.8.4.8 Voltage: 208V, 3 phase or 480V, 3 phase.
  - 5.8.4.9 Limit Switch: 2 – travel limits, 2 over travel limits.

- 5.8.4.10 Drums: to be sized for project, cut for 3/16" cable.
- 5.8.4.11 Motor control panel: Centralized, with manual overrides.
- 5.8.4.12 Remote Pendant with 50' cable.
- 5.8.4.13 Computer controlled with preprogrammed presets available.
- 5.8.4.14 Operator Panel
  - 5.8.4.14.1 The operator panel shall be in a 19" Panel, in the Stage Manager's Panel.
  - 5.8.4.14.2 The face plate shall be a 1/8" anodized aluminum panel.
  - 5.8.4.14.3 The operator panel will activate the winches and a key switch will activate the system.
  - 5.8.4.14.4 Provide "UP" and "DOWN" buttons for hold to run operation of each winch.
  - 5.8.4.14.5 All buttons will be engraved with purpose.
  - 5.8.4.14.6 Provide an "EMERGENCY STOP" red mushroom type button.
  - 5.8.4.14.7 The operator panel shall be incorporated into the stage manager's panel.
- 5.8.5 Pre-Approved Manufacturer and Product: Texas Scenic Company, San Antonio, TX
  - 5.8.5.5.1 JR Clancy
  - 5.8.5.5.2 Mainstage
  - 5.8.5.5.3 Approved Equal In-line motorized rigging products.

## 6.0 Stage Curtains

### 6.1 General Design Layout

#### 6.1.1 Elementary Schools

- 6.1.1.1 Front Setting, Provide the following:
  - 6.1.1.1.1 Valance Curtain – 3" side hems.
  - 6.1.1.1.2 Bi-parting draw Front Curtain – 1/2" width side hem.
  - 6.1.1.1.3 Added Fullness: 50%.
  - 6.1.1.1.4 Fabric: Heavy Weight IFR Velour.
  - 6.1.1.1.5 Color: Specified by Architect in consultation with FBISD Fine Arts Executive Director and Principal.
- 6.1.1.2 Rear Setting, Provide the following:
  - 6.1.1.2.1 Rear Traveler, walk along – 12" side hems.
  - 6.1.1.2.2 Mid-stage Traveler, walk along – 12" side hems.
  - 6.1.1.2.3 Two pipe mounted Border curtains – 3" side hems.
  - 6.1.1.2.4 Added Fullness: 50%.
  - 6.1.1.2.5 Fabric: Medium Weight IFR Velour.
  - 6.1.1.2.6 Color: Black.

#### 6.1.2 Middle Schools

- 6.1.2.1 Front Setting, Provide the following:
  - 6.1.2.1.1 Valance Curtain – 3" side hems.
  - 6.1.2.1.2 Bi-parting draw Front Curtain – 1/2" width side hems.
  - 6.1.2.1.3 Added Fullness: 50%.
  - 6.1.2.1.4 Fabric: Heavy Weight IFR Velour.
  - 6.1.2.1.5 Color: Specified by Architect in consultation with FBISD Fine Arts Executive Director and Principal.

- 6.1.2.2 Rear Setting, Provide the following:
  - 6.1.2.2.1 Rear Traveler, walk along – 12" side hems.
  - 6.1.2.2.2 Mid-stage Traveler, walk along – 12" side hems.
  - 6.1.2.2.3 Two pipe mounted Border curtains – 3" side hems.
  - 6.1.2.2.4 Added Fullness: 50%.
  - 6.1.2.2.5 Fabric: Medium Weight IFR Velour.
  - 6.1.2.2.6 Color: Black.
- 6.1.2.3 Stage Drops, Provide the following:
  - 6.1.2.3.1 Sky Cyclorama – Seamless, Bleach white.
  - 6.1.2.3.2 Fullness: Sewn Flat, Pipe pocket in the bottom hem, Grommets and Ties on top hem.
- 6.1.3 High Schools
  - 6.1.3.1 Front Setting, Provide the following:
    - 6.1.3.1.1 Valance Curtain – 3" side hems.
    - 6.1.3.1.2 Bi-parting draw Front Curtain – ½ width side hems.
    - 6.1.3.1.3 Added Fullness: 50%
    - 6.1.3.1.4 Fabric: Heavy Weight IFR Velour
    - 6.1.3.1.5 Color: Specified by Architect in consultation with FBISD Fine Arts Executive Director and Principal.
  - 6.1.3.2 Rear Setting, Provide the following:
    - 6.1.3.2.1 Tormentor legs, walk along – 6" side hems.
    - 6.1.3.2.2 Borders – 3" side hems.
    - 6.1.3.2.3 Concert Traveler, draw, – 12" side hems.
    - 6.1.3.2.4 Mid-stage Traveler, draw – 12" side hems.
    - 6.1.3.2.5 Rear Traveler, draw – 12" side hems.
    - 6.1.3.2.6 Added Fullness: 50%
    - 6.1.3.2.7 Fabric: Heavy Weight IFR Velour.
    - 6.1.3.2.8 Color: Black.
  - 6.1.3.3 Stage Drops, Provide the following:
    - 6.1.3.3.1 Sky Cyclorama – Seamless, Bleach white.
    - 6.1.3.3.2 Black Scrim – Seamless.
    - 6.1.3.3.3 White Scrim – Seamless.
    - 6.1.3.3.4 Fullness: Sewn Flat, Pipe pocket in the bottom hem, Grommets and Ties on top hem.
- 6.1.4 Fabrics
  - 6.1.4.1 Heavy Weight IFR Fabric
    - 6.1.4.1.1 KM Mills, Charisma IFR (Inherently Flame Retardant) or equal.
  - 6.1.4.2 Medium Weight IFR Fabric
    - 6.1.4.2.1 KM Mills, Plateau IFR (Inherently Flame Retardant) or equal.
  - 6.1.4.3 Sky Cyclorama: Seamless bleached white muslin (FR) as supplied by Rose Brand.
  - 6.1.4.4 Scrim: Seamless sharkstooth scrim (FR) as supplied by Rose Brand or comparable product approved by FBISD Design Manager.
- 6.1.5 Curtain Traveler Tracks (see also dead hung rigging)
  - 6.1.5.1 Tracks shall be by H&H Specialties or equal. Manufacturer's recommendations shall be followed on installation of all tracks and related hardware shall be followed.
  - 6.1.5.2 Straight track, curtains over 12' tall shall be:



- 6.1.5.2.1 H&H Specialties or equal, #400 track, Draw or Walk Along as required.
  - 6.1.5.3 Straight Track, curtains under 12' tall shall be:
    - 6.1.5.3.1 H&H Specialties or equal, #100 track, Draw or Walk Along as required.
  - 6.1.5.4 Curved track, curtains over 12' tall shall be:
    - 6.1.5.4.1 H&H Specialties or equal, #300 track, Draw with pipe back bone.
  - 6.1.5.5 Curved Track, curtains under 12' tall shall be:
    - 6.1.5.5.1 H&H Specialties or equal, #300 track, Draw or Walk Along as required.
  - 6.1.5.6 Pre-Approved Manufacturer and Product:
    - 6.1.5.6.1 Texas Scenic Company, San Antonio, TX or comparable product by Custom Sewn Stage Curtains.
- 7.0 Black Box Curtains
  - 7.1 Color: Black.
  - 7.2 Coordinate with acoustical and theater designer on sliding rack system at all four walls.
- 8.0 Stage Dimming and Control System
  - 8.1 Dimmer Racks
    - 8.1.1 The installation rack shall be the Sensor as manufactured by Electronic Theatre Controls, Inc., or equal. The fully digital dimmer rack shall consist of up to 120 dimmer module spaces.
    - 8.1.2 The dimmer racks shall house all dimmer modules, control electronics, and branch circuit breakers. Provide module and breaker quantities as indicated below. System shall have the performance features that follow.
    - 8.1.3 Rack shall be UL Listed and labeled.
    - 8.1.4 Rack shall employ dead front construction of code gage steel.
    - 8.1.5 Each rack must have a hinged locking door.
    - 8.1.6 Each rack must have an electrostatic air filter.
    - 8.1.7 Ventilation shall be by a low-noise fan activated by DMX level data.
    - 8.1.8 Each 48-module dimmer rack shall be provided with a keypad and LCD display for rack configuration, backup and fault indication.
    - 8.1.9 Each rack shall maintain active scene for a user-programmable period after loss of DMX-512 signal from console.
    - 8.1.10 Standard control format shall be USITT DMX-512. Dimmer rack CEM must accept two independent DMX signals concurrently in a highest- takes- precedence manner for each dimmer.
    - 8.1.11 Rack shall store a minimum of thirty-two user-programmable back-up looks which may be activated in case of loss of control signal.
    - 8.1.12 Each dimmer must include discrete "boost" feature to allow over- voltage output to compensate for voltage drop in branch wiring and allow a true 120 volts at the fixture lamp or "trim" maximum voltage output to lengthen lamp life.
    - 8.1.13 Each rack shall include a beacon which shall flash to indicate failures.
  - 8.2 Dimmer Modules
    - 8.2.1 Dimmer modules shall be plug-in type. No more than two dimmers per module will be accepted.
    - 8.2.2 Modules shall be assembled of aluminum or steel. Dimmer modules

with housings manufactured of plastic or a flammable material will not be accepted.

- 8.2.3 Each dimmer module shall contain fully magnetic circuit breakers(s), solid state switching module(s), choke(s) and connectors.
- 8.2.4 Each dimmer must have the discreet capability to operate in a dimmed or a non-dimmed mode. This function shall be selectable from the control console or the rack-mounted keypad.
- 8.2.5 Each dimmer circuit shall use solid state switching devices consisting of two silicon controlled rectifiers in an inverse parallel configuration, snubber network and all required gating circuitry on the high voltage side of an integral opto-coupled control voltage isolator.

### 8.3 Dimmer Feedback System

- 8.3.1 Rack shall be provided with a feedback network to provide rack performance data to the control console. The network shall provide operational information which shall be displayed on the rack-mounted LCD display and on the control console color monitor. A hand-held remote does not meet this requirement.
- 8.3.2 System shall annunciate DMX port errors at the rack and control console.
- 8.3.3 System shall annunciate backup cue errors at the rack and control console.
- 8.3.4 System shall annunciate individual phase voltages and power frequency at the rack and control console.
- 8.3.5 System shall annunciate control link address and recorded error log status indicators at the rack and control console.
- 8.3.6 System shall annunciate panic status at the rack and control console.
- 8.3.7 System shall annunciate airflow obstruction errors at the rack and control console.
- 8.3.8 System shall monitor cabinet temperature and annunciate over-temperature at the rack and control console.

### 8.4 Control Electronics

- 8.4.1 Control Electronics shall be plug-in module(s). A discrete keypad and LCD display shall be provided for each rack section of 96 dimmers. The control electronics shall provide the following functions:
  - 8.4.1.1 Thirty-two user programmable back-up looks shall be provided in case of loss of control signal and may be recalled from the rack keypad(s), remote station(s) and the control console.
  - 8.4.1.2 Dimmer multiplexing control: this optional feature allows each dimmer to be switched into multiplex mode. This function shall allow discrete control of two separate fixtures from one dimmer. This shall be accomplished by plugging in a multi-plexer at the fixture location and by use of fixtures capable of multiplexing.

### 8.5 Control Console

- 8.5.1 Elementary School
  - 8.5.1.1 Smart Fade 2496 as manufactured by Electronic Theatre Controls, Inc.

- or comparable product approved by Architect.
  - 8.5.2 Middle School
    - 8.5.2.1 Element 40/250 as manufactured by Electronic Theatre Controls, Inc. or comparable product approved by Architect with 2- Flat Screen Monitors.
  - 8.5.3 High School
    - 8.5.3.1 Ion1000 with 2x20 fader wing, as manufactured by Electronic Theatre Controls, Inc., or comparable product approved by Architect with 2-17" Flat Screen Monitors.
- 8.6 Pre-Approved Manufacturer and Product
  - 8.6.1 Electronic Theatre Controls, Middleton, WI or comparable product approved by Architect.
- 9.0 Stage Lighting - LED lighting only
  - 9.1 This section includes general (minimum quantity) fixture types for each venue. As much as possible, all fixtures should use the same lamp. All fixtures must be agency listed.
  - 9.2 Aisle Lighting in Auditorium and at Edge of Stage
    - 9.2.1 Soft LED lighting strip, 1.4 W, 24V, low level.
    - 9.2.2 In-floor aluminum mounting channel for LED strip lights.
  - 9.3 Elementary School
    - 9.3.1 8 - Source Four LED Series 2.
    - 9.3.2 6 – ColorSource PAR.
    - 9.3.3 All Fixtures to have, 575w lamp, stage pin connector, safety cable, and c-clamp.
    - 9.3.4 8 – ColorSource CYC (if Elementary has a cyc).
  - 9.4 Middle School
    - 9.4.1 16 – Source Four LED Series 2.
    - 9.4.2 8 – ColorSource
    - 9.4.3 All Fixtures to have, 575w lamp, stage pin connector, safety cable, and c-clamp.
    - 9.4.4 8 – ColorSource CYC.
  - 9.5 High School
    - 9.5.1 30 – Source Four LED Series 2.
    - 9.5.2 30 – ColorSource PAR.
    - 9.5.3 All Fixtures to have, 575w lamp, stage pin connector, safety cable, and c-clamp.
    - 9.5.4 12 – ColorSource CYC.
    - 9.5.5 Follow Spots as needed – Drama FS – LED 700 Follow Spots (2) as needed.
  - 9.6 Pre-Approved Manufacturer
    - 9.6.1 Electronic Theatre Controls, Middleton, WI or equal.
    - 9.6.2 Altman Lighting, New York, NY or equal.
- 10.0 Athletic and Recreational Equipment.
  - 10.1 Athletic Equipment
    - 10.1.1. Elementary Schools - Interior Basketball court goals
      - 10.1.1.1. Preferred: Porter Model or equal 312 Center-strut, Height adjustable system for wall-mounted backstops, Manual operation, Porter No. 00267-000 Fan Fiberglas Backboard with Backing Plate for secondary courts, main court backboards to be ½" tempered glass set in continuous vinyl rubber cushioned aluminum frame with "Super Flex" goal. Porter No. 00201-H00 Front Mount Goal with Mounting Hardware and Net. If not wall

mounted, use appropriate equal Porter products.

- 10.1.1.2 Alternate product: Draper Model EZ-Fold SWD Wall Mounted Stationary with Direct Mount Goal Brace, EZ-Fold 503086 Manual Winch Height Adjuster, EZ-Fold A0018 Fan Fiberglass Backboard, EZ-Fold A0572 Stationary Basketball Goal with Mounting hardware and Net. If not wall mounted, use appropriate equal Draper products.

#### 10.1.1.2 Middle Schools – Main Court Goals

- 10.1.1.2.1 Porter No. 900 W Series “Clear Vu” (Model 90949-000) forward fold pipe construction with Backboard Safety Padding. Winch to be key switch operated. Verify model numbers: Rectangular Glass No. 00208-000 Center-strut with Safety Pad 00227-000, No. 10797-100 “Saf-Strap” Safety Lock, No. 00706-000 Backstop Winch with No. XELE 00791-112 key switch control, and No. 00243-500 “Super Flex” Goal with nylon net.

#### 10.1.1.3 Middle Schools - Side Court goals

- 10.1.1.3.1 Porter No. 90949-000 Forward Fold with Backboard Safety Padding, Rectangular Glass No. 00208-000 Center-Strut with Safety Pad 00227-000, No. 10797-100 “Saf-Strap” Safety Lock, No. 00243-500 “Super Flex” Goal with nylon net. Backstop Winch with No. XELE 00791 Series key switch. Winch to be key switch operated. The number of Gang Box to be determined by number of backstops.
- 10.1.1.3.2 If cost is an issue, the side court goals can be a Porter No. 216 with applicable Safety Pad.

#### 10.1.1.4 High Schools

- 10.1.1.4.1 Porter Model 90617-W00 Forward Fold dual pipe suspended backstop with No. 00326-X00 backboard safety padding, Rectangular Glass No. 00204-000 Pro-Strut with Safety Pad, No. 00223-000 “Power-Flex” Goals with nylon net, No. 00707-000 Electric Backstop Winch with No. XELE 00791-112 key switch control and No. 10797-100 “Saf-Strap” Safety Lock.

#### 10.1.2 Volleyball Equipment

- 10.1.2.1 All equipment to be Senoh or equal as distributed by Sports Imports or equal (no substitutions) fit Senoh KA-25 floorplate and sleeve *from* Senoh DE5300. Inserts in floor to be detailed in construction documents for secure installation. Provide poles, antennas, net, Official’s Stand at each gym.
- 10.1.2.2 Coordinate locations of embedded sleeves in the gymnasium slab with the volleyball equipment manufacturer.
- 10.1.2.3 Basis of Design for volleyball net uprights: Sports Imports SI-1 Lightweight Carbon Poles to fit Senoh KA-25 floorplate and sleeve from Senoh DE5300.

#### 10.1.3 Wall Pads

- 10.1.3.1 Color selected from standard line (no custom colors).
- 10.1.3.2 Electrical and other devices shall not lie within pads.  
(Especially fire extinguisher cabinets).
- 10.1.3.3 Pad height shall be 6' with bottom at 12" AFF (top at 7'-0").
- 10.1.3.4 Elementary Schools
  - 10.1.3.4.1 Porter Model or equal No. 00560-0xx Hi NRG Saf-pad.
  - 10.1.3.4.2 Provide in PE room off of cafeteria along entire length of two end walls (from side court line to side court line).
- 10.1.3.5 Middle Schools
  - 10.1.3.5.1 Porter Model or equal No. 00560-0xx Hi NRG Saf-pad.
  - 10.1.3.5.2 Provide in both gyms along the entire length of the two end walls under goals (from side court line to side court line).
- 10.1.3.6 High Schools
  - 10.1.3.6.1 Porter Model or equal No. 00351-3XX.
  - 10.1.3.6.2 Provide in both gyms along the entire length of the two end walls under MAIN goals. (from side court line to side court line).
- 10.1.4 Provide power mounted on bleachers and wall behind bleachers, NEVER in floor.

## 11.0 Scoreboards

- 11.1 Middle School and High Schools to have two (2) indoor scoreboards located in both gymnasiums.
- 11.2 For Middle School Facilities:
  - 11.2.1 Basketball Basis of Design: Nevco #2700 or comparable product approved FBISD Design Manager.
    - 11.2.1.1 Type: Interior, multi-purpose basketball/volleyball/wrestling electronic scoreboard with two integral horns, LED displays for time, scores, period, bonus, double bonus, and next possession arrows; Model 2700-NL (Non-Lit caption plates, base model) as manufactured by Nevco Inc. Rear-lit (RL) caption plates or Electronic Team Names (ETN) are optional and scoreboard shall be capable of in-the-field retrofit. Only LED lighting shall be used for rear-lit captions, incandescent lighting excluded. No captions shall be applied directly to the face of the scoreboard. All caption plates will be changeable and made of polyvinylchloride with vinyl lettering applied.
    - 11.2.1.2 Size: 8 feet long x 3 feet high x 8 inches deep. (2.4 m long x .9 m high x 203 mm deep.)
    - 11.2.1.3 Approximate hanging weight: 71 pounds (32 kg).
    - 11.2.1.4 Large black and white captions providing maximum visibility: [6 inches] [152 mm] high: "Home", "Guests", and "Quarter".
    - 11.2.1.5 LED displays:
      - 11.2.1.5.1 Timing: Super Bright Red 13 inches (330 mm) high digits.
      - 11.2.1.5.2 Team scores: Super Bright Amber 13 inches (330 mm) high digits.
      - 11.2.1.5.3 Period: Super Bright Amber 9 inches (229 mm) high digits.

- 11.2.1.5.4 Next possession: Super Bright Amber arrow for each team.
- 11.2.1.5.5 Include bonus and double bonus in the form of a 4 inch (101 mm) Super Bright Red LED "B".
- 11.2.1.6 Rear-lit captions (when specified) shall require zero maintenance.
- 11.2.1.7 Provide Advertising /Team logo area 12" x 12" minimum.
- 11.2.1.8 Suspension mounting attachments will be included.
- 11.2.1.9 Power requirement: All options included: 126 Watts, MAX, 100-240 Volts AC w/Power Factor Correction.
- 11.2.1.10 Locate scoreboards diagonal from each other, avoid sight line issues.
- 11.2.1.11 Mount with bottom of scoreboard 12' to 15' above finished floor.
- 11.2.2 Football Basis of Design: Nevco #3650 or comparable product approved FBISD Design Manager.
  - 11.2.2.1 Type: Exterior, electronic, multi-sport soccer/football/in-line hockey scoreboard with integral horn and LED displays for time, scores, and period.
  - 11.2.2.2 Size: 10 feet long x 4 feet high x 8 inches deep. (3.05 m long x 1.22 m high x 203 mm deep).
  - 11.2.2.3 Approximate weight: 130 pounds (59 kg).
  - 11.2.2.4 White on black captions, 8 inches (203 mm) high: "MIN", "SEC", "HOME", "GUESTS", and "PERIOD".
  - 11.2.2.5 High intensity red, amber, or translucent white LED displays with 14 inches (355 mm) high digits: Time in minutes and seconds separated by colon, scores, and period.
  - 11.2.2.6 Power requirement:
    - 11.2.2.6.1 POWER (Red/Amber): 120 VAC, .7 Amps, 50/60 Hz. / 240 VAC, 0.4 Amps, 50/60 Hz.
    - 11.2.2.6.2 Requires earth ground.
    - 11.2.2.6.3 POWER (Translucent White): 120 VAC, 1.2 Amps, 50/60 Hz. / 240 VAC, 0.6 Amps, 50/60 Hz. Requires earth ground.
- 11.3 For High School Facilities:
  - 11.3.1 Baseball/Softball Basis of Design: Nevco #1604 or comparable product approved FBISD Design Manager.
    - 11.3.1.1 Type: Exterior, sectional electronic baseball scoreboard with LED displays for number of player at bat, balls, strikes, outs, hit, error, scores by 10 innings, and totals for runs, hits, and errors; Model 1604 as manufactured by Nevco Scoreboard Company.
    - 11.3.1.2 Size: 28 feet long x 8 feet high x 8 inches deep. (8.53 m long x 2.44 m high x 203 mm deep).
    - 11.3.1.3 Approximate weight: 650 pounds (295 kg) w/ETN's
    - 11.3.1.4 White on black captions:
      - 11.3.1.4.1 15 inches (381 mm) high: "HOME", "GUESTS", "AT BAT", "BALL", "STRIKE", "OUT" "H" & "E".
      - 11.3.1.4.2 8 inches (203 mm) high: All other features.
    - 11.3.1.5 High Intensity Red, Amber, or Translucent White LED displays: (Please specify color when ordering.)

- 11.3.1.5.1 18 inches (457 mm) high digits and letters: Balls, strikes, outs.
- 11.3.1.5.2 14 inches (356 mm) high digits: Scores by inning and totals for runs, hits and errors.
- 11.3.1.6 No single section of scoreboard shall be larger than 5 x 12 feet to ease burden of installation.
- 11.3.1.7 Should service be necessary, service access shall be from front of scoreboard.
- 11.3.1.8 Power requirement:
  - 11.3.1.8.1 POWER with ETNs (Red/Amber): 120 VAC, 4.1 Amps, 50/60 Hz. / 240 VAC, 2.1 Amps, 50/60 Hz. Requires earth ground.
  - 11.3.1.8.2 POWER without ETNs (Red/Amber): 120 VAC, 3.0 Amps, 50/60 Hz. / 240 VAC, 1.5 Amps, 50/60 Hz. Requires earth ground.
  - 11.3.1.8.3 POWER with ETNs (Translucent White): 120 VAC, 6.2 Amps, 50/60 Hz. / 240 VAC, 3.1 Amps, 50/60 Hz. Requires earth ground.
  - 11.3.1.8.4 POWER without ETNs (Translucent White): 120 VAC, 5.1 Amps, 50/60 Hz. / 240 VAC, 2.6 Amps, 50/60 Hz. Requires earth ground.
- 11.3.2 Basketball Basis of Design: Nevco #2750 or comparable product approved FBISD Design Manager.
  - 11.3.2.1 Type: Interior, multi-purpose basketball/volleyball/wrestling electronic scoreboard with two integral horns, changeable captions, LED displays for time, scores, period, number of player fouling with personal fouls, team fouls, bonus and double bonus indicators, and next possession arrows; Model 2750-NL (base) as manufactured by Nevco Inc. Rear-lit (RL) caption plates or Electronic Team Names (ETN) are optional and scoreboard shall be capable of in-the-field retrofit. Only LED lighting shall be used for rear-lit captions, incandescent lighting excluded. No captions shall be applied directly to the face of the scoreboard. All caption plates will be changeable and made of polyvinylchloride with vinyl lettering applied.
  - 11.3.2.2 Size: [8 feet long x 6 feet high x 8 inches deep.] [2.4 m long x 1.8 m high x 203 mm deep.]
  - 11.3.2.3 Approximate hanging weight: [130 pounds] [59 kg].
  - 11.3.2.4 Captions:
    - 11.3.2.4.1 6 inches (152 mm) high:
    - 11.3.2.4.2 Basic: "Home", "Guests", and "period".
    - 11.3.2.4.3 Basketball: "fouls" and "player".
    - 11.3.2.4.4 Volleyball: "won" and "game".
    - 11.3.2.4.5 Wrestling: "match" and "weight".
  - 11.3.2.5 LED displays:
    - 11.3.2.5.1 Timing: Super Bright Red [13 inches] [330 mm] high digits with lit colon.
    - 11.3.2.5.2 Team scores: Super Bright Amber 13 inches (330 mm) high digits.
    - 11.3.2.5.3 Period: Super Bright Amber 9 inches (229 mm) high digits.



- 11.3.2.5.4 Player number with personal fouls, game, and weight: Super Bright Red 9 inches (229 mm) high digits.
- 11.3.2.5.5 Team fouls, games won, and match: Super Bright Amber 9 inches (229 mm) high digits.
- 11.3.2.5.6 Next possession: Super Bright Amber arrow for each team.
- 11.3.2.5.7 Include bonus and double bonus in the form of a 4 inch (101 mm) Super Bright Red LED "B".
- 11.3.2.6 Rear-lit captions (when specified) shall require zero maintenance.
- 11.3.2.7 Provide Advertising /Team logo area 3 each, 12" x 12" minimum.
- 11.3.2.8 Suspension mounting attachments will be included.
- 11.3.2.9 Power requirement: All options included: 158 Watts, MAX, 100-240 Volts AC w/Power Factor Correction.
- 11.3.2.10 Locate scoreboards diagonal from each other, avoid sight line issues.
- 11.3.2.11 Review location of scoreboard control with FBISD Design Manager and Athletics prior to bidding. Ensure no obstructions with goals in lowered or raised positions. Power for scoreboard on opposite side of bleachers, center court.
- 11.3.3 Football Basis of Design: Nevco #3621 or comparable product approved FBISD Design Manager.
  - 11.3.3.1 Type: Exterior, electronic football scoreboard with integral horn and LED displays for time, scores, quarter, down, yards to go, ball location, and ball possession and time outs left.
  - 11.3.3.2 Size: 20 feet long x 8 feet high x 8 inches deep. (6.1 m long x 2.4 m high x 203 mm deep.)
  - 11.3.3.3 Approximate weight: 540 pounds (245 kg). OR 600 pounds (272 kg.) with optional Electronic Team Names (ETN).
  - 11.3.3.4 White on black captions, [15 inches] [381 mm] high: "HOME", "GUESTS", "QTR", "DOWN", "YDS TO GO", and "BALL ON".
  - 11.3.3.5 High intensity red, amber, or translucent white LED displays, [24 inches] [610 mm] high digits: Time in minutes and seconds separated by colon, quarter, scores, down, yards to go, and ball location.
  - 11.3.3.6 High intensity red, amber, or translucent white LED ball possession or hit/run indicators: One football shaped indicator per team.
  - 11.3.3.7 High intensity red, amber, or translucent white LED displays, [18 inches] [457 mm] high digits: Time Outs Left (T.O.L.)
  - 11.3.3.8 Power requirement:
    - 11.3.3.8.1 POWER without ETNs (Red/Amber): 120 VAC, 2.9 Amps, 50/60 Hz. / 240 VAC, 1.4 Amps, 50/60 Hz. Requires earth ground.
    - 11.3.3.8.2 POWER with ETNs (Red/Amber): 120 VAC, 4.1 Amps, 50/60 Hz. / 240 VAC, 2.0 Amps, 50/60 Hz. Requires earth ground.
    - 11.3.3.8.3 POWER without ETNs (Translucent White): 120 VAC, 4.9 Amps, 50/60 Hz. / 240 VAC, 2.5 Amps, 50/60 Hz. Requires earth ground.



11.3.3.8.4 POWER with ETNs (Translucent White): 120 VAC, 6.0 Amps, 50/60 Hz. / 240 VAC, 3.0 Amps, 50/60 Hz.  
Requires earth ground.

## 12.0 Exterior Play Field Equipment and Structures

### 12.1 Playground Equipment

- 12.1.1 All playground equipment must be in compliance with Chapter 756 (Sub-Chapter E) of the Texas Health and Safety Code:
  - 12.1.1.1 <https://statutes.capitol.texas.gov/Docs/HS/htm/HS.756.htm#756.061>
  - 12.1.1.2 AND Public Playground Safety Handbook, issued by the US Consumer Product Safety Commission (CPSC).
  - 12.1.1.3 <https://www.cpsc.gov/s3fs-public/325.pdf>
  - 12.1.1.4 ASTM F1487-07, Consumer Safety Performance Specification for Playground Equipment for Public Use.
- 12.1.2 Composite Playground Equipment Approved Manufacturers:
  - 12.1.2.1 Playscapes.
  - 12.1.2.2 Little Tykes.
  - 12.1.2.3 Superior.
- 12.1.3 Age Range
  - 12.1.3.1 Playground structure design to be based on Pre-K through 1<sup>st</sup> grade (Ages 3-6) or 2<sup>nd</sup>-5<sup>th</sup> Grade (5-12 years old) unless campus specific programs require additional provisions. Verify with FBISD Project Manager.
- 12.1.4 Capacity
  - 12.1.4.1 The capacity of play structures varies based on its size and number of play events. Each structure design should indicate its designed/intended capacity. Minimum capacity of 75 students per play structure.
- 12.1.5 Specific components of playground equipment to be included in drawings prior to bidding.
- 12.1.6 Color selection to be coordinated through FBISD Project Manager with school principal.
- 12.1.7 Coordinate with Division 32 for playground surfacing.
- 12.1.8 Reference Diagrams 11\_06 & 11\_07 in Appendix for sample FBISD playground equipment.
- 12.1.9 Coordinate clearances around playground equipment with Outdoor Covered Play Structure manufacturer.
- 12.1.10 Integral play assembly that provides more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units.
- 12.1.11 Metal Frame: Galvanized steel pipe or tubing connected with bolts or clamps.
- 12.1.12 Main Frame Posts: Not less than 4 inch (102 mm) OD.
- 12.1.13 Platforms: Perforated metal.
  - 12.1.13.1 Roofs: None. Refer Division 13 – Special Construction (Metal Buildings) for shade structure to be provided over play structures.
- 12.1.14 Play Structure Access Component(s): Ladder, stepladder, stairs, ramp, accessible crawl ramp, accessible transfer platform.
  - 12.1.14.1 Handholds: Guardrails on each side.
  - 12.1.14.2 Inclusion Equipment: Consider a minimum of 10% and to not only include ground based components (For example, ramps in lieu of stairs or musical components). Refer to FBISD Design Manager for specific ground level inclusion equipment.



- 12.2 Exterior Court Athletic Equipment
  - 12.2.5 Exterior Basketball Court Goals (Elementary Schools Only).
    - 12.2.5.1 Sports Play or equal Model 541-616 Aluminum Fan with Heavy Duty 4 ½" OD Galvanized Steel Post, Double Strength Super Goal with Steel Chain Net. Backboards to be removable.
    - 12.2.5.2 Porter or equal Model 00274-000 post with Model 0291-000 back straps and Model 00424-000 ground sleeves, concrete mounted.
- 12.3 Athletic Field Equipment
  - 12.3.1 Football/Soccer Goals
    - 12.3.1.1 Middle Schools
      - 12.3.1.1.1 H-type. Porter or equal Model 00270-000 or equal mounted on concrete footing with Model 00424-000 Ground sleeves and outdoor upright pads. Aluminum with powder coated finish.
    - 12.3.1.2 High School Competition Field
      - 12.3.1.2.1 Provide 8" Offset Goal Post. Sportfield Specialties Model No. GP830HSPL with Model GPAFIT and GPAFITC or approved equivalent with round football goal pads. Aluminum with powder coated finish.
    - 12.3.1.3 High School Practice field
      - 12.3.1.3.1 Provide H-type. Porter or equal Model 00281-232 with Model 00403-000 outdoor ground sleeves (concrete mounted) and Model 00069-003 outdoor upright pads. Galvanized finish.
  - 12.3.2 Soccer Goal Nets
    - 12.3.2.1 MS and HS: Porter Model 298 or comparable product approved by FBISD Design Manager.
  - 12.3.3 Baseball and Softball
    - 12.3.3.1 MS does not use bases so no base sleeves are required.
    - 12.3.3.2 HS does require base sleeves for bases.
    - 12.3.3.3 Ensure all portions of seating are protected from foul balls (no direct line of site to batter's box).
  - 12.3.4 High School Football/Soccer/Track
    - 12.3.4.1 Provide controller connections at front of bleachers and in press box
    - 12.3.4.2 Approved Manufacturers:
      - 12.3.4.2.1 Sportsfield Specialties
      - 12.3.4.2.2 Sports Edge Safety Matters

## 11 70 00 - Healthcare Equipment

- 1.0 Whirlpools (HS Field House and Athletics)
  - 1.1 Contractor Furnished, Contractor Installed
  - 1.2 Locate on support structure provided by manufacturer with stair/ladder access.
  - 1.3 Depress slab 1 1/2" under all units, with drain directly underneath EACH unit.
  - 1.4 Current approved manufacturer and model is:
    - 1.4.1 Whitehall Manufacturing Inc., Model S-110-S or equivalent, 818-968-6681

- 2.0 Special Education Changing/Treatment Table
  - 2.1 Hi-Lo Electric Changing/Treatment Table with Rails 72" (Owner Furnished, Owner Installed)
  - 2.2 Basis of Design: Item #1008140 as manufactured by Sports Health.
  - 2.3 Provide electrical (not within reach of the student on the table or from the shower) and provide adequate clearance for table.
    - 2.3.1 Electric Requirements: 120-Volt, 60hz motor with 8 ft. power cord.
  
- 3.0 Special Education Portable Hydraulic Lift
  - 3.1 Portable Hydraulic Lift provided as FFE, Provide power.
  - 3.2 Basis of Designs Products: Hoyer Advance E-340 Patient Lift or Invacare Reliant 450 Power Lift with power opening low base as an upgrade option.
    - 3.2.1 Hoyer Advance E-340 Patient Lift:
      - 3.2.1.1 Max. Lift Capacity: 304 lbs.
      - 3.2.1.2 Lifting Range: 15.3 inch to 66.5 inch.
      - 3.2.1.3 Lifts Patient from Floor: Yes.
      - 3.2.1.4 Overall Product Weight: 69 lbs.
      - 3.2.1.5 Disassembles for Transport/Storage: Yes.
      - 3.2.1.6 Power Operated Base Available: No.
      - 3.2.1.7 Base Width Open: 42.5 inch.
      - 3.2.1.8 Base Width Closed: 26.3 inch.
      - 3.2.1.9 Internal Base Width Open: 39.3 inch.
      - 3.2.1.10 Internal Base Width Closed: 22.4 inch.
      - 3.2.1.11 Furniture Clearance Needed: 4.5 inch.
      - 3.2.1.12 Base Height: 4.5 inch.
      - 3.2.1.13 Overall Height: 73 inch.
      - 3.2.1.14 Overall Length: 51 inch.
      - 3.2.1.15 Front Caster Size: 3 inch.
    - 3.2.2 Invacare Reliant 450 Power Lift with Power Opening Low Base:
      - 3.2.2.1 Overall Height: 24 inch to 74 inch.
      - 3.2.2.2 Clearance: 4.5 inch.
      - 3.2.2.3 Base Length: 48 inch.
      - 3.2.2.4 Base Width: Open: 41 inch, Closed: 26.5 inch.
      - 3.2.2.5 Caster Options: Front: 3 inch, Rear: 5 inch.
      - 3.2.2.6 Product Weight Capacity: 450 lbs.
      - 3.2.2.7 Product Weight: 109 lbs.
      - 3.2.2.8 Charger: Output: 24V DC.
      - 3.2.2.9 Power: Audible low battery alarm, Lifts per charge: 150-300 (varies with lift range and load).
  - 3.3 Warranties:
    - 3.3.1 Hoyer Advance E-340 Patient Lift:
      - 3.3.1.1 One (1) year for all parts and components from date of substantial completion.
    - 3.3.2 Invacare Reliant 450 Power Lift:
      - 3.3.2.1 Limited warranty of three (3) years on lift and one (1) year on electronic components from date of substantial completion.



## **11 80 00 - Other Equipment**

### **1.0 Kilns**

#### **1.1 Contractor furnished, contractor installed.**

- 1.1.1 Coordinate size with FBISD Project Manager.
- 1.1.2 Skutt Model KM1227-3 (the suffix of '3' indicates providing the Enviro-vent which is the kiln exhaust system mounted on the BOTTOM of the kiln) with 4" metal vent connection in wall venting DIRECTLY to exterior (similar to dryer vent).
- 1.1.3 Coordinate voltage with electrical engineer.
- 1.1.4 Kiln available from Ceramic Store of Houston or approved equal.
- 1.1.5 Supplier to provide complete assembly of kiln and accessories.
- 1.1.6 Hard-wire kiln to manual disconnect, ensure DIRECT access.
- 1.1.7 Provide EPO (emergency power off) by exit door.
- 1.1.8 Provide general exhaust fan (with wall-mounted timer) within kiln room (SEPARATE from Vent-A-Kiln).

**END OF DIVISION 11**



Technical Design Guidelines


## Division 12

# Furnishings

General Requirements for Furnishings		12 00 00
Art		12 10 00
Window Treatments		12 20 00
Casework		12 30 00
Multiple Seating		12 60 00
Other Furnishings		12 90 00

### DIVISION 12 - Furnishings

#### 12 00 00 - General Requirements for Furnishings

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3  Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations.
      - 1.3.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials.
      - 1.3.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients.
      - 1.3.2.4 EQc2: Indoor Environmental Quality Credit Low-Emitting Materials.
- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function,

dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.

### 3.0 Requirements

- 3.1 A/E to verify existing wall conditions and ceiling heights in relation to size, location and installation requirements. Require contractors to confirm the above prior to installation.
- 3.2 Reference FBISD Facility Educational Standards for quantities and locations.
- 3.3 Refer to Division 6 – Wood, Plastics, and Composites for blocking requirements.

### 4.0 Coordination

- 4.1 Coordinate power and data locations during design.

### 5.0 Common Work Results for Specialties

- 5.1 Consider durable items with long-term (low) maintenance in mind.

## 12 10 00 - Art

### 1.0 Murals

- 1.1 FBISD Project Manager to coordinate graphic design and location. Must be approved by FBISD Administration.
- 1.2 Allowance to be provided in contract for painted murals.

## 12 20 00 – Window Treatments

### 1.0 General:

- 1.1 Coordinate window covering types and location with FBISD Design Manager.
- 1.2 Horizontal Blinds to be used. Do not use Vertical Louver Blinds. No wood, metal only.
- 1.3 Provide blinds for all exterior windows excluding glazing at cafetoriums, entrances, large assembly spaces, and clerestory windows.
- 1.4 Inside mounting. Coordinate with frame depth. Reference Division 8 - Windows, for coordination of the window and door frames with the blinds.
- 1.5 Separate blinds should be installed in each frame.
- 1.6 Blinds are typically installed on the private side of the window they are covering.

### 2.0 Mini Blinds

- 2.1 Provide mini blinds with 1" blades of High (Classic 8 gauge slats w/1-1/2" head rail) or Medium (Classic 6-gauge slats w/1-1/2" head rail) quality.

### 3.0 Window Shades

- 3.1 Approved Manufacturers
  - 3.1.1 Draper, Inc.
  - 3.1.2 Levolor Contract; a Newell Rubbermaid Company.
  - 3.1.3 Hunter Douglas Contract.
  - 3.1.4 CACO, Inc; Window Fashions.

- 4.0 Window Shades Motor and Control System:
  - 4.1 Standard Motor: 120 VAC, single phase, 60 HZ, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches. Tubular motor concealed inside each shade roller tube.
    - 4.1.1 Group Control: ISO relay - UL listed component. One ISO relay per motor. Allows 110-120V group switching via toggle switch. Allows for up to 12 motors on one switch.
    - 4.1.2 Coordinate requirements for power supply conduit, and wiring required for window shade motors and controls.
- 5.0 Window Treatment Operating Hardware
  - 5.1 Coordinate operating hardware types and location with FBISD Design Manager.
  - 5.2 Consider for use at high windows.
- 6.0 Warranty
  - 6.1 Hardware and Shade Fabric: Standard twenty-five (25) year limited warranty.
  - 6.2 Motors and Controls: Draper's standard five (5) year limited warranty.

## 12 30 00 – Casework

- 1.0 General
  - 1.1 Refer to Division 06 – Wood, Plastics, and Composites for additional information non finish carpentry and architectural woodwork.
  - 1.2 No cabinet is to be more than 42" in width; 36" is preferred. Reinforce shelves that are 36" or more in width.
  - 1.3 All upper cabinets to be 14" clear inside (to accommodate a binder). Drawers to have ball bearing track drawer slides.
  - 1.4 No single cabinet to be more than 21" in width.
  - 1.5 All adjustable shelves to have a maximum tolerance gap width of 1/8", typical.
  - 1.6 All shelving to be full depth of cabinet, i.e. only 1/2" maximum back from any edge for full utilization of space.
- 2.0 Countertops
  - 2.1 Provide countertops with PVC edge in as long as practical continuous lengths. Provide field glued splines at joints. No joints closer than 24 inches either side of sink cutout. Refer to Diagram 12\_02 in Appendix for additional information.
  - 2.2 At art classrooms in Middle Schools and High Schools, chemical resistant solid phenolic or chemical resistant plastic laminate countertops shall be specified.
    - 2.2.1 WilsonArt Chemsurf or approved equal at countertop and backsplashes.
  - 2.3 Solid Surface Countertops
    - 2.3.1 Install at reception and library circulation desks.
    - 2.3.2 Basis of Design Manufacturer/Product: Corian as manufactured by DuPont or comparable product.
    - 2.3.3 Construction: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.



- 2.4 Metal Countertops
  - 2.4.1 Install at concessions, kitchen & school store.
  - 2.4.2 Stainless steel sheet: ASTM A240, Type 304.
  - 2.4.3 Fabricate from 0.062-inch- (1.59-mm-) thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 inch (25 mm) over the base cabinets.
  - 2.4.4 Joints: Fabricate countertops without field-made joints.
  - 2.4.5 Weld shop-made joints.
  - 2.4.6 Extend the top down to provide a 1-inch- (25-mm-) thick edge with a 1/2-inch (12.7-mm) return flange.
  - 2.4.7 Finish: Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.
- 3.0 Backsplashes
  - 3.1 Backsplash: 4 inch high, integral to countertop. Fabricate with single continuous sheet of laminate from front counter to top of splash with no joints from horizontal to vertical application. No joints shall occur at sink openings.
- 4.0 Manufactured Wood Casework
  - 4.1 Manufactured Plastic-Laminate-Clad Casework
    - 4.1.1 Refer to Division 06 for construction information and details, this section for information related to construction by a pre-fab shop.
    - 4.1.2 Hardware:
      - 4.1.2.1 Drawer Slides – NO Euro-Style Drawer Slides. Provide Full Extension Ball-Bearing Type.
      - 4.1.2.2 Hinges – NO European (Salice) Hinges allowed. Provide five-knuckle overlay ONLY.
      - 4.1.2.3 Shelf Standards and Brackets
      - 4.1.2.4 Provide Label Holders on all File Drawers
      - 4.1.2.5 Provide 3" grommets. Coordinate location in field with users.
      - 4.1.2.6 Shelf clips to be plastic and 'locking'. They should be rated for minimum 500# per shelf. One possible type is Collegedale Twin-Pin Shelf Support.
- 5.0 Specialty Casework
  - 5.1 Commercial Kitchen Casework: Refer to Division 11 for Food Service Equipment.
  - 5.2 Educational/Library Casework
    - 5.2.1 Approved Manufacturers:
      - 5.2.1.1 Buckstaff.
      - 5.2.1.2 Tesco Industries.
      - 5.2.1.3 Estey (Distributed by InterStor).
      - 5.2.1.4 Spacesaver.
      - 5.2.1.5 Approved equal as approved by FBISD Design Manager.
    - 5.2.2 Ensure that shelving book stacks are supplied with top and end panels for rigidity of the shelving system.

- 5.2.2.1 Depressible Book Truck for circulation desk height is 27 inches.
- 5.2.2.2 Book return with front slot for circulation desk varies from 30 inches to 39 inches in height.

5.2.3 Book shelving is to be metal (CANTILEVER-TYPE) with plastic laminate or wood (depending on price and design) top and end panels. Each shelf is to be supplied with a 'stop' on each shelf (even on back to back shelving) to keep books from falling between the shelving.

5.2.4 Circulation desks are modular. Plastic laminate and wood construction. See requirements for plastic laminate casework in Division 6, Plastic Laminate-Clad Architectural Cabinets.

5.2.5 At front desk, transaction counter for writing requirements

- 5.2.5.1 The counter height dimension is measured from the surface of the finished floor to the top of the reception counter and should be no higher than 34 inches, leaving it within reaching range for the visitor. In addition, a portion of the counter shall be at least 36 inches long to allow for ease of movement during the transaction. Coordinate requirements with ADA and TAS.

## 6.0 Laboratory Casework

### 6.1 At Middle Schools:

- 6.1.1 Lab Casework to be plastic laminate with epoxy resin top with integral resin sink. For requirements of construction, Refer to Division 6, Plastic Laminate-Clad Architectural Cabinets and Division 22 – Plumbing.
- 6.1.2 Prep room casework to be wood with epoxy resin top with integral resin sink.

### 6.2 At High Schools:

- 6.2.1 Lab Casework to be wood with finish as selected by FBISD Design Manager and epoxy resin tops with integral resin sinks.

6.3 All exposed surfaces to match in color as much as possible. Matching of finish per room will be reviewed and approved by FBISD Design Manager.

6.4 Provide 5 knuckle stainless steel institutional heavy duty type hinge with straight wings.

6.5 Drawer bodies to be minimum 3/8" thick Baltic birth, transparent sealed finish.

6.6 All drawers and file boxes to be maximum height, length, width and depth to fit within casework frame to fully utilize storage space. Maximum 1/2" to 3/4" clearances allowed.

6.7 Glass: 7/32" for tall cases and unframed wall and upper case doors, 1/8" for framed wall and upper case doors, without imperfections or marred surfaces of clear float glass.

6.8 All locking hardware on casework within a room should be keyed the same as the

door hardware to the room utilizing small format interchangeable cores. Please see Division 08 for more information on hardware.

- 6.9 Acceptable Approved casework manufacturers:
  - 6.9.1 Campbell Rhea Caseworks
  - 6.9.2 Diversified Woodcrafts, Inc.
  - 6.9.3 Hamilton Laboratory Solutions, LLC.
  - 6.9.4 Kewaunee Scientific Corp.
  - 6.9.5 Leonard Peterson & Co.
  - 6.9.6 MGC Millwork, LP.
  - 6.9.7 South Texas Woodmill, Inc.
  - 6.9.8 TMI Systems Corporation
- 6.10 Science Prep Room shelving:
  - 6.10.1 Shelving and shelving unit to be wood finish.
  - 6.10.2 No metal shelving allowed.
  - 6.10.3 Shelves to contain lip all four sides to contain spills (including fixed shelf).
  - 6.10.4 Shelves to be adjustable but screwed in place for safety (minimum 2 opposite corners).
  - 6.10.5 Plastic shelf support clips (more chemical resistant).
- 7.0 Performing Arts Casework
  - 7.1 Band Uniform Storage
    - 7.1.1 Band coat with trouser hanging underneath; height = 44"
    - 7.1.2 Hat box dimensions are 11 1/2" wide, 8 1/2" high and 11 1/2" deep.
    - 7.1.3 Shoe cubbies
    - 7.1.4 Tuxedos hang like band coats. Dresses hang 63" in height.
    - 7.1.5 For more information, refer to FBISD Facility Educational Standards.
  - 7.2 Music Instrument Storage
    - 7.2.1 For use at Middle Schools and High Schools. For more information, refer to FBISD Facility Educational Standards.
    - 7.2.2 Basis of Design Manufacturer: Wenger or comparable product approved by FBISD Design Manager.
    - 7.2.3 Cabinets to have straight compartment grille doors.
    - 7.2.4 Cabinets to be constructed of No Added Formaldehyde composite wood. If FSC Wood is required, coordinate with FBISD Design Manager.
    - 7.2.5 Color:
      - 7.2.5.1 Cabinet Interior Color: Oyster or coordinate with FBISD Design Manager.
      - 7.2.5.2 Cabinet Closure Material: Oyster or coordinate with FBISD Design Manager.
    - 7.2.6 Basis of Design Manufacturer: Wenger or comparable product as approved by FBISD Design Manager.
  - 7.3 Music Library Storage
    - 7.3.1 Provide Wenger sliding music storage system or comparable product as approved by FBISD Design Manager.

## 12 60 00 – Multiple Seating

### 1.0 Fixed Audience Seating

#### 1.1 Upholstered Audience Seating:

##### 1.1.1 Approved Manufacturers & Products:

1.1.1.1 "Stellar 220" as manufactured by American Seating Company.

1.1.1.2 "Citation" as manufactured by Irwin Seating Company.

1.1.1.3 "Continental" as manufactured by American Desk.

1.1.1.4 "Producer" as manufactured by Seating Concepts.

1.1.1.5 "Quattro Traditional" as manufactured by Hussey Seating Company.

1.1.2 Provide floor-mounted upholstered seating unit with steel pedestals and center standards.

1.1.3 Seat is to remain in the 'up' position when not in use. Armrests are to be plastic.

1.1.4 Do not provide desk tables or desk arms.

1.1.5 Architect to ensure that adequate clear width is maintained between seat back and seat in 'down' position as well as providing an aisle that allows for two people to pass each other.

1.1.6 Architect to provide for accessible seating, including appropriate quantity of folding arm rests at aisles. Ensure appropriate line of site (including horizontal and vertical viewing angles) are provided at accessible seating.

### 2.0 Stadium and Arena Seating

2.1 Stadium and Arena Bench Seating: Aluminum, no number required.

2.2 Stadium and Arena Seats: Molded plastic, numbers required at District Athletic Facilities.

### 3.0 Telescoping Stands

#### 3.1 Telescoping Bleachers

3.1.1 Coordinate seating quantities with FBISD Facility Educational Standards.

3.1.2 In Middle Schools, provide bleachers on one side only of each gym. Bleachers in gyms to be back to back. In each gym, team seating, timer's table, and all controls are on opposite wall from bleachers.

3.1.3 In High Schools, provide bleachers on one side of practice gym. Place the bleachers on the wall which backs up to the competition gym. Place the team seating, timer's table, and all controls on the wall opposite the bleachers. In the competition gym, provide bleachers on both sides of the gym. Place the team seating, timer's table and all controls on the side of the gym furthest from the adjacent practice gym.

3.1.4 Mount connections for controls in front of bleachers, no floor boxes.

3.1.5 For High Schools, provide one removable timer's table in each gym designed to mount in bleacher deck sockets.

3.1.6 Approved manufacturers:

3.1.6.1 Hussey Seating Company.

3.1.6.2 Interkal, Inc.

3.1.6.3 Comparable product approved by FBISD Design Manager.

3.1.7 Steel frame construction with wood tread and riser and plastic seats (more durable and more difficult to graffiti).

- 3.1.8 Coordinate school initials with seat layout.
- 3.1.9 For rows totaling 6 or more, provide non-friction motor (Roll-Eze).
- 3.1.10 For rows totaling 5 or less, provide fixed, non-motorized seating.
- 3.1.11 Allow partial opening with locking capability.
- 3.1.12 Each tiered row shall be fully enclosed at the footrest level.
- 3.1.13 Ensure that stairs are flush with seats.
- 3.1.14 Ensure that handrail will collapse with the bleacher and does not have to be removed each time bleachers are closed.
- 3.1.15 Provide ADA/TAS required recoverable seating so that it can be pulled out and used when no ADA seating is required.
- 3.1.16 Provide recoverable team seating in bleachers.
- 3.1.17 Provide access to underneath of bleachers for repair and maintenance.
- 3.1.18 Provide signage indicating that closed bleachers are not to be used for seating. Seating is allowed only on fully extended bleachers (not partially extended or closed bleachers).
- 3.1.19 Provide keyed switch for operation, spring loaded, limit switch. Keso or equal. Minimum row depth – 26”.
- 3.1.20 During design layout, ensure that there is adequate room for bleachers and a person to sit and still allow referee or circulation in front of the bleachers at the sidelines of the basketball main court. At the side courts, ensure that there is enough room for the bleachers to be extended for some seating for PE and the basketball goals and volleyball courts to still be utilized for PE.
- 3.1.21 Include a 5 year warranty and a demonstration of proper operation in the specifications.

#### 4.0 Seat and Table Assemblies (Pedestal Tablet Arm Chairs) – NOT ALLOWED.

### 12 90 00 – Other Furnishings

#### 1.0 Site Furnishings

##### 1.1 Bicycle Racks:

- 1.1.1 Refer to FBISD Facility Educational Standards for Quantity at each type of school.
- 1.1.2 Approved manufacturer
  - 1.1.2.1 AAA Ribbon Rack Co., Inc.
  - 1.1.2.2 Bike Security Racks, Co.
  - 1.1.2.3 Huntco Supply, LLC.
- 1.1.3 Construction
  - 1.1.3.1 Galvanized steel frame.
  - 1.1.3.2 Single pipe style.
  - 1.1.3.3 Polyester powder coat finish.
  - 1.1.3.4 Galvanized steel finish.

#### 2.0 Site Seating and Tables

- 2.1 Typical Furnishings available to assist A/E with layout spaces.

### END OF DIVISION 12


## Division 13

# Special Construction

General Requirements for Special Construction	13 00 00
Operation Maintenance of Special Construction	13 01 00
Common Work Results for Special Construction	13 05 00
Special Structures	13 30 00
Special Instrumentation	13 50 00

### DIVISION 13 – Special Construction

#### 13 00 00 - General Requirements for Special Construction

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3  Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.
- 3.0 Requirements
  - 3.1 Refer to FBISD Facility Educational Standards and Diagram 32\_01 Schedule of Exterior Improvements in Appendix for additional information.
  - 3.2 Special Activity Rooms - Refer to FBISD Facility Educational Standards and Division 09 - Finishes.



### **13 01 00 - Operation Maintenance of Special Construction**

- 1.0 Consider maintenance costs when selecting materials and systems

### **13 05 00 - Common Work Results for Special Construction**

- 1.0 Sound Control
  - 1.1 For CMU walls in sound sensitive rooms consider perlite or other insulating fill to solid fill all cells not already scheduled for structural grout and rebar.
  - 1.2 Architect shall utilize Acoustical Consultant for evaluation of all Fine Arts, Large and Heavy Traffic Areas, including: Band, Orchestra, Choir, Gymnasiums, Main Corridors, Black Box, Auditorium, Library, and Practice Rooms / Ensemble.
  - 1.3 Copy of acoustic report from A/E's consultant shall be provided to FBISD Project Manager along with Design Development deliverable. Provide additional copy with 90% CD set, confirming all original items have been complied with.

### **13 30 00 - Special Structures**

- 1.0 Fabricated Engineered Structures
  - 1.1 Glazed Structures
    - 1.1.1 Basis of Design: Ludy Greenhouse Corp. or comparable product approved by FBISD Design Manager.
    - 1.1.2 Review submittal with CTE and FBISD Project Manager prior to approval.
    - 1.1.3 Ensure designed for Gulf Coast climate. Consult with Texas Department of Insurance (TDI).
    - 1.1.4 Add to specification for installation: Architect, FBISD Project Manager, and General Contractor reserve the right to inspect the Work during fabrication. Upon completion of the Work, if inspection discloses that materials are not in accordance with specifications or have been damaged, Manufacturer/Fabricator agrees to furnish additional materials necessary to make repairs and place Work in an acceptable condition.
    - 1.1.5 Warranty: Manufacturer's Warranty: Warrant the Work specified herein against becoming unserviceable, causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship, or failure to perform as required.
      - 1.1.5.1 System Warranty: Defects are defined to include uncontrolled leakage of water, abnormal aging or deterioration, rusting or corrosion of prefinished metals, or loss of structural integrity.
        - 1.1.5.1.1 Warranty period: One (1) year from date of Substantial Completion.
      - 1.1.5.2 Polycarbonate Material Warranty: Defects are defined to include abnormal cracking, abnormal aging, more than 8.0 Delta E units of discoloration, or loss of light transmission greater than 6 percent according to ASTM D2244.
        - 1.1.5.2.1 Warranty period: Five (5) years non-pro rata from date of Substantial Completion.

- 1.2 Exterior Grandstands and Bleachers
  - 1.2.1 Approved Manufacturers:
    - 1.2.1.1 Sturdisteel Company
    - 1.2.1.2 Outdoor Aluminum
    - 1.2.1.3 Southern Bleacher Company
  - 1.2.2 Aluminum seating with steel support structure. Any splices in seating plank to be fully supported.
  - 1.2.3 Numbering to be used in some cases; consult with FBISD Design Manager. If provided, numbering to be stamped on metal plates and riveted to seat.
  - 1.2.4 Enclose underneath of bleachers (including under ramps and stair structures) up to handrail height with chain link to prevent access under bleachers by public. Allow for maintenance access with one lockable gate.
- 1.3 Press Box
  - 1.3.1 Consider pre-fabricated in lieu of onsite construction. Discuss with FBISD Design Manager.
  - 1.3.2 Laminated glass windows with a securable awning type shutter over them to guard against vandalism when not in use. However, shutter must not restrict view of field during use.
  - 1.3.3 Coordinate HVAC or natural ventilation with FBISD Design Manager. Design for a cross-breeze for proper ventilation even when not in use, i.e., low air flow area on one side/end and high air flow area on opposite side/end.
  - 1.3.4 Packaged Terminal Air Conditioner (PTAC) units for the small press boxes. Coordinate with FBISD Design Manager.
  - 1.3.5 Architect to provide a sightline study (site specific) for each project. This consists of a section through press box, bleachers, and field used to determine sightlines.
  - 1.3.6 Coordinate location with FBISD Design Manager and Athletics.
  - 1.3.7 All press boxes to have Wi-Fi and sound systems.
- 1.4 Fabricated Structures
  - 1.4.1 Guard Shack
    - 1.4.1.1 Guard station should be sized minimum to accommodate ADA/TAS requirements and clearances.
    - 1.4.1.2 Provide a concrete access drive for the security vehicle alongside one side of the building with electrical accommodations for recharging the vehicle.
    - 1.4.1.3 Provide ADA/TAS access to building and vehicle recharging area.
    - 1.4.1.4 Provide one – 2" empty conduit to building for future use.
    - 1.4.1.5 Design for a cross-breeze for proper ventilation even when not in use, i.e. low air flow area on one side/end and high air flow area on opposite side/end.
  - 1.4.2 Equipment Screening
    - 1.4.2.1 In some Authorities Having Jurisdiction, no mechanical equipment is to be visible from 1000' sight line in any direction. Verify requirements prior to design of system. Only where there is no other available option can there be roof screens or parapet walls to screen equipment.
    - 1.4.2.2 Basis of Design Manufacturer/Product: Envisor 2 by Cityscapes Towers.



#### 1.4.2.3 Other approved manufacturers

1.4.2.3.1 Architectural Louvers.

1.4.2.3.2 Comparable product approved by FBISD Design Manager.

### 2.0 Band Tower

2.1 Contractor furnished, contractor installed.

2.2 At High School practice area (parking lot) Band Tower to be located 25' from the painted side line to allow for percussion and drum majors, etc.

2.3 Height of tower shall be minimum height of 25 feet.

2.4 Consider a hose bib and power at band tower if utilities are located reasonably nearby.

2.5 Approved manufacturers:

2.5.1 Melhart Music Company.

2.5.2 Educational Steel Products, LLC.

2.5.3 K C Metal Works.

2.5.4 PortaKing.

2.5.5 Comparable product approved by FBISD Design Manager.

### 3.0 Pre-Engineered Metal Building Systems

3.1 Requirements below are for Metal Buildings to be used at Ancillary Facilities such as Agricultural Barns.

3.2 Metal building manufacturer shall design for recessed baseplates and anchor bolts which will be below the top of slab, same as conventional construction.

3.3 Provide schematic framing plan in design and construction documents. Do not rely solely on performance specifications.

3.4 Provide portal framing where future expansion anticipated. Design to be coordinated with structural engineer and minimum requirements included in documents prior to bidding.

3.5 Steel-framed column and beam shelter suitable for outdoor use.

3.6 Reinforced concrete drilled footings with embedded anchor bolts for column support.

3.7 Metal Buildings' Approved Manufacturers:

3.7.1 Red Dot Buildings

3.7.2 Ceco Building Systems, an NRCI Building Systems Company

3.7.3 MBCI, an NCI Building Systems Company.

3.7.4 Star Building Systems, an NCI Building Systems Company

3.7.5 Whirlwind Steel Buildings

3.8 Submittals:

3.8.1 Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal building system components:

3.8.1.1 Roof framing system.

3.8.1.2 Roof panels.

3.8.1.3 Trim and closures.

3.8.1.4 Accessories.

3.8.2 Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other Work.

3.8.2.1 Structural-Framing Drawings: Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

- 3.8.2.2 Roof Panel Layout Drawings: Show layouts of panels on support framing, details of edge conditions, panel profiles, supports, anchorages, trim and closures. Indicate field-assembled Work.
- 3.8.2.3 Fabrication drawings shall be sealed with structural engineer licensed to practice in the state of Texas. Frame and column spacings and member sizes and thicknesses shall be based upon 30 lb. dead load and 100 mph wind load unless greater design wind load is indicated.
- 3.8.2.4 Provide drilled pier design and layout prepared and sealed by structural engineer licensed to practice in the state of Texas. Depth and diameter of piers shall be based on geotechnical report for the site provided by the FBISD Project Manager, 30 lb. dead load, and wind load requirements of local region.
- 3.8.3 Samples for Verification: For the following products, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected, in the profile and style indicated. Prepare Samples from the same material to be used for the Work.
- 3.9 Warranty
  - 3.9.1 Manufacturer's System Warranty: Written warranty covering all system components against defects in materials and workmanship for a period of ten (10) years after Substantial Completion of the project.
- 3.10 Roof Panels
  - 3.10.1 Roof panel configuration to be coordinated with FBISD Design Manager based on application.
  - 3.10.2 Prefinished minimum 24-gauge roofing panels with nominal 16 inch wide coverage area and concealed fastening clip system. Seam height nominal 1-1/2 inch. Panels shall be provided precut to proper length according to approved roofing layout. Field cutting shall not be required nor allowed.
  - 3.10.3 Material and Finish: Steel sheet formed and factory-finished with specified powder coat finish. Steel sheet metallic coated by the hot-dip process and top and bottom faces pre-painted by the coil-coating process to comply with ASTM A 755.
- 4.0 Outdoor Covered Play Structures for Playgrounds
  - 4.1 Requirements below are for Outdoor Covered Play Structure over exterior basketball courts and Playground Equipment.
  - 4.2 Provide schematic framing plan in design and construction documents. Do not rely solely on performance specifications.
  - 4.3 Steel-framed HSS columns and beams with factory finish suitable for outdoor use.
  - 4.4 Reinforced concrete drilled footings with embedded anchor bolts for column support.
  - 4.5 Outdoor Covered Play Structure Basis of Design: Series 8300 Gable End Structure as manufactured by Superior Recreational Products. Other approved Manufacturers:
    - 4.5.1 Classic Recreation Systems.
    - 4.5.2 Comparable product approved by FBISD Design Manager.
  - 4.6 Submittals:
    - 4.6.1 Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal building system components:
      - 4.6.1.1 Roof framing system.
      - 4.6.1.2 Roof panels.

- 4.6.1.3 Trim and closures.
- 4.6.1.4 Accessories.
- 4.6.2 Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other Work.
  - 4.6.2.1 Structural-Framing Drawings: Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
  - 4.6.2.2 Roof Panel Layout Drawings: Show layouts of panels on support framing, details of edge conditions, panel profiles, supports, anchorages, trim and closures. Indicate field-assembled Work.
  - 4.6.2.3 Fabrication drawings shall be sealed with structural engineer licensed to practice in the state of Texas. Frame and column spacings and member sizes and thicknesses shall be based upon 30 lb. dead load and 100 mph wind load unless greater design wind load is indicated.
  - 4.6.2.4 Provide drilled pier design and layout prepared and sealed by structural engineer licensed to practice in the state of Texas. Depth and diameter of piers shall be based on geotechnical report for the site provided by the FBISD Project Manager, 30 lb. dead load, and wind load requirements of local region.
- 4.6.3 Samples for Verification: For the following products, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected, in the profile and style indicated. Prepare Samples from the same material to be used for the Work.
- 4.7 Warranty
  - 4.7.1 Manufacturer's System Warranty: Written warranty covering all system components against defects in materials and workmanship for a period of ten (10) years after Substantial Completion of the project.
- 4.8 Roof Panels
  - 4.8.1 Roof panel configuration to be coordinated with FBISD Design Manager based on application.
  - 4.8.2 Prefinished minimum 24-gauge roofing panels with nominal 16 inch wide coverage area and concealed fastening clip system. Seam height nominal 1-1/2 inch. Panels shall be provided precut to proper length according to approved roofing layout. Field cutting shall not be required nor allowed.
  - 4.8.3 Material and Finish: Steel sheet formed and factory-finished with specified powder coat finish. Steel sheet metallic coated by the hot-dip process and top and bottom faces pre-painted by the coil-coating process to comply with ASTM A 755.

### **END OF DIVISION 13**


## Division 14

# Conveying Equipment

General Requirements for Conveying Equipment		14 00 00
Maintenance of Conveying Equipment		14 01 00
Common Work Results for Conveying Equipment		14 05 00
Elevators		14 20 00
Lifts		14 40 00

### DIVISION 14 – CONVEYING EQUIPMENT

#### 14 00 00 - General Requirements for Conveying Equipment

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated within sections below.
  - 1.3  Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of the specified product.
- 3.0 Requirements
  - 3.1 Obtain products from one source from a single manufacturer.
- 4.0 Clarifications Regarding Specialties
  - 4.1 Purpose of this section is to provide performance criteria, and special detailing requirements, for conveying systems (elevators) in new and existing FBISD facilities.
  - 4.2 Information is also included on limited-use lifts, HOWEVER, use of this equipment is

strongly discouraged. It is preferred for A/E to design facilities that minimize need for this type of equipment by ensuring contiguous access to all areas, as well as utilizing current accessibility standards to avoid need for conveying equipment.

- 4.3 Maintenance and periodic inspections are required for all conveying systems and minimizing need for such equipment is imperative to minimizing FBISD use of Operation and Maintenance funds.
- 4.4 Information required to coordinate with other systems is included within this section, along with references to other sections, where appropriate.
- 4.5 Intention is for this section to assist with competitive pricing on all equipment, rather than outlining sole-source manufacturers.

#### **14 01 00 – Maintenance of Conveying Equipment**

- 1.0 FBISD Facilities Department has existing contract for maintenance and inspection of all conveying equipment. FBISD Project Manager to verify all designs with Facilities prior to fully incorporating into documents.
- 2.0 For Elevators, beginning at Substantial Completion, consider maintenance service contract to include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 2.1 Perform maintenance during normal working hours.
  - 2.2 Perform emergency callback service during normal working hours with response time of two hours or less.

#### **14 05 00 - Common Work Results for Conveying Equipment**

- 1.0 Provide design that is 100% in compliance with current Texas Department of Licensing and Regulation Chapter 754 for Elevators, Escalators, and Related Equipment.
- 2.0 Elevator consultant is not required, however, design confirmation by elevator manufacturer is strongly recommended. Extensive revisions to architectural, structural, and/or MEP during construction, due to lax in A/E coordination are not acceptable, except those directly related to changes in regulations.

## 1.0 General Requirements

- 1.1 A/E may utilize Elevator Consultant to ensure full coordination with other disciplines (use of this type of consultant not required, as noted within Division 14 General Requirements.)
- 1.2 Emergency two-way communication device (tied to FBISD Police Department) to be push button in lieu of handset.
- 1.3 Each elevator to have dedicated phone line for 24 hour dial-in to police department (verify phone number with FBISD Project Manager).
- 1.4 Police department to assign a building identification number for use in programming; coordinate with FBISD Design Manager.
- 1.5 State inspection certificate required by contractor to be forwarded to FBISD Design Manager as soon as possible. Inspection and all re-inspection fees related to deficient initial installation, to be paid by contractor. FBISD Design and Construction Department will forward certificate (keep a copy) to FBISD Maintenance so that elevator is added to their records. All subsequent annual inspection fees are paid by FBISD Facilities and Maintenance.
- 1.6 Finishes shall be as follows and coordinated with FBISD Design Manager.
  - 1.6.1 LVT Flooring, or VCT at existing to match adjacent, consider color and pattern to complement first floor corridor.
  - 1.6.2 Plastic laminate wall panels mounted over pre-finished steel panels (high performance baked on coating).
  - 1.6.3 Provide stainless rails on three sides.
  - 1.6.4 Provide stainless steel frame and doors at corridors.
- 1.7 Locate at central location for maximum convenience, access to all areas.
- 1.8 Specify that programming to be non-proprietary.
- 1.9 Call buttons and switches to be key-operated.
- 1.10 No car position indicator lights required in hallways.
- 1.11 Provide moving pads and support hooks.
- 1.12 TDLR inspects all elevators and requires sump pump in pit with audio and visual high water alarm.
- 1.13 Quality and Safety Standards
  - 1.13.1 ASTM A17.1 – Safety Code for Elevators and Escalators.
  - 1.13.2 ASTM A17.5 – Elevator and Escalator Electrical Equipment.
  - 1.13.3 A117.1 – Accessibility Code.
  - 1.13.4 Elevator manufacturer having minimum 10 years documented experience who is trained and approved by manufacturer.
  - 1.13.5 Manufacturer of the power unit, controller, signal fixtures, door operators cab, entrances, and other major parts of the elevator operating equipment.
  - 1.13.6 Primary and major equipment components are manufactured in the United States and are not be an assembled system.
  - 1.13.7 Documented, ongoing quality assurance program.
  - 1.13.8 ISO-9001 Manufacturer Certified.
  - 1.13.9 ISO-14001 Environmental Management System Certified.
- 1.14 Approved manufacturers.
  - 1.14.1 Thyssen Krupp.
  - 1.14.2 Otis Elevator.
  - 1.14.3 Schindler Elevator Corporation.

## 2.0 Electric Traction Elevators

- 2.1 Verify application with FBISD Design Manager. Consider for higher floor-to-floor

conditions and for facilities where space limited.

3.0 Hydraulic Elevators

3.1 Verify application with FBISD Design Manager, typical for most new facilities.

4.0 Do not design limited use/limited application elevators.

5.0 Custom Elevator Cabs and Controls:

5.1 Provide as required by State Inspector and current Elevator Requirements.

6.0 Door Reopening Devices

6.1 Infrared Array: Provide door-reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

6.2 Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door-reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

7.0 Warranty

7.1 Written warranty signed by manufacturer in which manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

7.1.1 Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

7.1.2 Warranty Period: Two (2) years from date of Substantial Completion.

- 1.0 General Requirements.
  - 1.1 Limited use only, A/E SHOULD NOT DESIGN for this equipment to be required in New Construction on FBISD Facilities.
  - 1.2 A/E ensure Variance is requested from Texas Department of Licensing and Regulation, Architectural Barriers Division, for any proposed use. Initial Variance request will be funded by FBISD, with subsequent requests or re-submittals paid for by A/E.
  - 1.3 FBISD Project Manager to coordinate with Special Education Department if lifts are required. Mobile wheelchair lifts are preferred.
- 2.0 Wheelchair Lifts
  - 2.1 Do not design inclined wheelchair lifts.
  - 2.2 Vertical Wheelchair Lifts
    - 2.2.1 Refer to information above concerning AVOIDING need for this equipment.
    - 2.2.2 Consider all approach and exit clearances when accommodating space for this type of equipment. Most models allow for entry and exit on OPPOSITE sides of unit, however, most manufacturers have versions where entrance and exit are perpendicular (90 degree exit).
- 3.0 Platform Lifts (Orchestra and Stage Lifts)
  - 3.1 Lift shall be designed, tested and installed in compliance with all applicable regulations of all governing agencies with jurisdiction and in accordance with ASME A.17.1 standards and A18.1 standards.
  - 3.2 All load ratings and safety factors must be certified by a professional engineer.
  - 3.3 Warranty: Warrant the work specified herein for two (2) years from date of Substantial Completion against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship. If Contractor permits use of elevators, he shall pay for extended warranty and extended maintenance.
    - 3.3.1 Defects shall include, but not be limited to, the following:
      - 3.3.1.1 Deterioration of finishes.
      - 3.3.1.2 Loose or missing parts.
      - 3.3.1.3 Non-functioning components and mechanisms.
      - 3.3.1.4 Rough or noisy operation.
- 4.0 Vehicle Lifts
  - 4.1 For use at District Transportation Facilities and CTE Auto Shops.
  - 4.2 Verify need with FBISD Design Manager.
  - 4.3 Coordinate power requirements.
  - 4.4 Revise or design foundation to accommodate unit weight and loaded weight.
  - 4.5 Provide accessible disconnect near unit.
  - 4.6 Warranty: Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of lifts that fail in materials or workmanship within specified warranty period.
    - 4.6.1 One (1) year from date of substantial completion.

#### END OF DIVISION 14



## Division 21

# Fire Suppression

General Requirements for Fire Suppression		21 00 00
Fire Suppression Sprinkler Systems		21 13 00

### DIVISION 21 FIRE SUPPRESSION

#### 21 00 00 - General Requirements for Fire Suppression

- 1.0 The fire suppression system will be by performance specification that will include FBISD specific requirements, as noted within these Division 21 sections. A/E team will incorporate the design elements into the documents and include the materials and installation requirements in the specifications.
- 2.0 Fire protection submittals require review by Engineer and Architect. Engineer to review for compliance with performance specification and design documents. Architect to review for pipe routing and head locations (coordination with architectural elements) as well as color/finish.
- 3.0 All new facilities and additions/renovations shall have full automatic fire suppression.
- 4.0 Design and install the system so that no part will interfere with doors, windows, heating, plumbing, or electrical equipment. Do not locate sprinkler heads within 6 inches of lighting fixtures, HVAC diffusers and other obstructions. Sprinkler piping cannot penetrate ductwork or lighting fixtures. Provide additional heads under ducts, equipment where required.
- 5.0 The Contractor shall conform to the National Fire Protection Association's Fire Code No. 13, latest edition. Special attention shall be given to Article 1-9, working plans. It shall be the Registered Fire Protection Engineer's responsibility to determine if any deficiency or deviations, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.
- 6.0 Require fire suppression contractor to provide coordination drawings for overall building showing all piping, sprinkler head locations and indicate sizing and proposed elevation from finish floor for coordination with other trades.

- 7.0 Flow test shall be performed at proposed site prior to A/E design for evaluation of supply and inclusion of special equipment (if needed) in the contract documents. Flow test information shall be submitted to owner prior to 50% CD design review phase.
- 8.0 Provide a composite fire protection plan in the construction documents to indicate any special areas regarding types of protection or areas sensitive to architectural design.
- 9.0 Sprinkler piping that is exposed (such as in stairwells, etc.) to be designed such that it is tight to a building element and is located minimum 8' above finish floor so that students do not hang on it. Review with Owner and detail routing of such areas in construction documents.
- 10.0 Consider dual level fire protection when designing and documenting areas (band halls or auditoriums) where hanging ceiling elements or large bulkheads are present. Include information on composite fire protection plans so subcontractor considers during final design submittal.
- 12.0 All system drain locations shall be located in building mechanical rooms and properly labeled per NFPA requirements and note all locations on as-built drawings.
- 13.0 Require contractor to fill out and submit a "Material and test certificate" in compliance with NFPA 13 – 10.10.0 AND receive fire marshal sign-off prior to 100% payment of underground portion of work.
- 14.0 Require contractor to fill out and submit a "Material and test certificate" per NFPA 13 – 16.1 AND receive fire marshal sign-off prior to payment of 100% for above ground work.
- 15.0 Testing of completed system for acceptance shall be witnessed and signed off by FBISD MEP Manager.
- 16.0 Provide 5% attic stock of sprinkler heads, escutcheons and wrenches at the end of the project.
- 17.0 Provide full size zoning diagram for all building areas per floor mounted in 30"x42" framed layout with plexiglass front. Mount layout next to main fire alarm control panel. Diagram should have the physical address, fire department connections (FDC) and indicate which zone valves control which portion of the building and indicate location of each valve, system drain and test valves. Diagram shall reflect actual room numbers indicated in the final approved architectural room graphics package. Diagram shall also show all sprinkler head locations for the entire building.
- 18.0 MEP Engineer to note in their performance spec for the fire suppression system to avoid running sprinkler lines over MDF/IDF footprints. Only piping for local sprinkler head shall be located in the MDF/IDF but any branch piping serving other locations shall not be installed above any telecommunication room.
- 19.0 Install 2" fiberglass insulation on all fire sprinkler piping and taps located in the central plant/main mechanical room and the main electrical room for the building. Label all piping to indicate fire sprinkler piping after install.

## 21 13 00 – Fire Suppression Sprinkler Systems

- 1.0 Sprinkler Heads:
  - 1.1. Flexible heads are acceptable as long as product has UL listing for fire suppression.
  - 1.2. Provide concealed sprinkler heads in all areas where possible.
  - 1.3. Provide exposed sprinkler heads at all areas open to structure.
  - 1.4. Provide wire guards on heads in all mechanical rooms, gymnasiums, and other areas where heads are subject to damage.
  - 1.5. Sprinkler heads to be centered within acoustical ceiling tiles.
  - 1.6. Avoid need for prefinished (special color other than white) sprinkler heads, however note as required in some areas (black box, auditorium).
- 2.0 Pipe and Fittings:
  - 2.1. Victaulic fittings are acceptable.
  - 2.2. Systems subject to freezing shall utilize antifreeze liquid or heat trace of piping. No dry pipe systems.
  - 2.3. All new construction shall use steel pipe. Renovation projects may consider CPVC, only with FBISD Design Manager approval in writing during design phase.
  - 2.4. Provide access panels in walls and ceilings that require access to service any fittings, valves and equipment. Panels shall be minimum 24"x24" or larger as needed to provide proper access.
  - 2.5. Provide dielectric union fittings for all dissimilar materials.
  - 2.6. All piping and specialty fittings shall be properly sized for the pressure and temperatures required by code serving a given area.
  - 2.7. Piping shall be labeled and show direction of flow arrow for all above ground sprinkler piping installed in open areas or above lay in ceilings at intervals no great than 25' on center.
  - 2.8. All piping passing thru walls and floors shall receive sleeves. Sleeves shall extend 2" on either side of wall or floor penetration. Sleeves shall be sized at 1.5" diameter greater than pipe passing thru sleeve.
  - 2.9. All piping, valves and fittings shall be made in the USA.
  - 2.10. Paint all exposed piping throughout building to be red in color.
  - 2.11. Insulate all fire suppressing piping in main Mechanical and Electrical rooms.
- 3.0 Fire pumps and controllers
  - 3.1. Acceptable manufacturers of fire pumps shall be **Aurora, Peerless, Fairbanks-Morse**
  - 3.2. Acceptable manufacturers of fire pump controllers shall be **Metron or Master.**
  - 3.3. Pumps and controllers shall be UL and FM approved.
  - 3.4. Fire water storage tank manufacturer shall be UL listed and FM approved.

**END OF DIVISION 21**

## Division 22

# Plumbing Systems

General Requirements for Plumbing Systems	22 00 00
Common Work Results for Plumbing	22 05 00
Plumbing Insulation	22 07 00
Instrumentation and Control for Plumbing	22 09 00
Domestic Water Distribution	22 11 00
Sanitary Waste and Vent Piping	22 13 00
General Service Compressed-Air Systems	22 15 00
Natural Gas Distribution	22 20 10
Domestic Water Softeners	22 31 00
Domestic Water Filtration Equipment	22 32 00
Electric Domestic Water Heaters	22 33 00
Plumbing Fixtures	22 40 00
Lavatories and Sinks	22 42 16
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Plumbing Fixture General Requirements	22 42 99
Emergency Shower	22 45 00
Drinking Fountains and Water Coolers	22 47 00
Sustainable Design Items	22 99 00

### DIVISION 22 – PLUMBING SYSTEMS

#### 22 00 00 - General Requirements for Plumbing Systems

- 1.0 Architect/Engineer to ensure walls are deep enough to accommodate carriers without excessive cutting of wall materials. This is to help ensure that excessive cracking in the wall material does not occur.
- 2.0 Require that all plumbing work shall be supervised by a licensed journeyman plumbing contractor at all times any plumbing work is being installed on a project.
- 3.0 Restrooms
  - 3.1. Where restrooms are back to back with two or more water closets, Provide chase with door access. Chase shall be minimum 30" wide.
  - 3.2. For restrooms with hard ceilings where chase is not accessible, provide a 24"x24" access panel effectively positioned at "wet" wall for maintenance and inspection purposes. If possible, leave one wall open above ceiling for chase inspection. Install access panels in boys/mens restrooms where possible.
  - 3.3. For water closet chase wall that is constructed of CMU, typical minimum depth is 24".

- 3.4. For lavatories and other fixtures chase walls that are constructed of CMU, typically minimum depth is 18".
- 4.0 Piping / Fittings:
  - 4.1. Pipe and fitting are to be manufactured in the USA.
  - 4.2. Pipes and fittings resting on the ground is unacceptable. Keep products covered and provide temporary end caps and closures.
  - 4.3. All abandoned piping shall be removed and disposed of off-site including ducts, hangers or equipment. All abandoned piping that can't be removed needs to be labeled, purged and capped in both ends. Note piping on as-built drawings.
  - 4.4. Require expansion loops where runs or piping cross expansion joints in building.
  - 4.5. Size underground domestic water, sanitary, and storm drainage to accommodate future additions of approximately 15% additional floor area without major revamp of the piping.
  - 4.6. Where possible, all piping to be concealed.
- 5.0 If a sink (single fixture) is not mounted in casework, typically provide a chase wall behind it of minimum 16" if CMU or 6" stud to minimize cracking of materials.
- 6.0 Coordinate location of plumbing fixtures with kitchen equipment layout.
- 7.0 Specify that all necessary precautions shall be taken as required to prevent damage to the roofing due to welding or cutting of pipe. Any damage shall be repaired by the roofing contractor, payment of which will be made by the responsible party. Extent and nature of repairs necessary will be as approved by FBISD Design Manager.
- 8.0 If there is a rack of exposed piping in an area, devise a way to avoid balls being able to be thrown on top of the piping.
- 9.0 Isolation Valves:
  - 9.1 Applies to all types of projects (new and renovation projects).
  - 9.2 Provide shut off valves at all laterals coming off of mains, provide at all fixture banks and provide at all exterior wall hydrants. Locate shut off valves for wall hydrants within 5' of exterior wall.
  - 9.3 Provide isolation valve in cold and hot water mains serving kitchen. Ensure valve is easily accessible.
  - 9.4 Provide isolation valves in main domestic water lines in building to isolate overall sections of the building.
  - 9.5 In Science Labs, provide shut off valves for water and gas.
  - 9.6 At all above ceiling isolation valves, provide permanent label on ceiling grid (white background, black letters) label shall read "SOV". Provide laminated sheet in main custodial office showing all valve locations and related valve number. Provide one page per floor.
  - 9.7 Lab utility shut off systems shall be hard wired; systems using circuit boards are not acceptable. All components of utility shut off system shall be located below ceiling (solenoid valves, contactors, etc.).
- 10.0 Where possible, all clean outs shall be located in areas which allow maintenance access.

## 22 05 00 - Common Work Results for Plumbing

- 1.0 Valves
  - 1.1 Acceptable manufacturers: **Nibco, Rigid, Viega ProPress or Keystone**
  - 1.2. Water supply valves.
    - 1.2.1. 1/4" to 2" size shall be UPC approved ball valves.
    - 1.2.2. Ball valves shall be full port stainless steel ball and stem.
    - 1.2.3. 2-1/2" and larger shall be ball or butterfly valves (butterfly valves shall be lug style only).
    - 1.2.4. When located above ceiling, provide easy access to horizontal stem).
  - 1.3. Check Valves
    - 1.3.1. (Through 2") Spring loaded in-line check valve **Nibco** 480 series, or **Watts** 600 series.
    - 1.3.2. (2-1/2" and larger) **Nibco** F908 series or **Watts** 410 series.
  - 1.4. Locate valves within 18" of ceiling so that they are within reach.
  - 1.5. Locate over accessible areas as practical.
  - 1.6. Coordinate location with architectural features so that the valves are operable and accessible.
  - 1.7. All exposed piping interior and exterior shall be painted. Interior color shall be according to the adopted color codes and shall be appropriately labeled at intervals in specified height letters. Piping exposed to view shall be painted to comply to color scheme. Piping on roof or building exterior shall be painted with epoxy or polyurethane industrial coating.
  - 1.8. Provide separate sub-meter and isolation control serving irrigation and cooling tower makeup water. Connect sub-meters back to building automation system. Refer to Div. 25 of Guidelines for additional interconnection details.
  - 1.9. Provide separate water meter for cooling tower connection where allowed by local authorities.
- 2.0 Backflow preventers:
  - 2.1 Acceptable manufacturers shall be **Watts**.
  - 2.2. Full line sized, complete with air gaps, strainers, and unions at inlet, outlet, and discharge. Installed horizontally, max. 4' AFF.
  - 2.3. All RPC backflow preventers to have air gap fittings and shall be piped to floor drains.
  - 2.4. Backflow preventers located outside shall be provided with a removable, insulated box for freeze protection.
  - 2.5. Arrange water service to enter building at a mechanical room. Verify water pressure drop and determine the necessary requirements. Provide backflow protection as required by AHJ. Locate backflow preventer in a readily accessible location, provide floor support and provide drain for leakage. Provide freeze protection when located outdoors.

## 22 07 00 - Plumbing Insulation

- 1.0 Heating water and domestic water piping to be insulated.
- 2.0 Fiberglass type insulation may be used for indoors.
- 3.0 Insulation outdoors to be phenolic foam with metal jacketing.
- 4.0 Provide thermal pipe insulation on all piping carrying domestic hot water and cold water lines subject to freezing, main water entry pipe for 50 linear feet within building and within exterior walls out to five feet into plenum.
- 5.0 Insulate all roof drains from the drain body to vertical downspout. Include all horizontal roof drain piping, which occurs above the finished floor ceiling line.
- 6.0 Insulate sanitary drains receiving condensate.



- 7.0 Insulate entire roof drain hangers, up to threaded rod.
- 8.0 Insulate entire wall hydrant box, valve and piping in exterior walls.
- 9.0 All insulation shall be asbestos free.

## **22 09 00 - Instrumentation and Control for Plumbing**

- 1.0 Refer to Division 25 of the Technical Design Guidelines for integration of plumbing system requirements.

## **22 11 00 – Domestic Water Distribution**

- 1.0 From meter to within 5' of building: Schedule 80 or C900 PVC.
- 2.0 Entrance into building: ductile iron or type K copper, no mechanical joints allowed under slab.
- 3.0 Water entry shall be within building with shut off valve accessible from floor. Water entry outside of building with a wall penetration above grade is not acceptable.
- 4.0 Viega ProPress fittings for domestic water piping up to 8" in size is acceptable.
- 5.0 Looped piping or under floor: Type K copper, no joints (for trap primers and island case work only).
- 6.0 Interior, Above Floor: Type L copper, lead-free solder. Specify wrought copper fittings. Do not allow "tube pull" or "Tee drill" fittings.
- 7.0 At instructional piping (water and gas) where used in science classrooms or laboratories, or otherwise used by students, route the supply lines through the storage or prep room and install electric control valves provide a separate set for each individual teaching space. Provide controls adjacent to the teacher's station.
- 8.0 Provide sleeves for all piping passing thru concrete slab.
- 9.0 Do not allow all-thread pipe nipples in any piping system.
- 10.0 Threaded nipples less than 1/2" in diameter to be Schedule 80.
- 11.0 Minimize water piping to be installed in proximity of rooms housing telephone equipment, IT equipment, MDF rooms, IDF rooms, fire alarm systems, transformers, or other electrical equipment. **Do not route water piping within or above ceilings of these rooms.**
- 12.0 Connections of dissimilar metal piping shall be made using dielectric fittings.
- 13.0 Roof mounted supports shall be compatible with roof system such as "Portable Pipe Hangers" or equal. No wood supports.

## 22 13 00 - Sanitary Waste and Vent Piping

- 1.0 Acceptable\_manufacturers for floor drains, roof drains and chair carriers shall be **Smith, MiFab, Josam, or Zurn**.
- 2.0 Acceptable\_manufacturers for trap primers shall be **Precision Plumbing Products (PPP)** or FBISD Design Manager approved equal.
- 3.0 Acceptable\_manufacturers for grease traps, solids interceptors and acid neutralization tanks shall be **Park USA** or FBISD Design Manager approved equal.
- 4.0 PVC, Schedule 40 pipe to be used below grade unless otherwise required by AHJ.
- 5.0 Acid resistant piping shall be socket, fusion welded below and above grade except where piping is accessible for maintenance and repair such as below sink, within cabinets. Polypropylene below grade and PVDF above grade. Plenum rated CPVC piping is acceptable, but consultant must receive approval from FBISD Design Manager prior to design phase.
- 6.0 Sanitary and vent piping no-hub connections shall utilize 4 band heavy duty bands.
- 7.0 Provide ample number of clean-outs. All sanitary sewer lines shall be capable of being cleaned/snaked out without removal of plumbing fixtures with integral traps. Cleanouts shall be sized the same as the largest pipe serviced, up to 4".
- 8.0 Full line-sized, two-way, clean outs (up to 4" diameter) shall be provided for each run inside the building at 75' intervals or closer as required by code. Clean out covers shall be flush with finished floor, brass or chrome plated brass threaded covers. Exterior clean outs shall be full line sized spaced at 75' intervals, two way type and set in concrete 24" square by 6" thick. Entire installation shall be set at grade with slot type threaded covers. Entire system shall be accessible for cleaning. Avoid placing cleanouts in center of hallway and instead place off-set to allow maintenance of piping and not block access to hallway when building is in use.
- 9.0 Wall clean outs shall be extended to within 1-1/2" of finished surface.
- 10.0 Only above grade drainage or vent piping may have no hub connections.
- 11.0 Trap Primers: All trap seals will be protected by trap primers. Flush tube type or lavatory tail piece type is preferred, electric primers second choice. Automatic pressure drop primers may be used if flush tube, lavatory or electric are not in area where trap is located.
- 12.0 Proseal "Trap Guard" inserts may not be used as the primary means of protection.
- 13.0 Locate grease trap in a location which will not require grease trap piping back under the building slab except as approved by FBISD Design Manager. Extend as necessary outside to intercept building drain.
- 14.0 At all restrooms (including single occupancy), clinics, planting areas, custodial rooms, locker rooms, kitchens and dishwashing areas, laundry rooms, MDF/IDF rooms, mechanical rooms, etc., specify 3" diameter floor drains. Provide floor drains under emergency shower and eye wash installations. They shall not be installed where sinks only are installed in cabinets such as workrooms, science rooms, art rooms, or at drinking fountains. All floor drains shall have trap primers.



- 15.0 Lift stations shall not be used, except upon the express written consent of FBISD Design Manager and within the following guidelines:
- 15.1. Pumps shall be mounted on rails and have pull chains and automatic couplings installed.
  - 15.2. Doors shall be made of aluminum plate and sized to facilitate pump removal.
  - 15.3. Control panel junction boxes shall be located inside building.
  - 15.4. No electrical connections or boxes shall be allowed in sump.
  - 15.5. All pump discharge piping shall be Schedule 80.
  - 15.6. Check valves shall be installed above the pumps.
  - 15.7. Pumps shall be activated by a float-ball system.
  - 15.8. Specify a minimum of two pumps to be installed in the sump, and one identical pump furnished by contractor to FBISD.

## 22 14 00 - Facility Storm Drainage

- 1.0 PVC, Schedule 40 pipe to be used below grade unless otherwise required by AHJ.
- 2.0 Provide Schedule 40 PVC sleeves across drives to planting areas and other islands for sprinkler piping. Sleeves shall be buried 18" below the finish grade, extended 18" beyond the curb each side.
- 3.0 Provide bracing/restraints on all roof drain piping above grade at all changes of direction and pipe size. Bracing and restraints to be clamps, rods, etc. as recommended by pipe manuf. This requirement shall be included on the drawings.
- 4.0 Overflow from roof drains shall not be discharged near any building entrance.
- 5.0 Any clean out access shall be at grade.
- 6.0 Storm piping no-hub connections shall utilize 4 band heavy duty bands.
- 7.0 All discharge from downspouts shall be tied into nearest storm drain piping or inlet locations.
- 8.0 At the completion of any renovation, new or building addition, contractor shall rod out all sewer lines and provide camera video showing lines are clear with no obstructions. Work scope shall be performed in front of owner and signed off by owner and contractor at the completion of the work scope and information provided in as-built documents.

## 22 15 00 - General Service Compressed-Air Systems

- 1.0 Acceptable\_manufacturers for air compressors shall be **Champion or Ingersoll-Rand**.
- 2.0 Acceptable\_manufacturers for overhead air hose reels shall be **Balcrank**.
- 3.0 Provide with a 50' long, 1/2" diameter air hose and quick connector.
- 4.0 Galvanized or copper pipe shall be acceptable.
- 5.0 Service drops to include dirt leg, regulator, dryer and ball valve
- 6.0 Provide automatic condensate purge function. Provide piping as necessary to closest floor drain.

**22 20 10 - Natural Gas Distribution**

- 1.0 Natural gas service run underground from the gas meter to the building shall be wrapped steel pipe or polyethylene pipe with socket weld connection and copper tracing wire (copper tracing wire shall be secured to piping where it exits grade and tagged). Minimum depth of piping shall be 30" and shall be sloped to prevent pockets. Provide a dirt leg at the lower end of each run.
- 2.0 Gas piping run inside building shall be Schedule 40 black steel pipe. Gas piping run inside building shall be installed according to code. Provide sleeves on interior pipe only as required by code.
- 3.0 All gas piping 2-1/2" or larger shall have welded connections made with bevel-ended pipe by certified welders.
- 4.0 All ball valves shall be AGA or U.L. and AHJ approved. Ball valves are acceptable for use, butterfly type valves are not acceptable.
- 5.0 Piping under 2-1/2" in size shall be made with screwed malleable fittings.
- 6.0 Pressure regulators shall be installed where required at the exterior of the building. At each regulator requires a test tee with nipple and cap downstream, and unions and gas cocks inlet side of regulator.
- 7.0 Branch runs shall be made off the top of main lines. Horizontal lines shall pitch toward the appliance and shall terminate with dirt leg and valve. Connections to appliances shall be hard piped or approved UL connector.
- 8.0 Gas meter shall be located in mechanical court located directly outside the main mechanical room with a Rockwell plug type gas valve with grease fittings and handle or wrench provided for emergency gas shut off. Protect meter and piping with heavy pipe bollards.
- 9.0 Gas piping on roof shall be supported at appropriate intervals to prevent sagging and to prevent piping from resting directly on roof. All supports shall be manufactured for the purpose, such as Portable Pipe Hangers and suitable for the roof type (no wood supports). Support spacing shall be determined by the roof type and loading.
- 10.0 Gas piping on roof shall be clearly identified using all weather, mechanically secured labeling.
- 11.0 Do not allow all-thread pipe nipples in any piping system.
- 12.0 Threaded nipples to be Schedule 80.
- 13.0 All gas piping shall be yellow in color.



## 22 31 00 – Domestic Water Softeners

- 1.0 Acceptable manufacturers shall be **Unity or Marlo**.
- 2.0 Acceptable manufacturers for control valves and controllers shall be **Clack or Fleck**.
- 3.0 Provide water softener for kitchen, HVAC/heating equipment and large commercial type laundry equipment only. Do not locate softener so that it treats entire water supply to building.
- 4.0 All domestic hot water and cold water for kitchen shall be piped to supply 0-grain water. All softeners shall utilize a three-valve bypass, installed prior to the resin tank. Resin tank shall be constructed of Fiberglass Reinforced Polyethylene (FRP) and shall be equipped with steel or brass multi-port diaphragm head. Brine tank shall be plastic or fiberglass and shall incorporate dry-tank with a salt shelf storage. The system shall also provide for automatic bypass during regeneration. Test cocks shall be provided on both inlet and outlet sides of the system. Provide 100 psi pressure gauge on the inlet and the outlet side. All valves to be ball type.
- 5.0 Locate water softener installation near an outside service entrance of the building for easy access for maintenance. Provide area for salt storage.
- 6.0 All piping associated with water softener system shall be copper.

## 22 32 00 - Domestic Water Filtration Equipment

- 1.0 Provide water filter “**Aqua Pure**” **A717** filter or FBISD Design Manager approved equal at all refrigerator wall boxes.
- 2.0 Provide water filter at all under-counter or large floor mounted ice makers.

## 22 33 00 - Domestic Water Heaters

- 1.0 Acceptable manufacturers for electrical water heaters shall be **AO Smith, State or Bradford White**.
- 2.0 Acceptable manufacturers for gas water heaters shall be **AO Smith, State or Bradford White**.
- 3.0 Acceptable manufacturers for In-line Circulators shall be **Bell and Gossett, Taco, Aurora, Armstrong or Grundfos**.
- 4.0 Domestic hot water heaters for kitchens shall be high efficiency units. The kitchen water heater shall be standalone units and not be tied to the building domestic water system. Provide duplex water heating system.
- 5.0 All electric water heaters shall be 208V.
- 6.0 Hot and cold water requirements:
  - 6.1. Faculty/staff restrooms, workrooms and lounges, clinic, custodial rooms, student or faculty/staff showers, art and science prep rooms, Special Education rooms, Pre-K, Kindergarten, First Grade multi-purpose rooms, clinic and cafeteria kitchens.
  - 6.2. Provide hot and cold water mixing valve to hose bib in service area by kitchen door.

- 7.0 Hot water temperatures: Toilet room, workroom, and other general use areas: 110°F, kitchen facilities other than hand lavatories and dish rinsing – 140°F . Dish rinsing – 180°F, (by booster heater in kitchen).
- 8.0 Where hot water is provided for hand washing (except kitchen hand sinks) or shower use, specify mixing valves.
- 9.0 Provide hot water at custodial sinks, in the kitchen, clinic, staff restrooms, concession areas and other food preparation areas such as kitchenettes.
- 10.0 Instant water heaters may be considered for remote sinks/lavatories but must be approved by FBISD Design Manager prior to use.
- 11.0 Provide circulating domestic hot water return, pumped and controlled by aqua-stat on hot water runs in excess of 40 lineal feet of pipe length.

#### **22 40 00 - Plumbing Fixtures**

- 1.0 All fixtures of a type for the project to be of one manufacturer
- 2.0 Acceptable manufacturers for water closets and urinals shall be **American Standard, Crane, Kohler, or Eljer.**
- 3.0 Acceptable manufacturers for flush valves shall be **Sloan, Royal or Regal (186 or 110 series)** with vandal resistant trim.
- 4.0 Typically, wall-hung fixtures are used. Provide carriers for all wall-hung fixtures, no exceptions.
- 5.0 Water Closets: Wall-mounted elongated vitreous china, siphon jet type, flush valve actuated, provide vacuum breaker and screwdriver stop. Extended flush pipe shall set the flush valve at 36" AFF on the right-hand side, according to National Plumbing Code, except at ADA water closets.
- 6.0 Toilet Seats: White plastic, open front, elongated, reinforced construction, without covers. Benke or Bemis. At Kindergarten and lower grades specify closedfront
- 7.0 Urinals: Pipe flush valve to right hand side of unit.

#### **22 42 16 - Lavatories and Sinks**

- 1.0 Acceptable manufacturers for lavatories and sinks shall be **American Standard, Crane, Kohler, or Eljer.**
- 2.0 Acceptable manufacturers for solid interceptors for art room sinks only shall be **Wade or Josam.** Shall be cast iron with gasketed cover and removable sediment bucket, 15 GPM.
- 3.0 Lavatories: Deck mounted or wall hung at new schools, shall be vitreous china. (All wall hung fixtures shall have chair carriers).
- 4.0 Acceptable manufacturers for multi-person wash fountains shall be **Willoughby, Bradley and Acorn.** Provide metered faucets. Provide chair carriers for units.

- 5.0 Sinks in Elementary science rooms and art rooms: large, single compartment, stainless steel type, drilled and fitted for goose neck **Chicago** faucets (with vacuum breakers) at each end. (Outfit art room sinks with plaster traps, **Wade or Josam**). (All wall hung fixtures shall have chair carriers). Plaster traps shall be serviceable without removing from the system, and unions on inlet and outlet.
- 6.0 Sinks in faculty workroom, main custodial rooms, mop sinks and other special-purpose rooms: Stainless steel single or double compartment with goose neck Chicago faucet with vacuum breaker. Discuss details in planning meetings. (All wall hung fixtures shall have chair carriers).
- 7.0 Secondary school science laboratory sinks: Epoxy sinks and countertops. (All wall hung fixtures shall have chair carriers).
- 8.0 For science room sinks, provide under counter acid dilution tanks in lieu of central, outdoor, in-ground dilution tank system. No central in-ground system is acceptable unless reviewed with FBISD Design Manager during the design phase.
- 9.0 Service Sinks: Mustee 24" x 24" x 36" according to space available, complete with bumper guards, hose and hose bracket, and Chicago #897 or FBISD Design Manager approved equal (with vacuum breaker) service faucet, hose end spout, pail hook, top reinforcing bar and mounting bracket. Floor mount sink with splash guards. Floor sink shall have high outer lip to prevent water from splashing on floor.
- 10.0 Acceptable manufacturers for traps and drains shall be **Kohler, Chicago, McGuire or Zurn**. All exposed traps and drains to be 17-gauge chrome plated brass and grid type.
- 11.0 Lavatory faucet supplies: 3/8" Chrome plated copper attached to a 1/2" IPS x 3/8" flare chrome plated loose-key stop. All exposed chrome plated fittings polished.

## 22 42 39 - Faucets, Supplies and Trim

- 1.0 Hose bibs:
  - 1.1. Acceptable manufacturers for interior applications shall be **Chicago or T&S** chrome plated with vacuum breaker, shielded stem and loose key. Female, flanged threaded connection at wall.
  - 1.2. Provide hose bib in each student restroom below lavatory, in each mechanical space and any other spaces capable of wash down.
  - 1.3. At HS baseball and softball competition field home dugouts, provide hose bib. Connect to domestic water system. Install hose bib in wall above grade, not in ground.
  - 1.4. At HS and MS football competition field home sidelines, provide hose bib and electrical receptacle (see Div. 23).
  - 1.5. Hose bib (or wall hydrant) Basis of Design: **Acorn Model 8151 or 8156**.
    - 1.5.1 Other acceptable manufacturers for hose bibs for exterior applications shall also include **Wade, Josam or Zurn**, freeze resistant, 6" deep, wall hydrant. Nickel bronze finish or as required by architect. The supply line shall extend up within the insulated wall to a ball valve above the ceiling of the adjacent room. The hose bib shall be recessed in a cast metal box.
  - 1.6. Provide at minimum 100' on center around perimeter of building.
- 2.0 Acceptable manufacturers for kitchen faucets shall be **Chicago or T&S** hi-flow.

- 3.0 Acceptable manufacturers for student restrooms faucet trim shall be: Three hole lavatory with **Chicago #857-E12-665PSHCP or T&S** metering faucet with soft flow aerator self-closing or FBISD Design Manager approved equal.
- 4.0 Acceptable manufacturers for faculty/staff restrooms faucet trim shall be **Chicago 797A or T&S** or FBISD Design Manager approved equal.
- 5.0 Gym showers mixing valves:
  - 5.1. Acceptable manufacturers shall be **Powers #432-2085** or comparable units manufactured by **Leonard, Chicago or Symmons**.
  - 5.2. Unit shall be sized for capacity required.
  - 5.3. Install a temperature gauge on tempered water, and on hot water supply lines.
  - 5.4. Locate mixing valves in accessible locations but not where accessible to students.
  - 5.5. Also provide unions, ball valves, and check valves at mixing valves for removal and servicing.
  - 5.6. No electrical solenoids on water controls.
  - 5.7. Acceptable manufacturers for individual shower valves in wall shall be **Symmons, Temptrol, or Chicago faucet SH-PB1-12-030 and SH-PB1-02-000** with service stops.
- 6.0 Whirlpool mixing valves: Same requirements as gym shower mixing valves (above) except unit shall be sized to accommodate separate hot and cold valved supply lines to whirlpool, a pipe size minimum of 1" at discharge.

#### **22 42 99 - Plumbing Fixture General Requirements**

- 1.0 Specify shock absorbers or air chambers, sized according to fixture units served, in piping at appropriate locations to eliminate water hammer.
- 2.0 Provide a box hydrant with vacuum break at the dumpster area.
- 3.0 Provide a box hydrant mixing valve and floor drain with roll over curb near the kitchen door for washing of garbage cans.
- 4.0 Require area drain with sand trap, centered in dumpster pad. As required by AHJ
- 5.0 Provide a wall box with filter at every refrigerator.
- 6.0 Provide air gap fittings for dishwasher connections, as required.

#### **22 45 00 - Emergency Shower**

- 1.0 Provide isolation valve for maintenance/repair. Locate isolation valve below ceiling if there is space, if not, locate just above ceiling tile.
- 2.0 Emergency showers and other fixtures shall have a flow switch connected to indicator light and horn, in corridor, that will notify staff when shower is operated.

## 22 47 00 - Drinking Fountains and Water Coolers

- 1.0 Acceptable manufacturers for drinking fountains shall be **Halsey-Taylor, Murdock or Elkay**.
- 2.0 Completely lead free, stainless steel cabinet, 8 gallon/hour capacity, accessible.
- 3.0 Access panels shall be removable without dismantling unit. Provide chair carriers for all drinking fountains.
- 4.0 Provide water bottle filling stations in new drinking fountains, one per bank of fountains. Verify with education specifications on additional requirements for locations.
- 5.0 Water bottle filling station retrofit kits with filters by Halsey-Taylor and Elkay are acceptable for use at existing facilities.
- 6.0 For power to drinking fountains, install GFCI breaker serving receptacle to allow reset of receptacle without having to remove panels under fountains.

## 22 99 00 – Sustainable Design Items

- 1.0 On-site Water Storage Tanks
  - 1.1. Acceptable manufacturers of water storage tanks are **John Deere or Water Storage Tanks, Inc.** Design shall include foundation design for tank and shall utilize site borings in overall design of foundation pad.
  - 1.2. Project design team shall coordinate with FBISD Design Manager on overall design of site water reclamation such as condensate collection, site rainwater collection, gray water collection, etc. to ultimately determine overall size of system and proposed costs to provide, install and maintain system.
  - 1.3. Design shall include freeze protection features for tank and connecting piping.
  - 1.4. Coordinate with architect and local neighborhood HOA requirements to determine final location and size of tank and equipment.
  - 1.5. For systems receiving building gutter/downspouts discharge, provide aluminum screen on roof panel and place screen in location that can be maintained monthly to keep clean.
  - 1.6. For large storage systems utilizing pump for site distribution, system shall include filtration system that can be maintained on a regular basis.
- 2.0 Leadership in Energy and Environmental Design (LEED)
  - 2.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
  - 2.2 Related Credits (as applicable)
    - 2.2.1 SS Credit: Rainwater Management
    - 2.2.2 WE Prerequisite: Outdoor Water Use Reduction
    - 2.2.3 WE Prerequisite: Indoor Water Use Reduction
    - 2.2.4 WE Prerequisite: Building-Level Water Metering
    - 2.2.5 WE Credit: Outdoor Water Use Reduction
    - 2.2.6 WE Credit: Indoor Water Use Reduction
    - 2.2.7 WE Credit: Cooling Tower Water Use
    - 2.2.8 WE Credit: Water Metering
    - 2.2.9 IN Credit: Innovation

**END OF SECTION 22**

## Division 23

# Mechanical (HVAC) Systems

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### DIVISION 23 – MECHANICAL (HVAC) SYSTEMS

#### 23 00 00 - General Requirements for Mechanical

1.0 The following design conditions shall be used in designing the size and capacities of the equipment:

<u>Summer</u>		<u>Winter</u>
Outside	97°F Dry Bulb 77°F Wet Bulb	20°F
Room Design	74°F (at 55% RH)	69°F



- 2.0 The engineer shall exercise discretion in applying these principles in design of cafeteria kitchens, science labs with significant fume exhaust, dressing rooms with unique moisture conditions, and other conditions. Each issue shall be discussed and passed on at the 50% CD design review meeting.
- 3.0 Mechanical room size and location is required to be provided by A/E. Design drawings shall show physical size of equipment on scaled drawings showing clearances and service access for all equipment as part of Design Development, 50% CD and 90% CD phases.
- 4.0 Prior to beginning any construction work, the mechanical contractor shall furnish as part of the mechanical equipment submittals, a scaled drawing of all proposed mechanical equipment, indicating accurate sizes and characteristics of proposed equipment as well as clearances, piping routes, and other details as required to allow the engineer, architect, and FBISD MEP Manager the opportunity to approve the proposed layout and equipment. If the arrangement is not acceptable, then the contractor shall modify the proposed equipment layout and/or routing as required, in order to gain approval from the Engineer, Architect and FBISD.
- 5.0 All designs shall comply with current energy code requirements and produced by a licensed engineer in the State of Texas.
- 6.0 Prior to commencing design on an existing facility, the engineer is to walk through and inspect existing HVAC system; including but not limited to:
  - 6.1. Inspect floor drains and sump pumps
  - 6.2. Inspect concealed (above ceiling) systems.
  - 6.3. Existing ductwork
  - 6.4. Existing piping
  - 6.5. Existing control wiring
  - 6.6. Engineer to submit findings to FBISD MEP Manager at completion of walk.
- 7.0 The following paragraph shall appear in the contract documents at prominent locations, shall be built into the overall project schedule and shall be strictly enforced by the architect and engineer during construction:

***No portion of the total contract will be declared substantially complete until the automatic temperature control system has been demonstrated to be complete and functioning as intended. The temperature control system will be complete and functioning as intended when all of the space temperatures are maintained at plus or minus two degrees of set point.***
- 8.0 The following statement shall be included in contract documents:

***The Contractor shall ensure that all ductwork either stored on site or installed in the building is thoroughly sealed to protect against dirt and moisture until such time that the building is deemed by the Owner to be adequately clean to allow for start-up of the associated air handling equipment. Should ductwork not be sealed as specified, then the Contractor shall have such ductwork professionally cleaned to an as-new condition at no cost to the owner.***
- 9.0 Central Plant
  - 9.1. Locate cooling towers outside the facility as close as practical to the central plant room within the building. Preferably this will be in a secured mechanical or service yard providing both security as well as ample service access to the tower.

- 9.2. Service yard wall shall be 10' minimum, coordinate with project architect on height of wall and material of wall to ensure proper airflow and clearances around mechanical equipment.
- 9.3. Chillers and associated pumps shall be located within the central plant room. Provide proper service clearance around each chiller as well as service doors to allow removal and replacement of the chillers.
- 9.4. Boilers and associated pumps shall be located in a separate room within the central plant. Provide service doors allowing for future servicing and removal/replacement of the boiler.
- 9.5. Provide auxiliary piping connections in the central plant to facilitate easy connection of temporary air-cooling or heating equipment to the hot water/chilled water piping systems. Include the following:
  - 9.5.1. Design the connection points to be the full size of the piping system and locate them to isolate the chiller/boiler yet allowing the system pump(s) to provide full circulation through both the distribution system and such temporary equipment as may be required.
  - 9.5.2. Connections should include valves at appropriate locations with blind flanges.
  - 9.5.3. Connections shall be easily accessible for connection.
- 9.6. The Engineer shall only specify refrigerants that comply with all the current refrigerant specifications of ASHRAE and the EPA.
- 9.7. The Engineer of Record shall consider the use of a primary/secondary pumping arrangement for chilled water systems with capacities greater than 400 tons, and if deemed appropriate incorporate into the design.
- 9.8. The engineer of record shall determine whether the new chillers can unload sufficiently to efficiently handle partial load conditions at night or on weekends. If not, then a pony chiller shall be added.
- 9.9. When partial load conditions indicate a pony chiller is necessary. Engineer shall evaluate the use of an air-cooled pony chiller. This evaluation shall include a comparison of energy usage versus a water-cooled pony chiller to assist in FBISD's decision as to which chiller is acceptable. Pony chiller shall be designed to carry the load of minimum load of main chiller.
- 9.10. Central plants with multiple chillers and cooling towers shall have interconnects to allow cross flow between the different pieces of equipment.
- 9.11. Chillers with single zone air handling units and VAV boxes with hot water heating coils shall have AHU and pumps served from VFD's.
- 9.12. Provide isolation valve and strainer at each cooling tower basin to allow for cleaning.
- 9.13. All condenser water lines shall be installed above ground.
- 9.14. The Engineer shall specify a complete DDC control system for the operation and control of the complete HVAC system. Refer to Division 25 for further information.
- 9.15. Ensure coordination of architectural elements with mechanical, electrical, and other equipment to ensure that all elements and equipment are accessible.
- 9.16. Locate mechanical and electrical equipment so that nothing straddles the building expansion joint.
- 9.17. Building Information Modeling (BIM) should be used where routing and space limitations will have an impact on systems operations.
- 9.18. In some AHJ, no mechanical equipment is to be visible from 1000' sight line in any direction. Verify requirements prior to design of system. Only where there is no other available option are roof screens or parapet walls to screen equipment allowable. Coordinate with FBISD Design Manager. See Division 13, Roof Equipment Screens.
- 9.19. Specify that all necessary precautions shall be taken as required to prevent damage to the roofing due to welding or cutting of pipe. Any damage shall be repaired by the roofing

- contractor, payment of which will be made by the responsible party. Extent and nature of repairs necessary will be as approved by FBISD MEP Manager.
- 9.20. On renovation work, note there is to be no unused pipes, ducts, hangers or equipment left in accessible areas.
  - 9.21. Provide factory start-up for all HVAC equipment including chillers, cooling towers, pumps, boilers and variable speed drives.
  - 9.22. All corridors shall be heated and cooled.
  - 9.23. Provide heating and cooling for all main mechanical/electrical/central plant rooms.
- 10.0 Gymnasiums
- 10.1. With wood floors shall have humidity control year-round.
- 11.0 Fieldhouses
- 11.1. Field houses shall be designed using a separate HVAC system that will allow them to operate independently from the central plant. A/E to design dehumidification sequences and equipment to serve these areas.
- 12.0 Administrative Areas
- 12.1. All administrative areas shall be designed with a separate D/X split to allow for operation of the HVAC system during periods when the central plant is not in operation including after hours, weekends, or extended periods of time when school is not in session. All other indoor air quality and occupant comfort requirements shall be followed with effective management of outside air. VRF systems not allowed.
- 13.0 Library spaces
- 13.1. Shall have humidity control year-round.
- 14.0 Classrooms
- 14.1. Each classroom shall be served by one temperature zone.
- 15.0 Kitchens
- 15.1. Kitchens shall be conditioned spaces service by single zone unit.
- 16.0 All locker rooms and coaches' offices
- 16.1. Shall be served by a single zone air unit with O/A and humidity monitoring effective.
- 17.0 Natatoriums
- 17.1. Shall be served by a system appropriately designed to handle humidity control, evaporation and condensation.
- 18.0 Telecommunication Rooms (MDF/IDF)
- 18.1. Acceptable manufacturers shall be **Liebert** or FBISD MEP Manager approved equal.
  - 18.2. All MDF and IDF rooms shall be air conditioned, (cooling only) 24 hours/day, seven days/week, 365 days/year. Provide a direct expansion split or self-contained system from district approved manufacturer.
  - 18.3. Minimum size of units shall be 3 tons for MDF rooms and 1.5 tons for IDF rooms. Design team is responsible for verifying if room requires larger tonnage units based on size of room and equipment installed. District prefers that floor mounted units be designed for these spaces to allow for ease of maintenance of unit. Locate remote condensing units on roof where possible to limit any equipment being located above ceilings within building.
  - 18.4. Design setpoint of rooms shall be 78°F (+/- 3°F) with a relative humidity ranging from 30% - 50% RH.

- 18.5. HVAC units serving MDF/IDF spaces shall be on emergency panels supported by the building generator.
- 18.6. Provide local thermostat control of unit with password protection.
- 18.7. Provide network interface module for HVAC unit to allow remote network connection to unit. Provide Category 6 data drop to network module and connect to room patch panel. Unit needs a VERTIV communications system that is connected to the data network for remote maintenance and monitoring.
- 18.8. Unit shall be equipped with Bacnet card and shall communicate with building automation system, (output only) on status of unit, room temperature and alarms. BAS shall only monitor status of unit and room temperature.
- 18.9. All MDF/IDF shall also have a ceiling mounted exhaust fan with the local thermostat to control exhaust fan. Exhaust fan thru roof or exterior wall on new construction. Exhaust fan is not required to be on generator. The exhaust fan should power on if the Liebert unit stops working.
- 18.10. Technology department shall monitor space temperature in MDF/IDF and shall report high temperature alarm to the computers/pagers, and/or text message designated cell phone personnel once temperature rises above 85°F for five minutes.
- 18.11. Specifications shall indicate factory startup of unit from authorized local Liebert company representative, not mechanical contractor. Startup report shall be provided to FBISD and project design engineer indicating findings and corrective action from mechanical contractor that deficiencies were addressed. Reports and sign off receipts shall be provided in project close out documents as well at the completion of the project. Technology department shall be included in final IDF/MDF sign off punchlist walks.
- 18.12. Provide gravity drain of condensate to proper connection as close to unit as possible. Avoid condensate pump when possible. If possible, locate drain 12" from the unit and 4"-6" from the wall.
- 18.13. Location of the Liebert Unit should be coordinated with the Technology Engineer during design. The unit should not encroach on the 36" door opening and egress of the room. Unit should have a 36" clear space in front of and behind the racks.

### **23 01 00 – Operation and Maintenance of HVAC Systems**

- 1.0 Building shall be kept broom clean prior to starting any mechanical equipment to minimize dust in the system.
- 2.0 Establish a training and demonstration requirement that is tied to contractor payment applications.
- 3.0 Operation and maintenance manuals (including start-up reports) shall be provided prior to training/demonstration.
- 4.0 Trainings are to be provided from manufacturer's trained technician.

### **23 05 14 – Variable Frequency Drives**

- 1.0 Acceptable manufacturers of variable frequency drives shall be **ABB and Danfoss**.
- 2.0 For Air Handling Units with multiple fans (Fan Array) and motors, VFD manufacturer shall provide internal individual motor overloads to match quantity of fan motors.
- 3.0 Submit VFD's only after coordination with approved Air Handling Units, Pumps, and Cooling Tower Submittals (If applicable).

- 4.0 Warranty shall be (2) two years and shall begin from date of Certificate of Substantial Completion. The warranty shall include all parts, labor, travel time and expenses to provide on-site warranty.
- 5.0 Installation shall be the responsibility of the mechanical contractor. Power wiring shall be completed by the electrical contractor.

### **23 05 23 – General Duty Valves for HVAC Piping**

- 1.0 Locate valves within 18” of ceiling so that they are within reach.
- 2.0 Provide engraved label (1/4” black lettering on white background) attached to ceiling grid labeled “VL” to indicate CHW/HW piping isolation valve locations above ceiling. Label shall be placed directly below valve location. In addition, provide wall mounted laminated floor plan in central plant showing valve locations for entire floor. Provide one floor per sheet.
- 3.0 Locate valves over accessible areas as practical. Provide any access panels as required for valves if ceiling type does not allow easy access.
- 4.0 Coordinate location with architectural features so that the valves are operable and accessible.
- 5.0 Plug type gauge cocks shall not be allowed. Use ball valves.

### **23 05 53 – Identification for HVAC Piping and Equipment**

- 1.0 All exposed piping interior and exterior shall be painted. Interior color shall be according to the adopted color codes and shall be appropriately labeled at intervals in specified height letters. Piping exposed to view shall be painted to comply to color scheme. Piping on roof/exterior shall be painted with epoxy or polyurethane industrial coating.
- 2.0 Piping in central plant mechanical yard shall be epoxy painted or polyurethane industrial coating applied in the appropriate color below. Insulated pipe will have the insulation jacket painted and non-insulated pipe shall be properly prepared and painted.
- 3.0 Provide a framed copy of the chart below in the central plant for maintenance personnel reference.

<b>System</b>	<b>Color</b>
Chilled water from chiller	Dark Blue (SW-4056)
Chilled water to chiller	Light Blue (SW-4054)
Hot water from boiler	Dark Red (SW-6871)
Hot water to boiler	Light Red (SW-6858)
Condenser water from tower	Light Green (SW-4069)
Condenser water to tower	Dark Green (SW-4071)
Natural Gas Piping	Safety Yellow (SW-4084)

### **23 05 93 – Testing and Balancing for HVAC**

- 1.0 The Testing, Adjusting and Balancing will be contracted and paid for directly by the Owner (FBISD) and will be coordinated with all requirements of Division 23.
- 2.0 The general contractor and appropriate sub-contractors shall turn over the completed job to the TAB contractor before testing begins. The general contractor shall ensure the system is fully

operational, has been cleaned and new air filters installed in all air-handling units prior to requesting the TAB contractor to perform his work.

- 3.0 It shall be the responsibility of the general contractor and sub-contractors to cooperate with the Owner's TAB contractor in furnishing personnel during the TAB to make such adjustments and corrections specified by the TAB, including but not limited to sheave changes.
- 4.0 The TAB to furnish electronic copies of test and balance reports and shop drawings to FBISD.
- 5.0 The TAB contractor to include the owner on all reports and deficiency logs submitted to contractors during construction, not just final copy.

### **23 07 00 – HVAC Insulation**

- 1.0 External insulation only on ducts, except as required for sound control.
- 2.0 Do not apply insulation on the surface of the inside of mechanical room walls, especially if room is used as a plenum return space. Provide insulation on equipment instead.
- 3.0 Chilled water pipe (inside the building) to be phenolic foam. Exterior chilled water pipe may be insulated with polyisocyanurate insulation (fiberglass is not allowed).
- 4.0 Condensate piping insulation in mechanical rooms shall be fiberglass with service jacket.

### **23 09 00 – Instrumentation and Control for HVAC**

- 1.0 Refer to design standards, Section 25 Building Automation systems for full BAS control specifications.
- 2.0 Provide a “purge” type control button for additional ventilation in locker rooms when there is a high volume of showers producing steam.

### **23 20 00 - HVAC Piping and Pumps**

- 6.0 Acceptable manufacturers of pumps shall be **Armstrong, Taco, Bell and Gossett, Aurora and Grundfos**.
- 7.0 All pumps shall be designed with variable speed drives.
- 8.0 Acceptable manufacturers for underground pipe shall be the pre-insulated type, as manufactured by **Thermacor Process Inc. Perma Pipe** or FBISD MEP Manager approved equal. All sections shall be factory fabricated to job dimensions with all fittings, anchors, and other accessories. Jackets for pre-insulated piping, including fittings, shall be HDPE in accordance with ASTM D1248, Type 3, Class C Insulation shall be rigid, 90-95% closed cell polyurethane with a 2.5 to 3.5 pounds per cubic foot density and a coefficient of thermal conductivity (K Factor) of .14 at 50 degree F or .17 at 75 degree F and conform to HH-I-1751/4. All piping insulation shall be labeled as “non-asbestos insulation” at point of access or use.
- 9.0 Carrier pipe shall be standard weight, carbon steel, seamless or ERW, ASTM A-106, ASTM A-53, Grade B

- 10.0 Underground systems shall be buried in a trench not less than two (2) feet deeper than the top of the pipe and not less than twelve inches wider than the combined O.D. of all piping systems. All backfill material shall be cleaned bank sand to a minimum thickness of 24 inches over the top of the jacket to meet H-20 highway loading.
- 11.0 Provide combination air/dirt separator at central plant serving pumps and chillers.
- 12.0 Locate thermometers and pressure gauges at the following:
  - 12.1. Inlet and outlet of chillers
  - 12.2. Inlet and outlet of boilers
  - 12.3. Inlet and outlet of heat exchangers
- 13.0 All piping will be pressure tested for 150 psi for 48 hours prior to cover-up.
- 14.0 A representative of the manufacturer shall be present during critical periods of installation and testing, to verify that the installation is being made in accordance with the manufacturer's recommendations.
  - 14.1. Cleaning of hydronic and chilled water piping systems:
  - 14.2. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate. Flush the chilled and hot water systems utilizing the filter feeders.
  - 14.3. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.
  - 14.4. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld heads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until "potable water clear" and particles larger than 5 microns are removed.
  - 14.5. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
  - 14.6. Dispose of water in approved manner.
  - 14.7. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), welding and soldering flux, mill varnish, piping components, rust (iron oxide) and other deleterious substances not removed by initial flushing. Chemical shall be approved by FBISD water treatment provide prepping compound. Insert anti-foam compound as necessary. Circulate for 48 hours or as recommended by the manufacturer. Dispose of water in approved manner. Flush system and replace with clean water. Verify compatibility of chemicals used with existing chemical treatment program on remodel projects.
  - 14.8. Phase Three: Final flushing and rinsing until "potable water clear" and particles larger than 5 microns are removed. Operate valves to dislodge and debris in valve body. Dispose of water in approved manner.
  - 14.9. Submit status report upon completion of each phase of work on each system.



- 14.10. Special requirements, if any, are specified in the sections on each type of piping or in the section on Water Treatment Systems.
- 15.0 HVAC water treatment by project mechanical contractor. Contractor to provide shot feeders, flow indicators and taps for condenser water treatment system. Contractor to provide labor and chemical to clean and flush all piping system.
- 16.0 Design consultant to coordinate with FBISD MEP Manager during design phase on current approved district chemical treatment company to include in project specifications.
- 17.0 The General Contractor is responsible to coordinate all flushing of piping to coincide with phasing of project.
- 18.0 For any renovation projects, the General Contractor shall be responsible to provide a full building heavy flush where any HVAC components come in contact with building hot/chilled water loops.
- 19.0 At all mezzanines with ladder access, provide overhead structural support for crane to be attached for maintenance use.

### **23 23 00 - Refrigerant Piping**

- 1.0 Design engineer shall ensure that refrigerant run distances are within design standards of equipment manufacturer requirements.
- 2.0 Provide aluminum jacketing for all exterior refrigerant lines.

### **23 30 00 - HVAC Air Distribution**

- 1.0 Provide access doors in ductwork for cleaning ductwork before and after coils, filters, fans and dampers. Locate doors so that the minimum numbers possible are used.
- 2.0 Provide proper maintenance clearances for all fan powered VAV boxes and fan coil units.
- 3.0 Intake and Exhaust Louver Detail. Objective is to allow wind-blown water into ducts to escape to building exterior. Detail to be included on drawings to indicate louver to duct installation to achieve this objective. See reference Diagram 08\_01 in the Appendix for provided detail. All louvers located above ceilings are to have sheet metal plenums. Plenums are to be welded or soldered and shall be watertight. Plenum bottoms also shall slope to louver and the connection to the louver shall be watertight.

### **23 34 00 - HVAC Fans**

- 1.0 Exhaust Fans
  - 1.1. Acceptable manufacturers shall be **Greenheck, Acme, Loren Cook or Twin City**.
  - 1.2. Fans shall be spun aluminum, roof or wall mounted, direct drive.
  - 1.3. Fans shall be constructed in accordance with UL 705 and bear the AMCA certified ratings seal air performance.
  - 1.4. Motor shall be heavy duty type with permanently lubricated sealed bearings.
  - 1.5. Curbs shall be at least 12 inches high of 18 gauge galvanized steel construction with welded seams, built-in cant strips, 1-1/2" insulation, damper tray, hinged curb adapter for access to dampers. Coordinate installation with Division 7.
  - 1.6. Provide motor speed control option on direct drive units.



- 2.0 Science classrooms shall be treated similarly to regular classroom except when they contain laboratory fume hood exhaust systems and special classroom exhaust systems. Pre-treated make up air shall be provided to compensate for the air exhausted through the fume hoods. The engineer shall follow the Texas Safety Standards, and ASHRAE when designing air-conditioning and exhaust systems for these classrooms.
- 3.0 Biology, chemistry and art labs are to have purge fans with local control (timer).
- 4.0 Continuous 24 hour exhaust is required in chemical storage rooms routed to building exterior.
- 5.0 MS and HS Art rooms to have a general exhaust fan for odor control with local controls (timer).
- 6.0 Ventilation for kiln – see Division 10.
- 7.0 MS and HS Prep rooms have general exhaust fan with high/low grilles interlocked with air handling unit.
- 8.0 Ventilation fans to be roof-mounted where possible.
- 9.0 All outside air fans must be assessed for full function and control as a part of any HVAC upgrade or replacement.

#### **23 36 00 - Air Terminal Units**

- 1.0 Acceptable manufacturers for Air Terminal Units shall be **Titus, Krueger, Price Industries, Nailor Industries and Metalaire.**
- 2.0 Provide coil kits with separate isolation valve on supply and return lines for all fan coil units and air terminal boxes.
- 3.0 Provide access panels in ductwork at all hot water coils to allow maintenance access.

#### **23 40 00 - HVAC Air Cleaning Devices**

- 1.0 Final air filters shall have a MERV 11 rating
- 2.0 FBISD requires flexibility in the filtration methods. Provide a steel filter frame that may be used with roll type media and sized to accept 2" pleated filters.

#### **23 50 00 - Central Heating Equipment**

- 1.0 Approved boiler manufacturers shall be **RBI, Raypak or Lochinvar.**
- 2.0 Mechanical contractor to coordinate with roofing contractor on flue pipe material, installation and roof penetration locations prior to rough in and installation.
- 3.0 Heating shall in general consist of a natural gas-fired boiler providing hydronic heating throughout the facility. Electric resistance heating should be avoided when possible.
- 4.0 Units shall be designed in a modular format to provide redundancy in the event that one unit can fail but overall system can still provide 100% heating capacity for the building.

- 5.0 Boilers shall have interlocked CO monitors, combustion/ventilation flue fans. Provide training on servicing and calibrating sensors as part of a requirement of the project.
- 6.0 Sequence boilers to allow for master/slave configuration and also allow boilers to be rotated in lead/lag configuration to rotate boiler operation and even out run times.
- 7.0 All designs shall be setup around utilizing condensing boilers for heater purposes.

### **23 63 13 – Air Cooled Refrigerant Condensers**

- 1.0 Approved manufacturers shall be **Carrier, Daikin and JCI**.
- 2.0 Warranty shall be for full 5 year term from substantial completion.
- 3.0 Warranties shall be full machine parts, labor and refrigerant warranty. All components replaced thru the warranty process shall be new, not rebuilt. Warranty shall also include all miscellaneous materials, travel time, expenses, shipping, refrigerant, oils, lubricants, belts, filters, insulation and any expenses related to service calls required to diagnose and correct warranty issues with equipment.
- 4.0 Mount starters, disconnects and controls in weatherproof panel with full opening access doors. Furnish mechanical interlock to disconnect power when door is opened.
- 5.0 Furnish removable access doors or panels with quick fasteners. Units over 25 tons shall be provided with piano hinges and quick fasteners.
- 6.0 Furnish welded steel floor mounting stand and duct collars at coil inlet and fan outlet.
- 7.0 Provide variable speed compressors or hot gas bypass to allow compressors to operate at low load conditions.
- 8.0 Provide full BACnet control and interface of unit.

### **23 64 00 – Air and Water-Cooled Chillers**

- 1.0 Approved manufacturers for water cooled chillers shall be **Carrier, JCI, and Daikin**.
- 2.0 Approved manufacturers for air cooled chillers shall be **Carrier, JCI and Daikin**.
- 3.0 Centrifugal chillers are to have Variable Frequency Drives and line reactors.
- 4.0 Buildings with a total building load greater than 500 tons shall be water-cooled chiller design, building with less than 500 tons shall be designed utilizing an air-cooled chiller solution.
- 5.0 Provide minimum 2 chillers for a central plant design with each chiller sized for 60% of overall building cooling load.
- 6.0 All equipment shall comply with the local authorities' noise ordinance when in operation. As part of DD submission, design team shall present strategies used to alleviate potential noise issues among neighboring properties.

- 7.0 All cooling fins will be coated with anti-corrosive protectant.
- 8.0 Provide additional voltage protection at chillers.
- 9.0 Chillers shall be factory tested and performance data shall be submitted to FBISD MEP Manager for review prior to being shipped to the site.
- 10.0 Consultant to add warranty language to provide 10 year base warranty. Warranties shall be full machine parts, labor and refrigerant warranty. All components replaced thru the warranty process shall be new, not rebuilt. Warranty shall also include all miscellaneous materials, travel time, expenses, shipping, refrigerant, oils, lubricants, belts, filters, insulation and any expenses related to service calls required to diagnose and correct warranty issues with equipment. All warranty work shall be performed by factory direct service technician, not the project mechanical contractor. During warranty phase, provide quarterly inspections (4 per year) by factory direct technician. Provide at least one week notice to owner to schedule service. All warranties shall begin upon project substantial completion, no exceptions.
- 11.0 All chiller equipment shall be listed as alternates for the project requiring the contractor to submit line item pricing for each FBISD approved manufacturer. There shall be no chillers as part of the base bid. FBISD will make the decision on which chillers are selected for the project based on the alternate pricing submission information.
  - 11.1. All materials and labor costs to coordinate, receive, install and start-up the equipment for a complete and operating system shall be included in contractor's base bid.
  - 11.2. All equipment startups of the system will be performed by factory trained service technician employed by the chiller manufacturer.

### 23 65 00 – Cooling Towers

- 1.0 Acceptable manufacturers shall be **Marley or Evapco**.
- 2.0 Provide stainless steel construction for walls and basins. Walls shall be 304 Stainless minimum with 316 Stainless basin, no exceptions.
- 3.0 Provide strainers with isolation valve on inlet and outlet at each cooling tower basin to allow for cleaning. (Where possible, locate strainers on the building exterior with downstream isolation valves).
- 4.0 All cooling tower electrical conduit will be "Plasti-Bond" covered with NEMA external rated disconnect devices.
- 5.0 Provide davit arm at tower for future equipment access.
- 6.0 External motors for tower are preferred.

### 23 73 00 – Indoor Central Station Air Handling Units

- 1.0 Acceptable manufacturers shall be **Carrier, Temtrol and Daikin**.
- 2.0 No roof-mounted equipment unless approved by FBISD Design Manager.

- 3.0 Outside Air Pre-Treatment
  - 3.1. The Engineer shall specify a system to pre-treat the outside air introduced into the building. The pre-treatment shall include dehumidification, tempering and pre-filtering of all outside air.
  - 3.2. Provide a separate AHU unit for outside air pre-treatment when possible.
  - 3.3. Outside air intakes shall be located a minimum of 50 ft. away from bus loading areas.
- 4.0 Provide CO2 sensors for all large single zone AHU serving areas such as gyms, auditoriums and cafeterias to control volume of outside air being required based on occupant load.
- 5.0 Dehumidification shall be designed as part of the overall HVAC system.
- 6.0 During construction, temporary filters shall be maintained until Substantial Completion.
- 7.0 Warranty shall include parts and labor for one year from substantial completion.
- 8.0 Design with adequate clearance for servicing, cleaning, filter changing and coil pull clearances. Design for a minimum of 24" of clear space around all equipment. This in addition to the required service clearances recommended by the manufacturer.
- 9.0 Furnish each unit with a durable, deep etched, 0.25" thick factory installed aluminum identification plate, permanently mounted with the following information: Unit ID as indicated on contract drawings, Serial Number, Model Number, CFM, SP, Motor HP, Unit Power supply - V/PH/A, Supply fan type, Coil GPM and PD, Sales order #, and Date unit manufactured.
- 10.0 Four pipe chilled water / hot water system with single zone air handling units and, or variable air volume boxes. Hot water coils shall be utilized for heating purposes where possible.
- 11.0 All Air Handling Units shall be on variable speed drives.
- 12.0 Air Handling Units to be installed on a minimum 4" high housekeeping pad.
- 13.0 Condensate drain pans shall be designed so the internal pans slope to drain so that no standing water is present in unit during unit operation.
- 14.0 Unit Construction:
  - 14.1. Air unit shall be double wall construction, 2" thick insulated panels of minimum 16 gauge exterior and 20 gauge interior galvanized steel.
  - 14.2. Panels must be removable without affecting structural integrity of the unit.
  - 14.3. Provide minimum 12 gauge galvanized steel base rails.
  - 14.4. 2" Insulated double wall hinged removable access doors with full perimeter gaskets and steel door jams. Provide quarter turn cam lock latches. Provide access doors on both sides of the unit at the upstream side off the coils, filters, and motor/fan assembly.
  - 14.5. Provide 2" deflection internal spring isolation fan and motor assembly.
  - 14.6. Fan shafts to be solid steel.
  - 14.7. Bearings shall be regreasable, 200,000 hour, ball or roller bearings. Extend grease fittings to the drive side of the fan assembly.

- 14.8. Provide TEFC (totally enclosed), premium efficiency motors mounted inside the fan section.
- 14.9. Drives and belts must be sized for 175% of motor horsepower. Variable pitch sheaves on motors. Provide replacement sheaves as required for final air balance.
- 14.10. Drives shall be two-belt.
- 14.11. Provide 304 stainless steel, double walled, drain pan sloped in two directions.
- 14.12. There shall be no standing water allowed inside the unit. Pans shall be provided for hot and chilled water coils. Pans shall extend minimum 10" down-stream of the cooling coil.
- 14.13. Provide 304 stainless steel coil casings tube supports and coil tracks.
- 14.14. Coils are not to be installed on tracks; disassembly of the unit removal is not acceptable.
- 14.15. Coils are not to be trapping. Coil vents and drains are to be accessible outside the units.
- 14.16. Coils to be factory tested at minimum 300 psig.
- 14.17. All penetrations thru the air unit shall be sealed with a grommet.
- 14.18. FBISD requires flexibility in the filtration methods. Provide a steel filter frame that may be used with roll type media and sized to accept 2" pleated filters
- 14.19. Contractor will maintain all filters from start up through substantial completion; a clean set of filters are to be installed when needed by Testing and Balancing.
- 14.20. At substantial completion the units shall be clean inside and out and left in factory new condition.

### **23 73 13 – Packaged Outdoor Central Station Air Handling Units**

- 1.0 Approved manufacturers shall be **Daikin, Carrier** or **JCI**.
- 2.0 Warranty shall be for full 5 year term from substantial completion.
- 3.0 Warranties shall be full machine parts, labor and refrigerant warranty. All components replaced thru the warranty process shall be new, not rebuilt. Warranty shall also include all miscellaneous materials, travel time, expenses, shipping, refrigerant, oils, lubricants, belts, filters, insulation and any expenses related to service calls required to diagnose and correct warranty issues with equipment.

### **23 81 00 - Decentralized Unitary HVAC Equipment**

- 1.0 Approved manufacturers shall be **Daikin and Carrier**.
- 2.0 Provide at out buildings, field house and press boxes.

### **23 84 16 – Indoor Dehumidification Units**

- 1.0 Approved manufacturer shall be **Novelair** or FBISD MEP Manager approved equal.
- 2.0 Provide at all athletic uniform storage rooms, book rooms, band uniform storage rooms, locker rooms and band instrument storage rooms.
- 3.0 Dehumidification Unit:
  - 3.1. Shall be a single packaged unit including compressor, evaporator (dehumidifying coil), condenser (reactivation air coil), supply air blower, and reaction blower motor in one enclosure.
  - 3.2. Shall be for indoor installation and horizontal configuration.
  - 3.3. Reactivation air coil shall be sized for dissipating heat generated from the refrigeration cycle.
  - 3.4. Provide BACnet interface to building automation system.



### **23 99 00 – Sustainable Design Items**

- 1.0 Leadership in Energy and Environmental Design (LEED)
  - 1.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
  - 1.2 Related Credits (as applicable)
    - 1.2.1 EA Prerequisite: Fundamental Commissioning and Verification
    - 1.2.2 EA Prerequisite: Minimum Energy Performance
    - 1.2.3 EA Prerequisite: Fundamental Refrigerant Management
    - 1.2.4 EA Credit: Enhanced Commissioning
    - 1.2.5 EA Credit: Optimize Energy Performance
    - 1.2.6 EA Credit: Advanced Energy Metering
    - 1.2.7 EA Credit: Demand Response
    - 1.2.8 EA Credit: Enhanced Refrigerant Management
    - 1.2.9 EQ Prerequisite: Minimum Indoor Air Quality Performance
    - 1.2.10 EQ Prerequisite: Environmental Tobacco Smoke Control
    - 1.2.11 EQ Prerequisite: Minimum Acoustic Performance
    - 1.2.12 EQ Credit: Enhanced Indoor Air Quality Strategies
    - 1.2.13 EQ Credit: Construction Indoor Air Quality Management Plan
    - 1.2.14 EQ Credit: Indoor Air Quality Assessment
    - 1.2.15 EQ Credit: Thermal Comfort
    - 1.2.16 EQ Credit: Acoustic Performance
    - 1.2.17 IN Credit: Innovation

**END OF DIVISION 23**

## Division 25

# Energy Management & Control Systems

### DIVISION 25 00 00 – ENERGY MANAGEMENT AND CONTROL SYSTEMS

GENERAL CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply this section.

*THIS SPECIFICATION SECTION SHALL BE ISSUED AS WRITTEN FOR ANY NEW OR RENOVATION PROJECTS WHERE HVAC EQUIPMENT IS BEING INSTALLED, REPLACED OR MODIFIED. DO NOT MODIFY UNLESS APPROVED BY FBISD DESIGN MANAGER.*

#### 1.1 GENERAL

- A. The Energy Management and Control System (**EMCS**) shall be comprised of a Local Area Network (**LAN**) infrastructure, Operator Workstations (**OWS**), Engineering Workstations (**EWS**), a Primary Network Server (**PNS**), Network Area Controllers (**NAC**), Application Specific Controllers (**ASC**), Unitary System Controllers (**USC**), and Field Devices installed within the facility.
- B. The Workstations, Primary Network Server, and Network Area Controllers shall be connected by an EMCS Contractor supplied and installed Local Area Network. The LAN shall comply with all IEEE Standards as outlined in: IEEE STD 802-1990: IEEE Standards for Local and Metropolitan Networks, Overview and Architecture.
- C. If the EMCS contractor wishes connect to the Owner's Wide Area/Local Area Network as part of the control system network, the EMCS contractor shall acquire permission in writing and include the letter in the submittal. Any system that requires connection to the owner's network for communication between NAC, ASC, USC and/or field devices that is submitted without the written permission from the owner shall be rejected. The EMCS Contractor shall coordinate with the Owner and supply all required information.
- D. Access to the system, either locally in the building, or remotely from a central site or sites, shall be accomplished through standard web browsers, via the Internet and/or a local area network. System shall be compatible across various devices including iPhone, Android and Windows phones and various tablets running these operating systems.
- E. All EMCS controllers and workstations shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2010, latest revision. Management level TCP/IP Ethernet network speeds shall be 1 Gbps minimum and the Automation Level MS/TP network speeds shall be 76.8 Kbps minimum.
- F. The Server shall gather data from the system and generate HTML5 pages accessible through a conventional web browser from all personal computers (PCs) connected to the network. System shall include any and all software and hardware to support unlimited users. The EMCS shall be compatible with all common web browsers.
- G. Facility Operators shall be able to view and configure systems through the standard web browser and all graphical/data representations shall appear identical, whether the

user is on site or viewing via the Internet at a remote location. Standard operator functions such as control point manipulation, configuration and viewing of trends, schedules and alarms shall be performed through the standard browser. Each mechanical system and building floor plan shall be depicted on the operator workstation by point-and-click graphics.

- H. The EMCS shall directly control HVAC equipment as specified in the Sequence of Operations. Furnish Energy Conservation features such as Optimal Start/Stop, Night Setback, Setpoint Reset logic, and Demand Control Ventilation.
- I. The EMCS vendor shall provide the following additional services as part of this specification: warranty and service during the warranty period; submittals, samples and record documentation; comprehensive startup and testing of the EMCS with documentation; training services for the owner and facility operators; coordination with other contractors and suppliers; operator and technician training program, and shall cooperate fully with the Project Commissioning Agent.
- J. Products furnished under this specification but installed by other.
  - 1. Mechanical devices installed under Division 23 by the mechanical contractor or other suppliers: temperature sensing thermowells; automatic control valves; pipe taps for flowmeters; water pressure sensors and switches; automatic control dampers not installed in air handling unit mixing boxes or louver schedules; damper actuators for variable air volume (VAV) terminal units; mounting cost of controller and actuator for VAV terminal units.
  - 2. Electrical devices installed under Division 26 by the electrical contractor:
    - a. 120 VAC power to controllers and control panels at locations indicated on the drawings. Review and verify that these locations are adequate for the proposed EMCS.
    - b. Interlock wiring to duct mounted smoke detector or fire alarm shutdown relays to HVAC equipment motor starters, variable frequency drives (VFD) and etc.
- K. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.
- L. All BAS cabling shall be yellow in color. All BAS communication cabling shall be yellow with purple stripe (Unify) and yellow with red/green stripe (ALC).
- M. DDC system to be tied in to emergency button/switch to initiate shut down of all HVAC equipment when activated.
- N. System shall be fully compatible and interface with current district scheduling program. Owner shall be able to use Maintenance Direct for Actions on individual Areas as needed and requested by owner. Contractor responsible for all hardware, software and coordination involved.
- O. It is contractor responsibility to discover and integrate all devices and points into system as necessary. This includes, but not limited to, HVAC, electrical, plumbing and lighting devices.
- P. It is the intent of this specification to describe the basic architecture and performance requirements of the Energy Management Control System (EMCS). The turn-key EMCS shall include all work station software including operator software, cables, programming tools, graphics editor, all other available software programs, modules, handhelds, or plug-ins offered by the DDC manufacturers, hardware, Control Units, Distributed Controllers, Unitary Controllers, Local Area Networks (LANs), sensors, modems, wiring, connectors, control devices, actuators, installation and calibration, supervision, adjustments and fine tuning necessary for a complete and fully



operational system.

- Q. Systems shall be furnished and installed complete in all respects, including any and all equipment, controls, wiring, instrumentation, enclosures, labor, engineering, training, commissioning, programming, supervision, calibration, coordination with other trades, etc. No information given in (or omitted from) these specifications shall relieve the contractor of this absolute requirement. Include all associated electrical work except as noted. Work includes furnishing of all labor, superintendence, materials, tools, equipment and sources necessary for the complete installation or modification of the following systems as herein specified. It is the intent of these specifications that the Contractor shall furnish and install the systems complete in every respect and ready to operate. All equipment, miscellaneous items and accessories required for such installation and for the correct and convenient operation of the entire installation whether or not each such item or accessory is shown on the plans or mentioned in these specifications shall be furnished and installed.
- R. All systems shall be complete true stand-alone systems. Program database, data acquisition, and all control sequence logic shall reside in each DDC Device. The Building Level Communication Network (BLCN) shall not be dependent upon connection to a Server or Master Controller for the performance of the Sequence of Control as outlined in this specification. Each Device shall, to the greatest possible extent, perform its programmed sequence without reliance on the BLCN.
- S. All devices installed shall be native BACnet. Lonworks or proprietary protocols are not allowed. Devices that are not BACnet tested, compliant, certified, clearly stamped and listed by the BACnet Testing Laboratories (BTL) shall not be acceptable under this specification and are strictly prohibited.
- T. System shall be provided with a complete Web-enabled operator interface. The application shall operate on industry standard PC hardware. Proprietary server hardware or "Black Boxes" will not be acceptable. Third party Web-enabled applications are acceptable if they are configured to be indistinguishable from the OWS applications.
- U. Programming of software shall be written in BASIC STRUCTURED logic that client is familiar with and not written within CORE spec engineering.
- V. No Gateways, Communication Bridges, Protocol Translators or any other device that translates any proprietary or other communication protocol to the BACnet communication the protocol shall be permitted as a part of the BAS installation under this specification section. Gateways may only be used as required for communication to existing systems or systems installed under other specification sections.
- W. All BAS DDC Devices shall be capable of updating firmware using software via the internet without replacing any hardware, microprocessors or chips.
- X. Installed system must have full access to logic and functional blocks. User shall have full ability to modify programming.
- Y. Outside air temperature shall be supplied by the National Weather Service with a local backup at every site.
- Z. Point naming/labeling shall be consistent throughout buildings.
- AA. Where drawings are provided as part of or supplement to these specifications, such drawings are inherently schematic only and not intended to convey all controls, wiring, installation, details, etc. It shall be the responsibility of the EMCS contractor to verify that control approaches presented are appropriate for the HVAC systems involved, and that bids include all work described, specified, or otherwise necessary for a complete and functioning system.
- BB. System shall have the ability to program schedules locally if needed during network outages.

## 1.2 RELATED DOCUMENTS & REFERENCES

- A. Drawings and general provisions of the contract documents, apply to this section including:
  - 1. Division 01 for General Conditions and Supplementary Conditions.
  - 2. Division 21 for fire protection equipment.
  - 3. Division 22 for plumbing equipment and domestic water systems.
  - 4. Division 23 for mechanical equipment, ductwork, and piping systems.
  - 5. Division 26 for electrical equipment, lighting control, and fire alarm systems.
- B. The latest edition of the following standards and codes in effect as approved by the authority having jurisdiction and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
  - 1. ANSI MC85.1 - Terminology for Automatic Control.
  - 2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
  - 3. ANSI/ASHRAE Standard 135-2010, BACnet.
  - 4. BTL Mark by the BACnet Testing Laboratories.
  - 5. Uniform Building Code (UBC), including local amendments.
  - 6. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
  - 7. National Electrical Code (NEC).
  - 8. FCC Part 15, Subpart J, Class A.
  - 9. National Institute of Standards and Technology (NIST).
  - 10. IEEE STD 802-1990: IEEE Standards for Local and Metropolitan Networks, Overview and Architecture.

## 1.3 RELATED WORK IN OTHER SECTIONS

- A. Refer to Division 00 and Division 01 for allowances and related contractual requirements.
- B. Refer to Division 21 for General Fire Protection Provisions and fire suppression pump.
  - 1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP or Modbus acceptable if IP interface is not available from equipment manufacturer.
  - 2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.
- C. Refer to Division 22 for General Plumbing Provisions, domestic water heating systems, domestic water pumping systems, and domestic water metering.
  - 1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP or Modbus acceptable if IP interface is not available from equipment manufacturer.
  - 2. The EMCS contractor shall coordinate with all vendors providing above

systems to obtain communications requirements and points lists. Map all available points to EMCS.

- D. Refer to Division 23 for General Mechanical Provisions for equipment such as chillers, cooling towers, boilers, pumps, air-handling units, terminal units, ventilation fans, variable frequency drives, unitary AC units, etc.
  - 1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP or Modbus acceptable if IP interface is not available from equipment manufacturer.
  - 2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.
- E. Refer to Section 26 for General Electrical Provisions for equipment such as electrical switchgear control, electrical power monitoring, emergency generators, lighting control system, etc.
  - 1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP or Modbus acceptable if IP interface is not available from equipment manufacturer.
  - 2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.
  - 3. System shall be configured so that lighting control modules on physical wired modules controlled by web interface control schedule.

#### 1.4 ELECTRICAL POWER PROVISIONS

- A. Primary power will be provided under Division 26 by the electrical contractor to the panel locations indicated on the mechanical & electrical drawings. Provide step down transformers within panel enclosures. Provide all necessary fuses and circuit protection devices
- B. Power will be provided to the controllers serving fan powered terminal units with electric heat via the control transformer provided with the unit.
- C. All components of the EMCS shall be powered from the sources above. Provide final terminations from the locations indicated on the Division 23 Drawings.
- D. The EMCS Contractor shall provide any additional control power that is required as part of this contract and not indicated by other. This shall include all conduit, cabling, circuit breakers, etc.

#### 1.5 CONTRACTOR QUALIFICATIONS

- A. Acceptable manufacturers shall be **Automated Logic or Unify**.
- B. The EMCS Contractor shall:
  - 1. Have a local office within 100 miles of jobsite before bid date and at a minimum until the completion of the warranty period.
  - 2. Have a local staff of trained personnel capable of giving instructions and providing routine and emergency maintenance on the EMCS, all components and software/firmware and all other elements of the EMCS.
  - 3. Have a proven record of experience in the supply and installation of equivalent EMCS/BACnet systems over a minimum period of five years. Provide

documentation of at least three equal and complexity, if so requested by the Owner's Representative.

4. Be a factory certified representative of the native BACnet EMCS manufacturer for design, installation, and service of the proposed system.
5. Have comprehensive local service, training and support facilities for the total EMCS as provided. Maintain local, supplies of essential expendable parts.
6. Have a local 24/7 phone support service.

## 1.6 SUBMITTALS

- A. ALL DOCUMENTS SUBMITTED SHALL BE IN NATIVE PDF FORMAT. NO SCANS.
- B. Shop Drawings:
  1. The following information shall be included on the cover page for each shop drawing and equipment documentation submittal:
    - a. Project name with date. Refer to the applicable specifications by name and number.
    - b. Provide submittal number and re-submittal number and date as applicable.
    - c. Provided name and address of Consulting Engineer, Mechanical Contractor, General Contractor
  2. Shop drawings shall be CAD generated, plot size of 8-1/2" x 11" or 11" x 17". Drawings shall include diagrams, mounting instructions, installation procedures, equipment details and software descriptions for all aspects of the system to be installed.
  3. Provide schematic of systems indicating instrumentation locations, all interconnecting cables between supplied cabinets on a mechanical floor plan.
  4. Software specifications and descriptions including operating sequences.
  5. Provide a bill of material that indicates specific manufacturer, part number, part description and quantity of each device for all system components.
  6. Provide a list of the wire labels to be installed on each end of the control wiring, at the device and the control panel terminal. Labels shall be machine generated, typed and legible with a maximum of 17 characters. The label description "AHU-1 SAT" shall indicate the supply air temperature of AHU-1.
  7. Equipment Schematic: Provide an electronic equipment schematic for each piece of mechanical equipment. The schematic shall display all mechanical equipment characteristics including fans, dampers, valves, sensors and other applicable control devices. The schematic shall show wiring terminations to each control device as shown in the submittal and as-build documentation. Control devices shall be labeled by a symbol that can easily be identified in a bill of material that is shown on this graphic. The bill of material shall show the device symbol, description, manufacture and part number.
  8. Sequence of Operations: The control sequences shall be viewable for each piece of mechanical equipment and be in a text format as shown in the as built documentation. The sequence of operations shall be selectable at the applicable location for the control program.
  9. Provide detail points list on every piece of equipment.
  10. Provide technical cut sheets showing all relevant devices and/or information highlighted to distinguish what was installed.

- C. Control component submittals:
1. Component technical data sheets with mounting and installation details.
  2. The documentation shall include comprehensive and complete details of the BACnet Interoperability Building Blocks (BIBB) and automation level documentation including address, associated controller type, etc. as required and for the interface to the EMCS.
  3. Details of networks/communications equipment, cabling and protocols proposed. Provide schedule of cabling including details of proposed cable types.
  4. Module Drawing: Provide an electronic wiring diagram of each control module (as shown in submittal documentation). Diagram shall display wiring schematic and terminations to end devices. Diagram shall display each input and output terminals and label those that are used for the control application. Diagram shall display module type/name and network address.
  5. Field sensor and instrumentation specification sheets. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.
  6. Schedule and specification sheets for dampers, valves and actuators.
  7. Design and provide layout of all components of panel mounted control devices, terminal strips and power supplies.
- D. Color graphics: Provide sample layout of color graphic representations of the systems for review. The submittal shall indicate the quality of the graphic to be provided with the system with a sample of the specific control points to be included. Control points shall as a minimum include points indicated in the input/output summary, control schematic and primary controlling points defined in the sequences of operation. Provide a sample of a floor plan layout, typical AHU, terminal unit, outside air pretreatment unit, variable frequency drive, exhaust/supply fan, chiller plant and hot water plant. For control points to be provided by equipment BACnet integration provide sample of the control points.
- E. Verification Reports. The submittal shall include a sample of the verification reports to be utilized during the verification section of this specification. Sample reports shall be approved as submitted or be modified by the engineer or owner's representative. The verification reports shall be included in the final Operation & Maintenance Manuals. Reports shall be provided in electronic PDF format.
1. Project Systems Verification Form for each controller.
    - a. General information for each form shall include: project name; associated equipment with mark number; control panel number and location; controller number and model number; controller device instance number (address); MS/TP LAN segment number; verifying technician and date.
    - b. Each connected control point and device shall contain the following columns with a separate line for each connected physical point: point description (same as device label); input/output number for each connected control device (AI-XX, AO-XX, DI-XX, or DO-XX).
    - c. Check boxes confirming that the verification tasks have been completed: device location, proper termination at device; proper termination at control panel; sequence is verified; point trend is enabled.
    - d. Data entry boxes indicating measured/confirmed values: preliminary control point value on the graphic; observed control point value;

calibration or adjustment value to correct offset; final displayed point value on the color-graphic; date of verification; engineer or owner's representative verification.

2. Control Panel Verification Form for each control panel.
    - a. General information: panel location and identification number; panel dimensions and NEMA rating; panel properly installed; Class 1 and Class 2 wiring are properly separated; correct voltage to the panel; no shorts or grounds in panel; no induce voltages in panel wiring; point to point termination match submittal; devices are mounted in the correct location; controller software revision number; address of controllers; panel device checkout is complete; panel startup is complete.
  3. **Sequence of Operation Verification Form** per piece of equipment (AHU, VAV, chiller, boiler, etc.).
    - a. General information: project name; system identifier; building area served; control panel and controller numbers; controller model number and instance number (address); MS/TP LAN segment number; name of verifying technician and date.
    - b. Each step of the sequence of operation for each piece of equipment shall be documented shall include a "description of test", "input to trigger test" and "expected outcome". A pass/fail checkbox shall indicate each of these actions. Provide space for technician approval with associated date.
- F. Operating and Maintenance (O&M) manuals: Provide O&M manual with full information to allow the owner to operate, maintain and repair installed products. Include trade names with model numbers, color, dimensions and other physical characteristics.
1. Format: Produce on 8-1/2 x 11-inch pages, and bind in 3-ring/binders with durable plastic covers. Label binder covers with printed title "OPERATION AND MAINTENANCE MANUAL", title of project, and subject matter and "Number \_ of \_" of binder. Provide substantial dividers tabbed and titled by section/component number.
  2. Table of Contents for each volume:
    - a. Part 1: Directory with name, address and telephone number of Designer, Contractor and Subcontractors and Suppliers for each Project Manual section.
    - b. Part 2: Operation and maintenance instructions, arranged by Project Manual Section number where practical and where not, by system. Include:
  3. Product design criteria, functions, normal operating characteristic and limiting conditions. Installation, alignment, adjustment, checking instructions and troubleshooting guide. Operating instructions for start-up, normal operation, regulation and control, normal shutdown and emergency shutdown. Test data and performance curves.
  4. Spare parts list for operating products, prepared by manufacturers including detailed drawings giving location of each maintainable part, lists of spares recommended for user- service inventory and nearest source of in-stock spares.
- G. Record Documentation:
1. Details of all alarm, diagnostic, error and other messages. Detail the Operator



- action to be taken for each instance.
2. Detail special programs provided and provide a complete programming instruction manual. Detail operation of all software applications.
3. Detailed list of the database for all installed devices.
4. Record drawings shall be CAD generated and shall include final locations and point ID for each monitored and controlled device.
5. In addition to the required hard-copies, provide electronic copies on a USB Drive with all of the record documentation in PDF format and a USB Drive containing backup copies of all installed software and graphics.
6. Provide an excel spreadsheet for tracking and maintenance by equipment type. Coordinate with owner for database and template requirement.
7. Online as-built documentation: provide digital replications of as-builts that shall be accessible from each equipment graphic controlled or monitored by the EMCS.

## 1.7 WARRANTY

- A. Warranty work and the equipment provided under this contract shall be for a period of one year from the date of Substantial Completion. Warranty shall cover all components, system software, parts and assemblies supplied by this contractor and shall be guaranteed against defects in materials and workmanship for one (1) year from the date of Substantial Completion. If manufacturer warranty on a product is longer than (1) year, contractor is responsible for honoring and coordinating the warranty of that product up to the end of manufacturer warranty. Labor to troubleshoot, repair, reprogram or replace system components that have failed due to defects in materials and workmanship shall be provided by this contractor at no charge to the owner during the warranty period. All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software. All warranty work shall be performed by the EMCS contractor's local service group.
- B. Warranty shall not include routine maintenance, e.g., equipment cleaning, mechanical parts lubrication, pilot lamp replacement, operational testing, etc. Warranty shall not cover repair or replacement of equipment damaged by under- or over-voltage, misuse, lack of proper maintenance, lightning, water damage from weather or piping failure.
- C. Hardware and software personnel supporting this warranty agreement shall provide on- site or off-site service in a timely manner after failure notification to the EMCS contractor. The maximum acceptable response time to provide this service at the site shall be 24 hours, during normal working hours.

## 1.8 OPERATIONS PERSONNEL TRAINING

- A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. BAS contractor shall coordinate with project commissioning agent and the district contact on final verification and programming that all BAS points and sequences operate as designed prior to training. Initial training session shall be a minimum of 4 hours. Training session shall include at the minimum:
  1. Purpose of equipment.
  2. Principle of how the equipment works.

3. Important parts and assemblies.
  4. How the equipment achieves its purpose and necessary operating conditions
  5. Most likely failure modes, causes and corrections.
  6. On site demonstration that includes hands-on demonstration of the manipulation of setpoints, schedules and other adjustable elements of the system.
  7. The demonstration shall be on the actual, completed graphic interface pages for the specific project.
- B. Provide a second training session 6 months after initial session for any follow-up or additional training requested by owner's personnel. Allow 3 hours for the second training session.

## **1.9 ENGINEERING WORKSTATION (EWS)**

- A. When entire building is receiving a new BAS system, the contractor shall provide a new workstation laptop computer and have all operating software and controls software setup and operational to be delivered to the district at the end of the project.
- B. The Engineering Workstation shall be any personal computer or virtual pc and/or server, connected to the WAN/LAN, with a registered copy of the EMCS contractor supplied engineering and/or programming software installed. The EMCS contractor shall provide at least one copy of all required software(s) and files, to enable the Owner complete editing/programming functions of all controllers, graphics, and control logic.
- C. The EMCS shall provide one virtual pc and/or server which is compatible with the performance required by the EMCS Engineering Software. It shall be able to be reached locally and remotely as needed.

## **PART 2 - PRODUCTS**

### **2.1 APPLICATION SPECIFIC CONTROLLERS (ASC)**

- A. All devices required for single loop control shall be terminated on a single controller. (for example, CHW loop pressure control. The differential pressure sensor and the pump VFD ramp signal.)
- B. ASCs shall be capable of implementing control strategies for the system based on information from any or all connected inputs. The AC shall utilize factory pre-programmed global strategies that may be modified by field personnel on-site. Global control algorithms and automated control functions should execute via a 32-bit processor
- C. Programming shall be object-oriented using control program blocks that will support a minimum of 500 Analog Values and 500 Binary Values. Analog and binary values shall support standard BACnet priority arrays. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing.
- D. Controller shall have adequate data storage to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1 year (cumulative). Battery shall be a field-replaceable (non-rechargeable) lithium type. The onboard, battery-backed real time clock must support schedule operations and trend logs.
- E. The base unit of the ASC shall host various I/O combinations including universal inputs, binary outputs, and switch selectable analog outputs (0-10V or 0-20 mA). Inputs shall support thermistors, 0-5VDC, 0-10VDC, 4-20mA, dry contacts and pulse inputs



directly.

- F. All binary outputs shall have onboard Hand-Off-Auto switches and a status indicator light. HOA switch position shall be monitored. The position of each HOA switch shall be available system wide as a BACnet object.
- G. Controller shall be capable of BACnet communication. BACnet Conformance:
  - 1. Standard BACnet object types supported shall include as a minimum: Analog Input, Binary Input, Analog Output, Binary Output, Analog Value, Binary Value, Device, File, Group, Event Enrollment, Notification Class, Program and Schedule object types. All necessary tools shall be supplied for working with proprietary information.
- H. Schedules: Each ASC shall support a minimum of 10 BACnet schedule objects.
- I. Logging Capabilities: Each controller shall support a minimum of 100 trend logs. Sample time interval shall be adjustable at the operator's workstation. Controller shall periodically upload trended data to system server for long term archiving if desired. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.
- J. Alarm Generation: Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures. Alarm logs shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications. Controller must be able to handle up to 200 alarm setups stored as BACnet event enrollment objects – system destination and actions individually configurable.
- K. All AHU, RTU, FCU and central plant equipment controllers shall be MP1 and MP2 style to allow local control or override capabilities.

## 2.2 UNITARY SYSTEM CONTROLLERS (USC)

- A. All devices required for single loop control shall be terminated on a single controller. (for example, cooling coil control valve control. The temperature sensor and the valve control signal.) Distributed control of one singular piece of major mechanical equipment shall not be performed by multiple controllers.
- B. The EMCS Contractor shall provide all Unitary System Controllers. USCs shall be fully programmable or applications specific controllers with pre-packaged operating sequences maintained in Flash RAM. Building scheduling shall be downloaded into flash memory in order to function during network outages.
- C. The USC shall be a node on the automation network and shall control its own communications so that the failure of any one node, shall not inhibit communications on the network between the remaining nodes. USCs shall be totally independent of other network nodes for their monitoring and control functions.
- D. Provide each USC with a battery back-up for the protection of volatile memory for a minimum of 72 hours. Batteries shall be rated for a seven year life.
- E. All associated applications programs shall reside at the USC. The USC shall not require communication to any other panel for normal operating sequences other than time scheduled base commands.
- F. Control shall be based on algorithms, i.e. proportional plus integral plus derivative (PID), proportional plus integral (PI), or proportional to comply with the sequences of operation PID algorithms shall maintain the system operation within +/- 2% of setpoint.
- G. The USC shall be configured with sufficient input/output capacity to achieve the required control points to meet the sequence of operations.

### 2.3 VAV TERMINAL UNIT CONTROLLER (TUC)

- A. All devices required for single loop control shall be terminated on a single controller. (for example, terminal unit air valve control. The flow sensor and the actuator control signal.)
- B. The EMCS Contractor shall provide all controllers required for all variable air volume (VAV) terminal units. The number and location of terminal units and airflow rates shall be as indicated on the mechanical drawings.
- C. The TUC shall be capable of monitoring and controlling the following parameters for VAV terminal units per the sequences of operation and input/output summary: space temperature; primary air flow rate; damper modulation; heating coil stage control, heating valve control, heating SCR control (as applicable); fan on/off control; supply air sensor; occupancy sensor; carbon dioxide sensor or humidity sensor.
- D. Furnish primary damper actuators, for factory mounting, meeting the following requirements: direct shaft mounting; adequate torque, to properly operate the damper from fully open to fully closed without binding; locking "V" groove or similar means to prevent slippage between actuator and shaft.
- E. The EMCS Contractor shall field install the following components for each terminal unit: space temperature sensor; supply air temperature sensor; occupancy sensor, and carbon dioxide sensor as indicated on the Mechanical Drawings.
- F. The EMCS Contractor shall furnish to the terminal unit manufacturer the following components for factory installation and wiring for each terminal unit: VAV controller with integral differential pressure transducer and damper actuator.
- G. The terminal unit manufacturer may provide the following components for each terminal unit for interface and mounting of the TUC: primary air dampers; enclosure to house the TUC and associated components including suitable mounting brackets shall be NEMA 1 rating and located outside the terminal unit; multi-point averaging type flow sensor at the primary air inlet to the terminal unit; 24 VAC control transformer; 24 VAC fan control relay interface; 24 VAC heater control relay interface (up to two stages); 24 volt SCR heater input as scheduled (0-10 Vdc or 4-20 mA).
- H. **Any items required for proper operation but not provided by TU vendor, shall be provided under this section.**

### 2.4 AIR HANDLING UNIT CONTROLLER

- A. All devices required for single loop control shall be terminated on a single controller. (for example, AHU static pressure control. The differential pressure sensor and the VFD ramp signal.)
- B. The EMCS Contractor shall provide controllers required for chilled/hot water and DX/electric heat air handling units and fan coil units. Provide an enclosure to house the controller and associated components including suitable mounting brackets shall be NEMA 1 rated and located outside the FCUs.
- C. The controller shall be capable of monitoring and controlling the following parameters per the sequences of operation and input/output summary; space temperature; space relative humidity sensor ; cooling/heating stage control or modulating valve control; fan on/off control and status; supply air sensor; occupancy sensor; carbon dioxide sensor; VFD control and monitoring.
- D. All AHU controllers shall be MP1 and MP2 style to allow local control or override capabilities.

## 2.5 SOFTWARE OVERVIEW

- A. **Dynamic Colored Floor plans:** Dynamic colored floor plans that compare actual space conditions to setpoints shall be provided on all floorplan graphics displayed on the front- end. Floorplan enlargements shall also use the thermographs to display space conditions. Zones within the set point range shall appear transparent white. As the space gets warmer the zone color shall gradually modulate from transparent white to transparent red to identify a hot zone. As the space conditions get cooler the zone color shall gradually modulate from transparent white to transparent blue to identify a cold zone. Each zone shall indicate the current actual zone temperature within the zone. The floor plans shall use a dynamic scheduling icon to indicate schedule occupancy for each zone and provide direct one-click access to that zones unique schedule. Provide a designated icon or symbol indicating that the zone is in the occupied/unoccupied condition. From the floorplan graphic, the operator shall be able to click on any zone and go directly to the graphic for the piece of equipment controlling that zone. All dynamic floor plans shall be visible via web interface as well as on the LAN. The authorized system operator shall be able to change the zone or system identifier (or name) on the graphic and that change shall be distributed to other associated graphics and to the equipment controller.
- B. All unitary graphics must have interactive graphics with animations. All relevant points shall be shown on graphic pages.
- C. **Pop up Trends:** Provide trend logs that automatically pop up when the operator mouse clicks on the point from the graphic. Provide pop up trends for all dampers, control valves, temperature sensors, carbon dioxide sensors, humidity sensors, airflows, static pressures, flow meters, VFD speeds, etc. The EMCS contractor shall set up all trends for the owner. The pop-up trend shall include a trend tool that allows the operator to modify the trend time scale and sample interval for up to 10 sample values. The trends shall be graphical on the computer screen but shall provide an output as an .xls, .csv, .pdf, HTML, r text file.
- D. **Interactive Maps:** Implement such as Google Interactive maps depicting the facility location to indicate the site plan. This is not a static image and must be completely interactive.
- E. **Custom User HTML applications:** The EMCS shall utilize HTML5 applications as an extra feature. At minimum, provide 7-day forecast, weather radar, traffic map and hurricane tracker. All of these features shall be imbedded into the EMCS system.
- F. Provided a web-based EMCS platform; contractor shall provide an Open License software. Licenses that are not open are not acceptable. There shall be no per seat or per user licensing fee charged to the owner by the contractor.
- G. System shall use the **BACnet** protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends, and alarms shall be BACnet Objects.
- H. **User access** shall include 50 assigned operators that shall include five levels of access within the web system. Each operator log-in shall have an expiration date to allow for temporary access to the system. The operator's access description shall include his e- mail address and cell/phone numbers. The operator access can be limited from 5 minutes to permanent access. The user shall be limited to eight bad login attempts before being locked out of the system.
- I. **Global modification:** Provide the capability for global modification of user definable parameters of all points shall be provided. Global modification is defined as the mass adjustment of user definable parameters across a defined group, area, facility, campus, or network. Parameters shall include, but not be limited to temperature set

point (VAV boxes, AHU Discharge, VAV AHU Static Pressure Setpoints etc.), equipment start/stop, equipment status, valve output signal, VFD speed control signal, and damper position signal. User shall be able to lock the definable parameter to a set value, or adjust a set point to an operator adjustable value. This function shall be accomplished through the standard graphical user interface/workstation and is to be selectively applicable by the user to all controllers on the network, all controllers in a specific facility or all controllers in a specific zone within a specific facility.

- J. The system operator shall be able to override the output signal to the valves, dampers, variable frequency drives, etc. with the use of the PC mouse click on the device. The system override shall include a **Hand-Off-Auto (HOA)** capability. If the output is commanded to the hand position the operator shall designate an output value of 0-100% in 1% increments. The hand override position shall be permanent or expire after a designated time period and revert to the auto position. The color-graphic shall indicate the device that has been overridden by a color change of the output value.
- K. For non-emergency in-warranty events the system operator may submit a **Service Request** directly from the floor plan or system graphic. The web interface shall include the EMCS suppliers contact information including phone numbers and e-mail address. The service request will be logged into the EMCS suppliers service department. A non- response by the assigned technician shall elevate the request to the next highest manager or supervisor until the system operator receives an response that their request has been received and is scheduled for a resolution. All requests for service shall be maintained in the customer's database for future reference. The service request capability may be extended after the expiration of the warranty as part of a service agreement.
- L. The web-based system shall be accessible from **Tablet PCs** and provide the same functionality that is available from personal computers connected through the LAN or WAN to the system operator. The tablet PCs as a minimum shall include an Apple iPad and Google Android based tablet PC. Operation shall include touch screen capability and use of the tablet keyboard screen. The operator shall be able to view color-graphics, system trends, override setpoints, change time schedules, and override damper and valve positions.

## 2.6 ENERGY SAVING PROGRAMS

- A. Demand Limiting: Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.
- B. Duty Cycling: Periodically stop and start loads, based on space temperature, and according to various on/off patterns.
- C. Automatic Time Scheduling: Self-contained programs for automatic start/stop/scheduling of building loads. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary schedules.
- D. Optimal Start/Stop: Perform optimized start/stop as function of outside conditions, inside conditions, or both. Optimization shall be adaptive and self-tuning, adjusting to changing conditions by modifying occupancy period based upon the desired temperature at beginning and end of the occupancy period. Base optimization on occupancy schedules, outside air temperature, seasonal requirements, and interior room temperature. Employ adaptive model prediction for how long building takes to warm up or cool down under different conditions.
- E. Night-Setback Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours in conjunction with scheduled start/stop and optimum start/stop programs.

- F. Setpoint Reset: Setpoints for control of variable load systems shall be reset based on load demand, as described in the Sequence of Operations.
- G. Calculated Points: Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.
- H. Event Initiated Programming: Any data point capable of initiating event, causing series of controls in a sequence.
- I. Holiday Scheduling
- J. Direct Digital Control: Furnish software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.
- K. Trend logging shall be provided for all points per the input/output summary where there is a change in the analog or binary signal. Each controller shall be capable of storing trend values and then automatically transfer data to the NAC or the NS hard disk. Trend data shall be updated continuously per the operator assigned interval at intervals as low as one minute. Collect samples at intervals specified in minutes, hours, days, or month. Output trend logs as line-graphs or bar graphs. Binary points (input and output) shall only be logged upon a change of value (COV). Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.

## 2.7 FIELD INSTRUMENTATION

- A. Temperature Sensors: All temperature sensors shall be thermistor type, factory-calibrated to within 1 °F, interchangeable with housing appropriate for application. Sensors shall have a temperature curve rated for the application. Sensor wiring terminations shall be in a galvanized box.
  - 1. Outside air temperature sensors shall be installed in weather proof enclosure with ventilated sun-shield
  - 2. Duct mounted temperature sensors shall be averaging type for supply air, mixed air and low temperature applications for air handling units. Duct probe temperature sensor shall be acceptable for terminal units.
  - 3. Space temperature sensors shall contain a backlit LCD digital display and user function keys along with temperature sensor, setpoint adjustment and after-hours override use. Override time may be set in one-hour increments.
  - 4. Thermowell temperature sensors shall be stainless steel probe of length that is equivalent to a minimum of 50% of the pipe diameter. End-to-end accuracy shall be  $\pm 1$  deg. F. Connection box shall be moisture/water proof with conduit fitting. Furnish the stainless steel thermowell to the mechanical contractor for installation. A thermal conducting grease shall be installed in the thermowell to provide uniform temperature sensing.
  - 5. Provide flat plate stainless steel space temperature sensors with no local setpoint adjustment as indicated on the drawings.
- B. Carbon Dioxide Sensors: The sensor shall be capable of monitoring carbon dioxide concentration with an accuracy of  $\pm 50$  parts per million (PPM). The sensor shall produce a linear 0-10 VDC or 4-20 mA signal over the range of 0 to 2000 PPM. The sensor shall measure using non-dispersed infrared (NDIR) technology to measure carbon dioxide gas and shall be;
  - 1. The EMCS contractor shall utilize the required calibration devices to properly commission and calibrate the sensors per the manufacturer's requirements.

- C. Relative Humidity Sensors: relative humidity sensors shall be a two-wire type, 4-20 mA output proportional to the relative humidity range of 0-100%. The accuracy of the sensors shall be +2% over a range of 10-90% RH.
  - 1. Outdoor relative humidity sensors: provide non-corroding outdoor shield to minimize wind effects and solar heating. Install wall-mount weather proof enclosure with conduit fitting.
  - 2. Wall-mounted relative humidity sensor: sensor shall be installed in a wall-mounted enclosure with white cover.
  - 3. Duct-mounted relative humidity sensor: sensor shall be provided with a moisture resistant enclosure with conduit fitting. The probe length shall be 8" minimum.
- D. Pressure Transducers:
  - 1. Air pressure sensor: The pressure sensors shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA.
  - 2. Water pressure sensors: The pressure sensors shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA. Sensor shall be installed with a valved piping bypass and bleed off for each port.
- E. Freezestat: Provide freezestats for all chilled water air handling systems that receive more than 10% untreated outside air. Freezestats shall provide vapor tension elements, which shall serpentine the inlet face on all coils. Provide additional sensors, wired in series, to provide one linear foot per square foot of coil surface area. Freezestat shall be manually reset at the switch. Interlock to the associated fan so that fan will shut down when HOA switch is in hand or auto position. Provide time delay relays with a 0-10 minute time delay relay duration to minimize nuisance freezestat trips. Time delay relay shall be adjustable at the associated control panel.
- F. Air differential pressure switch: For fan shutdown, provide air differential pressure switches for all fans controlled by a variable frequency drive (VFD) to shut down the associated fan in the event of sensing high differential pressure. Air differential pressure switches shall have an adjustable setpoint with a range of 0-10 inches w.g. with manual reset at the switch. Provide ¼ inch copper tubing with compression fittings to mount to the side of the duct.
- G. Momentary control relays: Provide momentary control relays as indicated. . Relays shall have coil ratings of 120 VAC, 50 mA or 10-30 VAC/VDC, 40 mA as suitable for the application. Contact ratings shall be 10 amp. Provide complete isolation between the control circuit and the digital output. Relays shall be located in the UC or other local enclosures and have pin-type terminals. Relays shall have LED indication of status.
- H. Current sensing relay: Current sensing relays shall be rated for the applicable load. The output relay shall have an accessible trip adjustment over its complete operating range. Enclosure shall have an LED to indicate relay status.
- I. Photocell: Ambient light level shall be by a photocell in a non-corroding in a weatherproof housing with sun shield suitable for exterior installation. The control signal output shall be 4-20 ma or binary contact closure as specified in the sequences of operation. Mount the photocell on the north side of the building on the roof. The sensor reading shall be 0- 750 foot-candles.
- J. Occupancy Sensors
  - 1. The dual-technology occupancy ceiling mounted sensor shall be capable of detecting presence in the control area by via Doppler shifts in transmitted ultrasound and passive infrared (PIR) heat changes. Sensor shall utilize



Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off. The sensor shall operate at 24 VDC/VAC.

2. Sensors shall have a time delay that is adjustable with configuration software or shall have a fixed time delay of 5 to 30 minutes, set by a DIP switch. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
3. The sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options. The sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.

## **2.8 WHOLE BUILDING METERING**

- A. Buildings are to monitor electrical, water and gas usage. Any additional sub metering is to be provided by the contractor and determined by each specific project as called out on the drawings or specifications.

## **2.9 WATER FLOW METERS**

- A. Insertion Turbine Flow Meters shall be provided at every Air Handling Unit and for HVAC applications in piping larger than 2 inches. The flow meter shall have a stainless steel insertion probe with non-metallic rotors; 2.0 % accuracy of actual reading from 0.4 to 20 ft/s; turndown ratio of at least 50:1; pulse outputs proportional to flow rate for monitoring by the EMCS. The flow meter shall be single turbine type on applications with 20 diameters of pipe upstream and 5 diameters of pipe downstream. The flow meter shall be a dual turbine type on applications with less than 20 diameters of pipe upstream and 5 diameters of pipe downstream. Provide full port valve to allow for removal and re-insertion without disruption to the water service, to be installed by Division 23. Acceptable manufacturer shall be Onicon.
- B. Inline nutating-disk type flow meters shall be provided for domestic water and cooling tower metering applications. The meter shall include a pulse output for monitoring by the EMCS. Provide meter to be installed by Division 23.

## **2.10 AIRFLOW MEASURING STATIONS (AFMS)**

- A. Duct mounted airflow measuring stations with combination airflow and air temperature measurement devices shall have the following features:
  1. Multi-point sensors in one or more probe assemblies with a maximum of one to sixteen sensor nodes per location, and a single remotely mounted microprocessor-based transmitter for each measurement location. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. Each sensing point shall independently determine the airflow rate and temperature at each node, which shall be equally weighted in calculations by the transmitter prior to output as the cross-sectional average. Each ducted sensor probe shall have an integral, U.L. Listed, plenum rated cable. Each independent temperature sensor shall have a calibrated accuracy of  $\pm 0.14^{\circ}\text{F}$  ( $0.08^{\circ}\text{C}$ ) over the entire operating temperature range of  $-20^{\circ}\text{F}$  to  $160^{\circ}\text{F}$  ( $-28.9^{\circ}\text{C}$  to  $71^{\circ}\text{C}$ ), and be calibrated at 3 temperatures against standards that are traceable to NIST. Acceptable manufacturer shall be

EBTRON, Inc. GTx116-PC.

2. Each transmitter shall have a display capable of simultaneously displaying both airflow and temperature. Airflow rate shall be field configurable to be displayed as velocity or volumetric rates, selectable as IP or SI units. Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges.
3. Each independent airflow sensor shall have a laboratory accuracy of +/-2% of Reading over the entire calibrated airflow range of 0 to 5,000 fpm (25.4 m/s)., and be wind tunnel calibrated at 16 points against air velocity standards that are traceable to NIST.

## 2.11 DAMPER ACTUATORS:

- A. Outside and exhaust air damper actuators shall be mechanical spring return. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.
- B. Outside and return air modulating actuators shall utilize analog (proportional) control 0-10 VDC. Actuators shall be driven in both the open and closed directions.
- C. Electric damper actuators shall be direct shaft mounted and use a V-bolt and toothed V- clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.
- D. Single section dampers shall have one electronic actuator direct shaft mounted.
- E. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section.
- F. Damper actuators shall be BELIMO only.

## 2.12 CONTROL VALVES

- A. Furnish all valves controlled by the EMCS as shown on the Mechanical Drawings. Furnish all automated isolation valves as shown on the Mechanical Drawings. Control valves shall be factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated. EMCS contractor to size control valve with a maximum of three psi pressure drop. 2- position isolation valves shall be full-line size.
  1. All chilled water, condenser water, and hot water valves shall meet, at minimum, the following ANSI Class 150 ratings. Valves 0.5 inch to 2 inches shall have NPT female screwed ends. Valves 2.5 inches and larger shall have flanged ends.
  2. Equal Percentage control characteristic shall be provided for all 3-way water coil control valves.
- B. Pressure Independent Characterized Control Valves (PICCV) ½" to 6", for **two-way modulating applications** shall have equal percentage characteristics and control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSID across the valve. The pressure independent control valve shall be provided and delivered from a single manufacturer as a complete assembly. The actuator shall be integrally mounted to the valve at the factory with a single screw on a direct coupled DIN mounting-base. The PICCV valves shall be sized for the scheduled flow and not pressure drop. Valves shall be Belimo PICCV or approved equal
  1. NPS 2" and Smaller: Forged brass body rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated



- O- rings and a brass or TEFZEL characterizing disc. Close off pressure rating of 200 psi.
2. NPS 2-1/2" through 6": GG25 cast iron body according to ANSI Class 125, standard class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless steel flow characterizing disc. Close off pressure rating of 100 psi.
- C. Characterized Control Ball Valves (CCV) for ½' to 2": for **3-way modulating applications** shall have equal percentage characteristics. Manufacturer shall be Belimo or approved equal.
1. Valve housing shall consist of forged brass rated at no less than 400 psi at 250 °F. Three-way valves shall have EPDM O-rings behind ball seals to allow for a minimum close-off pressure of 40 psi with an actuator that provides 35 in-lbs torque for ½ to 2 in. sizes. Three-way valves shall be installed in a "tee" configuration with actuator perpendicular to the shaft. Confirm mixing or diverting application for correct valve selection.
- D. Globe Valves 2-1/2" to 6": for **3-way modulating applications** shall have equal percentage characteristics. Manufacturer shall be Belimo G7 series or approved equal.
1. Valve housing shall consist of cast iron rated at no less than 125 psi at 300 °F. Valve shall have stainless steel stem, plug and seat. Three-way valves shall be installed in a "tee" configuration with actuator perpendicular to the shaft. Confirm mixing or diverting application for correct valve selection.
- E. Butterfly valves: For chiller and cooling tower isolation control valves, butterfly control valves may be provided.
1. Butterfly Isolation valves shall be line-size. Design velocity shall be less than 12 feet per second when used with standard EPDM seats. Butterfly valves shall have ductile iron body, 304 stainless steel disc and EPDM seat. The valve body close-off pressure rating shall be 150 psi over a range of -20 F to 250 F. The flange shall be ANSI 125/250. Belimo F6 and F7 series or approved manufacturer.
- F. Control Valve Actuators for CCV and Globe valves: Provide electric actuators for all control valves that are furnished as part of the EMCS contract. Two way and three way control valve actuators shall meet, at minimum, the following requirements:
1. Motor driven type with gear assembly made of hardened steel. Actuator shall have an input voltage of 24 VAC. Interior actuator housings shall be NEMA-2 rated. Exterior housings shall require a weather shield or shall be NEMA-4 rated. Provide visual mechanical position indication
  2. Valves shall be sized to meet the shut-off requirements when operating at the maximum system differential pressure and with the installed system pump operating at shut-off head. Actuators shall control against system maximum working pressures.
  3. Normal and failure positions shall be as indicated in the operating sequences. Provide spring return action per the sequences.
  4. Manual declutch lever to enable manual operation of the valve. It shall be possible for an operator to manually modulate valves located in mechanical rooms in the event of loss of power.
  5. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to

stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for butterfly valve actuators.

6. All actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow. Programming using actuator mounted switches or multi-turn actuators are not acceptable.
7. Electric actuators shall be Belimo, compatible with the valves furnished.

G. Butterfly Valve Industrial Actuators

1. Enclosure shall be NEMA 4 (weatherproof) enclosure and will have an industrial quality coating.
2. Actuator shall have a motor rated for continuous duty. The motor shall be fractional horsepower; permanent split capacitor type designed to operate on a 120 VAC, 1 phase, 60 Hz supply. Two adjustable cam actuated end travel limit switches shall be provided to control direction of travel. A self-resetting thermal switch shall be imbedded in the motor for overload protection.
3. Reduction gearing shall be designed to withstand the actual motor stall torque. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.
4. Actuator shall have a 6 ft wiring harness provided for ease in field wiring (above 1500 in-lbs). Two adjustable SPDT cam-actuated auxiliary switches, rated at 250 VAC shall be provided for indication of open and closed position. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.
5. Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator and when in manual operation electrical power to the actuator will be permanently interrupted. The hand wheel will not rotate while the actuator is electrically driven.
6. The actuator shall be analog, floating, or two position as called out in the control sequence of operation. All analog valves shall be positive positioning, and respond to a 2-10 VDC, 4-20 mA, or adjustable signal as required. Analog actuators shall have a digital control card allowing any voltage input for control and any DC voltage feedback signal for position indication.
7. Butterfly valve actuators shall be Belimo furnished with specified butterfly valves.

## 2.13 REFRIGERANT LEAK DETECTION:

- A. Refrigerant leak detection monitors shall be provided for the refrigerant and number of chillers installed.
1. Power consumption: AC - 325 mA, DC - 250 mA. Volt free contacts to indicate an alarm condition.
  2. Operating temperature range of 32 °F to 105 °F. Operating humidity range of 0 to 95% non-condensing.
  3. Measuring range of 0-1000 ppm proportional to 4 to 20mA output range for each sampling point.
  4. System shall detect the presence of the following types of refrigerants regardless of refrigerant type using sequential sampling and multi-point

monitoring method: CFC, HCFC and HFC as provided with the chillers.

5. System shall annunciate to the EMCS through a contact closure and have a local alarm (audible and visual) Control panel shall have a silencing alarm button. Signage at all entry points to the chiller room shall be installed. Initial alarm shall comply with recommended Allowable Exposure Level (AEL). Adjustable 3 level alarm for each point shall be supplied with common alarm output contacts. Provide local digital indication of ppm level for a minimum of 1 sample point per chiller. A sample point shall be located close to each chiller and the refrigerant pump out unit location. Location to be approved by the engineer. Sample point if in alarm shall flash the associated LED. Provide local alarm horns and visual (stroboscopic) beacons at the following locations to activate upon alarm to an approved detail:
  - a. Outside of entrance doors to chiller machine room.
  - b. Inside rooms without an escape route other than through the chiller room.
  - c. At each chiller location.
  - d. At any other location in the chiller room as necessary to ensure that a person at any location in the chiller room and room that can be entered from the chiller room can see the visual alarm and hear the audible alarm and at any other location required to meet the applicable codes.
6. System shall shut down all electrical equipment (chiller systems and associated pumps, AHU, FCU, etc.) and sequence emergency extract equipment as required to meet regulations. Where combustion equipment is employed, refrigerant vapor monitoring system shall automatically shut down the combustion process in event of refrigerant leakage if other alternative acceptable conditions are not applied. Ventilation system, chiller and associated pumps and other equipment shut down as a result of the refrigerant leak alarm shall return to normal operation when the refrigerant monitoring system is no longer detecting refrigerant levels above set points and alarms have been silenced.
7. System shall have self-diagnostics and supply common malfunction output. Loss of sample flow at either sample or ZERO line and electrical malfunction shall annunciate to the EMCS.
8. Provide two (2) additional particulate filters and zero gas filter cartridges.
9. Provide an emergency shut-off control button outside each chiller plant room entrance/exit door. Button shall be mounted at 48 inches above finished floor adjacent to refrigerant leak detection alarm light. Activation of any one of the buttons shall de-energize all chillers and other electrical equipment within the chiller plant room. Button shall be manually reset.
10. Provide BACnet MS/TP interface to EMCS. Provide Strobe/Horns and Emergency Push Buttons.
11. Maximum System Maintenance Requirements - The system shall require no periodic maintenance other than periodic checking. Periodic checking or adjustments of the unit shall be capable of being accomplished by one person at the unit location.
12. Manufacturer Capability Requirements - As a minimum, the Gas Monitoring Equipment manufacturer must meet the following requirements:
  - a. Be capable of supplying all equipment used to check or calibrate the unit
  - b. Be capable of providing onsite service with factory trained personnel

- c. Be capable of providing start-up assistance and training for the owner/operator
- 13. Gas Monitoring System shall be a Mine Safety Appliances Company Chillgard RT Refrigerant Monitor or equal.

## **2.14 PANELS AND ENCLOSURES**

- A. Provide panels and enclosures for all components of the EMCS, which are susceptible to physical or environmental damage.
- B. Interior panels and enclosures shall meet be NEMA 1 rated painted steel panels with locking door.
- C. Exterior mounted panels and enclosures shall be NEMA 4X stainless steel panels with locking door.
- D. Panels for USCs shall be mounted on the outside of all unit ventilators and fan coil units with three feet of wall clearance in front of them and no higher than 7 feet to the bottom of the panel.

## **2.15 LABELING AND WARNING NOTICES**

- A. Provide labeling for all control panels and enclosures.
- B. Provide labeling of all control wires and input/output points at the controller and at the control device; the label at each end of the wire shall be the same Labels shall be machine generated, typed and clearly legible with a maximum of 17 characters. Hand written labels or labels written on the control wire jacket will not be acceptable. Each label shall be unique to its function and shall reference the applicable system. For example "AHU-1 SAT" will indicate the supply air temperature sensor for AHU-1. Improper labeling shall be removed and shall require re-commissioning of the control device and controller to document correct functionality.
- C. Provide high voltage warning notices at all equipment controlled by the EMCS and at all associated motor starters when used by equipment controller.
- D. Provide high voltage warning notices at all equipment controlled by the EMCS and at all associated motor starters when used by equipment controller.
- E. Phenolic label on the front of panel to indicate name of control panel and also indicate what equipment is controlled from panel.

## **2.16 TUBING AND PIPING**

- A. Provide tubing and piping as required for the field instrumentation.
- B. Tubing within equipment rooms, vertical risers, and penetrations to ductwork shall be either copper pipe or shall be plastic tubing within conduit. Tubing for all water-based instrumentation shall be copper pipe. Identify the type of tubing proposed in the shop drawing submittal.
- C. Provide suitable bulk head fittings for duct and panel penetrations.
- D. Tubing in plenum rated areas may be plastic tubing. Polyethylene tubing shall meet, at minimum, the following requirements: flame retardant; crack resistant; 300 psi burst pressure.

## **2.17 CONDUIT AND FITTINGS**

- A. Provide all conduits, raceways and fittings for the EMCS monitoring, communication and control cabling. All work shall meet all applicable codes.

- B. Conduit, where required, shall meet, the requirements specified within Division 26.
- C. EMCS monitoring and control cable shall not share conduit with cable carrying voltages in excess of 90 VAC.
- D. Conduit and fittings must be rated for exterior/outdoor conditions.
- E. Provide PVC coated conduits for all exterior conduits serving cooling tower.

## **2.18 CABLING**

- A. Provide all cables for the EMCS. Cable shall meet, at minimum, the following requirements:
  - 1. Minimum 98% conductivity stranded copper.
  - 2. Proper impedance for the application as recommended by the EMCS component manufacturer.
  - 3. Monitoring and control cable shall be #18 AWG or larger, dependent on the application. Analog input and output cabling shall be shielded.
  - 4. Management Level Network cable shall be CAT 6, 24 gauge unshielded.
  - 5. Automation Level Network cable shall be #24 AWG shielded.
  - 6. Shield shall be grounded at the CCP, UC, or control panel. Ground at one end only to avoid ground loops.
  - 7. Identification of each end at the termination point. Identification should be indicated on and correspond to the record drawings.
- B. 120 VAC power wiring shall be of #12 AWG solid conductor or larger as required.

## **PART 3 - EXECUTION**

### **3.1 PRE-CONSTRUCTION**

- A. The EMCS supplier shall provide a pre-construction coordination meeting with the affected trades to ensure a cooperative efficient process of installation. The invited trades shall include the general contractor, mechanical contractor, electrical contractor, test and balance contractor, owner's representative, consulting engineer and others with a direct interest in the coordination of the affected systems. The EMCS contractor shall provide an outline of the meeting agenda highlighting the construction schedule, coordination with mechanical and electrical trades. Provide a sign-in sheet and submit it through the attendees along with a summary of the meeting notes for future reference.

### **3.2 INSPECTION DURING INSTALLATION**

- A. Provide a technician to assist the Engineer or Owner's Representative, Test and Balance and Commissioning Agent with inspections made during the installation period that are required to review the progress and quality of ongoing work. The engineer/owner's representative shall generate field observation reports on the findings of the inspection. The engineer or owner's representative shall advise the EMCS contractor during the inspection of any concerns noted with respect to the installation and shall repeat the concerns in writing as soon as possible after the inspection is completed. The EMCS contractor shall take corrective action to meet the requirements of the specifications. Upon correction, the EMCS contractor shall submit written documentation through the contractors to the engineer.

### 3.3 INSTALLATION OF COMPONENTS

- A. Provide all interlock and control wiring. All wiring shall be installed in a neat and professional manner in accordance with specification Division 26 and all national, state and local electrical codes.
- B. Provide wire and wiring techniques recommended by equipment manufacturers. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Owner's Representative prior to rough-in. Provide auxiliary pilot duty relays on motor starters as required for control function.
- C. Electrical Contractor shall provide 120 or 277 volt power at a junction box within 48" of the controller. The BAS Contractor shall coordinate with the Electrical Contractor to identify locations of power requirements prior to the installation of the controls.
- D. Conduit for control wiring shall be provided whenever one of the following conditions exists:
  - 1. Conduit is indicated on the drawings or specifically required by the specifications.
  - 2. Cabling runs through inaccessible areas such as within partitions/walls, above closed in ceilings, under floor; within trenches and underground; on the exterior of the building; exposed on the surface of the building; when encased in concrete or other material that makes the cable inaccessible or when located such that access to the cable is not readily obtained.
  - 3. Cable within mechanical, telecommunications and electrical equipment rooms and control rooms.
  - 4. Conduit shall be installed, inside wall from sensor box to above the wall, for all wall mounted temperature, humidity and CO2 sensors.
- E. Control wiring located above an accessible ceiling space may be plenum rated cable. Plenum rated wire shall be bundled and routed at right angles to the building lines and secured to the building structure every 15 feet.
- F. When communication bus enters or exits a building, a surge suppressor shall be installed. The surge suppressor shall be installed according to the controls manufacturer's instructions.
- G. Provide sleeves for all cable and conduit passing through walls, partitions, structural components, floors and roof
- H. All sensor wiring shall be labeled to indicate the origination (at the device) and destination of data (at the control panel). The description shall indicate the type and location of the control device such as "AHU-1 SA temp" or "VAV 1-1 space temp".
- I. Wall temp sensors at 48" above the finished floor to comply with ADA requirements and to match the height of the light switches. Mount humidity sensor at equal height to wall temperature sensor.

### 3.4 VERIFICATION REQUIREMENTS

- A. Verification shall be provided by the EMCS contractor to demonstrate and confirm that the installed system complies with the specifications and the control sequences of operation herein specified. Upon completion of the verification process the EMCS contractor shall demonstrate to the engineer or owner's representative and Commissioning Agent the functionality of the control system devices are in compliance

with the contract documents.

- B. Technicians provided by the EMCS contractor shall be factory trained and qualified in the operation of the provided control system. The EMCS contractor shall provide, if requested, the factory training certificates of the individuals providing the verification services on this project.
- C. Verification tools, applicable to the system provided, shall be utilized by the factory-trained technicians for proper verification of system operation and functionality. Temperature verification sensors shall be NIST certified within the last 12 months. Meters such as Fluke 52 series or better shall be utilized. Use of non-certified meters may require the system to be re-verified with certified meters at no cost to the owner.
- D. Documentation of the verification process shall be provided per the project general conditions in electronic PDF format as required. Documentation shall include the following forms:
  - 1. **Project System Verification Forms** for each controller provided on the project to verify the proper function of each controller, control device and system component provided.
  - 2. **Panel Verification Forms** for each control panel to document the proper installation and function of each control panel provided.
  - 3. **Sequence of Operation Verification Forms** for each piece of controlled equipment to confirm compliance of the control system with the specified sequences of operation.
  - 4. Not providing proper documentation for each control devices, panel, or system, upon request by the engineer or owner's representative, may require the EMCS contractor to re-verify the applicable systems at no additional cost to the owner.
- E. After completion of the verification, the EMCS contractor shall be able to demonstrate the sequence of operations for each system to the engineer and the owner's representative.
- F. Equipment checkout sheets are to be produced by this contractor showing checkboxes and compliance with the following procedures for each piece of equipment and turned over to the owner and/or mechanical engineer.

### 3.5 COLORGRAPHICS

- A. The colorgraphics shall be provided for the EMCS system prior to system acceptance and owner training. Owner has final final approval and decision on all graphic templates.
- B. The colorgraphics provided shall include the following as a template. Provide forward and backward links on the graphic.
  - 1. Site plan with link to overall building plan including detached buildings. The site plan shall be referenced to an automatically updated aerial view or map view of the area such as Google Maps or Bing Maps. Provide link to proceed to the overall building floor plan.
  - 2. The overall building plan shall indicate space temperature conditions referenced by the color of the zone. Specific details of the zone temperatures and equipment are not required. Provide a link to the floor plan wings, upper floors and remote buildings.
  - 3. The floor plan colorgraphics shall indicate the space temperatures by color references. Additional information shall indicate the space temperature, the



occupancy of the zone, air handling units, VAV terminals and ductwork with diffusers. A link at each terminal unit or AHU shall automatically connect the system operator to the equipment colorgraphic.

4. The colorgraphics for the equipment shall as a minimum be equal to the points from the input/output summary or control schematic. Primary control devices as required by the sequences of operation shall also be provided.
5. Control points from equipment that are integrated into the EMCS via BACnet shall be provided to convey the operating conditions of the attached equipment. Coordination of the integration points shall be accomplished during the submittal phase. The EMCS contractor shall provide a list of all integrated points on their submittal.

### 3.6 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

- A. Startup testing documentation: Prepare the checklist documenting startup testing of each input and output device, with technician's initials and date certifying each device has been tested and calibrated prior to acceptance testing. This document shall indicate proof that the following functions have been commissioned and shall be included in the as-built documentation: short to ground check, configuration of trends, confirmation that color-graphics are accurately representing actual systems, point to point checkout, all damper and valve actuators respond to input change, control modules are addressed and have functional descriptors, specified interlocks are functional, calibration report of all sensors, discrete outputs respond to time schedule or manual enable command.
- B. Demonstration. Prior to acceptance, demonstrate the following performance tests to demonstrate system operation and compliance with specifications.
  1. Engineer, owner's representative and mechanical contractor shall be invited to observe and review system demonstration. Provide attendees at least 10 days notice.
  2. Demonstration shall follow process approved as part of the submittal and shall include complete checklists and forms for each system as part of system demonstration.
  3. Demonstrate actual field operation of each sequence of operation as specified. Demonstrate calibration and response of any input and output points requested by engineer or owner's representative.
  4. Demonstrate complete operation of operator interface including review of color-graphics, time schedules, trend logs, alarm notification, functionality of tablet PC operation.
    - a. PID loop response. Supply graphical trend data output showing each PID loop's response to a set point change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be selectable from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show set point, actuator position, and controlled variable values.
    - b. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand limiting setpoint, and status of set points and other affected equipment parameters.
    - c. Trend logs for each system. Trend data shall indicate set points, operating points, valve positions, and other data as specified. Logs



shall be accessible through system's operator interface and shall be retrievable for use in other software programs.

5. Alarms and Interlocks. Check each alarm with an appropriate signal at a value that will trip the alarm. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction. Alarm verification shall include temperatures exceeding alarm threshold (high and low), fan failure safety, duct high static pressure switch, freezestat, and smoke detector shutdown.
  6. Tests that fail to demonstrate proper system operation to the engineer shall be repeated after contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.
- C. Owner Acceptance.
1. After tests described in this specification are performed to the satisfaction of both engineer and owner's representative and Commissioning Agent, the engineer shall accept the control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond EMCS contractor's control. Engineer shall provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.
  2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved by the engineer, owner and commissioning agent.

### 3.7 DEMONSTRATION AND OWNER TRAINING

- A. Furnish basic operator training for multiple persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 16 hours: 8 hours instructor time for onsite training and 8 hours of hands on class environment training. Training sessions may be provided in 4-hour increments as approved by the owner's representative.
1. Change/modify temperature setpoints.
  2. Change/modify time of day, holiday and override schedules.
  3. Display, create, and modify trends of system points.
  4. Update room numbers on the color-graphics.
- B. Demonstrate complete and operating system to Owner. Provide written documentation listing the attendees of the specified training with sign-in sheet and training time and date.

## PART 4 - SEQUENCE OF OPERATIONS

**Editor's Note: Engineer must choose and adjust sequences to meet design intent and scope.**

- A. The following are sequences of operations which will be accomplished by the EMCS. Coordinate with Owner in operating equipment to maximize comfort and economy. All points required to accomplish the sequences will be provided and connected to the EMCS.
- B. Equipment interfaces are acceptable for providing information but each piece of equipment (including but not limited to chillers, VFD's, unitary equipment, etc.) shall have a hard wired point for start/stop and speed control.

- C. All Points added by Engineer and/or Control Contractor needed for the sequences shall be identified in the Submittals and Project Record Documents.
- D. All VFD's and actuators shall have feedback that reports to the EMCS.
- E. All units to have economizer sequences and economizer fault detection and diagnosis capabilities.
- F. Flow meters at air handlers shall be integrated into the EMCS.

### **Freezer/Cooler Alarm**

- Freezer temperature – AI
- Cooler temperature – AI
- Remote-bulb temperature sensors shall be mounted in both the freezer and cooler. Alarms shall be sent to the computers, pagers, and/or text message compatible cell phones designated by the FBISD personnel when either temperature rises above or falls below operator adjustable set points.

### **Building Shutdown (shelter in place)**

- Shutdown switch status – dry contact - DI
- A maintained mushroom type emergency local override button shall be installed in the principal's office or the administration area shall shut down the HVAC system in case of emergency. Once pushed the button must be reset to allow the HVAC system to resume normal operation. The final location of the building shutdown is to be determined by FBISD personnel. Button shall have operable plastic cover. Provide phenolic cable to indicate "HVAC Shutdown". Color of button shall be Red. Button shall be keyless type button to allow button to be "deactivated" without a key.

### **Chemical Injection Feeders**

#### **Refrigerant Monitoring System**

An "ON ONLY" emergency switch will de-energize the chillers and initiate an audible/visual alarm. The "ON ONLY" emergency switch will have to be manually reset after it has been engaged.

An "OFF ONLY" emergency switch will de-energize electrical equipment within the central plant.

The refrigerant sensor will energize the exhaust fan for emergency ventilation and de-energize the chiller and electrical equipment in the central plant when the concentration of refrigerant vapors exceeds the set percentage by the UMC 94 section 1107.5.

Refrigerant monitoring annunciation shall be installed at all entry points into mechanical rooms.

### **SEQUENCE OF OPERATION - VAV AIR HANDLING UNITS (WITH VFD) AND OUTSIDE AIR ECONOMIZER**

- A. System Off - When the system is off:
  - 1. All the fans shall be off.
  - 2. The heating coil valve shall be 30%.
  - 3. The cooling coil valve shall be 30%.
  - 4. The outside air damper shall be closed.
  - 5. All control loops shall be disabled.
- B. Initiation of System Start-Up - System start-up shall be initiated:
  - 1. By an operator manually entered command at the EMCS.
  - 2. Automatically by the EMCS based on optimal start, night setup, time schedule, restart following a fire alarm, or restart following a power failure.
- C. Occupancy: Valid Occupancy modes shall be:
  - 1. Occupied: Normal operating mode for occupied spaces or daytime operation. When the unit is in the occupied mode the unit shall maintain the discharge air temperature at the

active discharge heating or cooling setpoint. The occupied mode shall be the default mode of the unit.

2. Unoccupied: Normal operating mode for unoccupied spaces or nighttime operation. When the space temperatures in the spaces served are off the heating or cooling unoccupied temperature setpoints plus/minus an offset the unit shall start the fan and enable the primary heating or cooling capacities to maintain the discharge air temperature at the active discharge air temperature setpoint. The outside Air damper shall remain closed, unless economizing.

Unoccupied Cooling Setpoint: 85°F Unoccupied Heating Setpoint: 55°F

- D. Heat/Cool Mode - In standalone or auto mode the unit shall automatically determine the Heat/Cool mode by transitioning between morning warmup, cooldown or normal operation.
- E. Cooling Operation - When the unit is in cooling mode, the unit shall maintain the discharge temperature at the active discharge cooling setpoint. Based on the unit occupancy mode, the active discharge cooling setpoint shall be:
- F. Occupied Discharge Air Cooling Setpoint: 55°F - 59°F based on an outside air temperature reset
- G. Unoccupied Discharge Air Cooling Setpoint: 55°F - 59°F based on an outside air temperature reset
- H. The unit shall use the active discharge air temperature cooling setpoint and the discharge air temperature to determine the requested cooling capacity of the unit (0-100%). The outputs shall be controlled based on the unit configuration and the requested cooling capacity.
- I. Heating Operation - When the unit is in heating mode or morning warmup, the unit shall maintain the discharge air temperature at the active discharge air heating setpoint. Based on the unit occupancy mode, the active heating setpoint shall be:
- J. Occupied Discharge Air Heating Setpoint: 90°F
- K. Unoccupied Discharge Air Heating Setpoint: 90°F
- L. The unit shall use the active discharge air temperature heating setpoint and the discharge air temperature to determine the requested heating capacity of the unit (0-100%). The outputs shall be controlled based on the unit configuration and the requested heating capacity.
- M. The discharge heating and cooling setpoints shall be limited by adjustable parameters in the unit to prevent them from being set too low or too high.

Setpoint	Default Value
Maximum Discharge Air Cooling Setpoint	59°F
Minimum Discharge Air Cooling Setpoint	55°F
Maximum Discharge Air Heating Setpoint	100°F
Minimum Discharge Air Heating Setpoint	85°F

- N. Transition from Unoccupied to Occupied - When the unit transitions from unoccupied mode to the occupied mode, morning warm-up routine shall be activated.
  1. Morning Warm-Up - When unit is occupied and return air temperature is below 65°F (adj.) or more the occupied heating setpoint and morning warm-up sequence shall be activated. During warm-up the fan shall be turned on, the outside air damper shall remain closed, and the heating capacity shall be controlled to the discharge heating setpoint. When the return air temperature reaches the morning warmup return air temperature setpoint the unit shall operate in occupied mode.

2. Pre-Cool mode is communicated only- During Pre-Cool, the fan shall be turned on, the outside air damper shall remain closed, and the cooling capacity shall be controlled to the discharge cooling setpoint.
- O. VAV Supply Fan Operation: The unit shall always maintain duct static setpoint in all modes of operating with the fan on. When the fan is on the unit shall read and compare the duct static pressure input to the duct static pressure setpoint and adjust the supply fan speed accordingly. A duct static pressure reset algorithm shall be used. Static pressure must be placed down the supply duct run where pressure setpoint cannot exceed 1.2 inches w.c.
  - P. VAV Return/Exhaust Fan Operation: The unit shall always maintain building pressure setpoint in all modes of operating with the fan on. When the fan is on the unit shall read and compare the building pressure input to the building pressure setpoint and adjust the return/exhaust fan speed accordingly. The return/exhaust fan shall be controlled to maintain a positive building pressure setpoint of .08" wg (adjustable) above atmospheric pressure.
  - Q. Hydronic Cooling Valve Control- If the unit is in the cooling mode the unit shall modulate the cooling valve to maintain the discharge air temperature at the active discharge air temperature setpoint. If the economizer function is enabled and the outside air damper is not fully open the cooling valve shall be closed. If economizer is unable to maintain discharge air setpoint, cooling valve shall open to meet cooling demand. The cooling valve shall be at 30% open if the fan is off.
  - R. Hydronic Heating Valve Control- If the unit is in the heating mode, the unit shall modulate the hydronic heating valve to maintain the discharge air temperature at the active discharge air temperature setpoint. The heating valve shall be at 30% open if the fan is off.
  - S. Outside Air Damper Control - During all occupied modes the outside air damper shall be controlled to the effective minimum adjustable position, unless the economizing mode is active. The outside air damper shall be closed during the unoccupied mode, morning warm-up and pre-cool modes or when the outside air temperature falls below a Low Ambient Damper Lockout Setpoint [38°F], operator adjustable. Control outside air supply rate using a carbon-dioxide based demand ventilation control strategy. The outside air and return air dampers shall modulate to provide ventilation CFM to maintain CO2 levels in the spaces. The outside air damper shall be initially set at the minimum position. The dampers shall incrementally increase/decrease to maintain CO2 levels. The EMCS shall monitor CO2 levels in the return air duct. Upon CO2 value rising above 1100 ppm, the outside air damper shall modulate open from the normal position to maintain the CO2 level at 1100 ppm. Once CO2 values fall below set point (1100 ppm), the outside air CFM shall return to its minimum position.
  - T. Economizer Control - The unit shall allow economizer during all occupied and unoccupied modes. The modulating outdoor air damper shall provide the first source of cooling. The unit shall enable economizer mode if the outside air temperature is between 55°F-65°F, operator configurable. If economizer is initiated, the unit shall modulate the outside air damper between the active minimum position and fully open and shall modulate the mixed air damper between fully open and fully closed to maintain the discharge air temperature at the active discharge air temperature setpoint. If a hardwired outdoor air temperature sensor or a communicated value is not present, economizing shall not be allowed. System must be able to accomplish economizer fault detection and diagnostics.
  - U. Exhaust Air Control - The unit shall coordinate the exhaust function with the return fan and mixed air damper. The exhaust output shall be energized whenever the supply fan is on and the outdoor air damper open beyond the exhaust fan/damper enable setpoint [30%], operator configurable. The exhaust output shall remain energized until the outdoor air damper closes to below 10% (adjustable) of the exhaust damper enable setpoint and or the supply fan is turned off.

## **SEQUENCE OF OPERATION – VARIABLE AIR VOLUME BOX WITH SUPPLEMENTAL HEAT**

- Space temperature sensor – AI
  - Hot water valve - AO
  - Cold deck flow – velocity sensor – AI
  - Outdoor air temperature - AI
  - Cooling damper - AO
  - Discharge air temperature –AI
  - Space occupancy sensor – DI
  - Space lighting relay(s) – DO
  - Space lighting, local switches – DI (each switch) Zone Occupancy
- A. System Off - When the system is off:
1. The heating coil valve shall be closed.
  2. All control loops shall be disabled.
- B. Initiation of System Start-Up - System start-up shall be initiated:
1. By an operator manually entered command at the CMCS.
  2. Automatically by the EMCS based on optimal start, night setup, time schedule, restart following a fire alarm, or restart following a power failure.
- C. System Operation - When system start-up has been initiated, the following sequences shall be implemented:
1. The supply air damper and heating coil valve shall be controlled to maintain the space temperature setpoint.
- D. Setpoints - The system shall have the following setpoints:
1. Space temperature setpoint shall be 69 Deg. F. for heating and 74 Deg. F. for cooling.
  2. Unoccupied temperatures shall be 55 Deg. F. for heating and 85 Deg. F. for cooling
- E. Initiation of System Shutdown - System shutdown shall be initiated:
1. By operator entered manual command.
  2. Automatically by the EMCS base on time schedule or optimal stop.

#### **SEQUENCE OF OPERATION - CONSTANT VOLUME AIR HANDLING UNIT (HEATING/ COOLING) WITH OUTSIDE AIR ECONOMIZER**

- Space temperature – AI
  - Space humidity – AI
  - Leaving air temperature (provide on all single zone and multizone units for each zone) – AI
  - Pre-heat/cool discharge air temperature - AI
  - Air handler fan status – current switch - DI
  - Chilled water valve – AO
  - DX Cooling – As noted only DO
  - Pre-Cool chilled water valve – AO
  - Pre-heat hot water valve - AO
  - Hot water valve - AO
  - Air handling unit fan start/stop - DO
  - Exhaust fan start/stop - DO
  - Outdoor air damper – AO
  - Return Air CO2 - AI
  - Freeze Status - DI
- A. System Off - When the system is off:
1. All the fans shall be off.
  2. The heating coil valve shall be 30%.

3. The cooling coil valve shall be 30%.
  4. The outside air damper shall be closed.
  5. All control loops shall be disabled.
- B. Initiation of System Start-Up - System start-up shall be initiated:
1. By an operator manually entered command at the CMCS.
  2. Automatically by the EMCS based on optimal start, night setup, time schedule, restart following a fire alarm, or restart following a power failure.
- C. System Operation - When system start-up has been initiated, the following sequences shall be implemented:
1. The supply air fan shall start.
  2. The heating coil valve shall be controlled to maintain the heating space temperature setpoint.
  3. The cooling coil valve shall be controlled to maintain the cooling space temperature setpoint.
- D. Return/Exhaust Fan Operation: The unit shall always maintain space pressure setpoint in all modes of operating with the fan on. When the fan is on the unit shall read and compare the space pressure input to the space pressure setpoint and adjust the return/exhaust fan speed accordingly. The return/exhaust fan shall be controlled to maintain a positive building pressure setpoint of .08" wg (adjustable) above atmospheric pressure.
- E. Outside Air Damper Control - During all occupied modes the outside air damper shall be controlled to the effective minimum adjustable position, unless the economizing mode is active. The outside air damper shall be closed during the unoccupied mode, morning warm-up and pre-cool modes or when the outside air temperature falls below a Low Ambient Damper Lockout Setpoint [38°F], operator adjustable. Control outside air supply rate using a carbon-dioxide based demand ventilation control strategy. The outside air and return air dampers shall modulate to provide ventilation CFM to maintain CO2 levels in the spaces. The outside air damper shall be initially set at the minimum position. The dampers shall incrementally increase/decrease to maintain CO2 levels. The EMCS shall monitor CO2 levels in the return air duct. Upon CO2 value rising above 1100 ppm, the outside air damper shall modulate open from the normal position to maintain the CO2 level at 1100 ppm. Once CO2 values fall below set point (1100 ppm), the outside air CFM shall return to its minimum position.
- F. Economizer Control - The unit shall allow economizing during all occupied and unoccupied modes. The modulating outdoor air damper shall provide the first source of cooling. The unit shall enable economizer mode if the outside air temperature is between 55°F-65°F, operator configurable. If economizer is initiated, the unit shall modulate the outside air damper between the active minimum position and fully open and shall modulate the mixed air damper between fully open and fully closed to maintain the discharge air temperature at the active discharge air temperature setpoint. If a hardwired outdoor air temperature sensor or a communicated value is not present, economizing shall not be allowed. System must be able to accomplish economizer fault detection and diagnostics.
- G. Exhaust Air Control - The unit shall coordinate the exhaust function with the return fan and mixed air damper. The exhaust output shall be energized whenever the supply fan is on and the outdoor air damper open beyond the exhaust fan/damper enable setpoint [30%], operator configurable. The exhaust output shall remain energized until the outdoor air damper closes to below 10% (adjustable) of the exhaust damper enable setpoint and or the supply fan is turned off.
- H. Setpoints - The system shall have the following setpoints:
1. Space temperature setpoint shall be 69 Deg. F. for heating and 74 Deg. F. for cooling.
  2. Unoccupied temperatures shall be 55 Deg. F. for heating and 85 Deg. F. for cooling
  3. Freezestat setpoint shall be set at the device for 35 Deg. F.

- I. Initiation of System Shutdown - System shutdown shall be initiated:
  1. By operator entered manual command.
  2. Automatically by the EMCS base on time schedule or optimal stop.
  3. By the fire alarm system. The EMCS shall automatically set the control relay to the off state.

### **SINGLE ZONE CENTRAL STATION CONSTANT VOLUME AIR HANDLING UNIT (CHILLED WATER/HOT WATER)**

#### **GENERAL:**

The unit shall have supply fan, hot water coil, chilled water coil, modulating outside air damper, and return air damper. The supply fan shall have a variable frequency drive (VFD) for balancing and soft start purposes only. The unit will be provided with a dedicated stand-alone DDC controller to control the fan cycle, outside air damper, return air damper and modulate the chilled water valve, and hot water coil. A freeze stat shall be provided for the air handling unit that will shut down the unit whenever the supply air temperature falls below 35°F (adj.).

#### **VENTILATION:**

The outside air and return air dampers shall modulate to provide ventilation CFM to maintain CO2 level in the space. The outside air damper shall be initially set at the minimum position. The dampers shall incrementally increase/decrease to maintain CO2 levels. The EMCS shall monitor CO2 levels in the return air duct. Upon CO2 value rising above 1100 ppm, the outside air damper shall modulate open from the minimum position to maintain the CO2 level at 1100 ppm. Once CO2 values fall below set point (1100 ppm), the outside air CFM shall return to its minimum position.

#### **TEMPERATURE CONTROL:**

**Warm-up Mode:** The EMCS shall determine the required warm-up period based on the optimized start algorithm. When the unit is indexed to this mode, the unit fan shall run continuously at maximum supply air CFM, the hot water valve shall modulate to maintain the scheduled heating supply air temperature set point, the chilled water valve shall be closed to their coils, the return air damper shall be open to the return air, and the outside air damper shall be closed to the outside air. Once the space set point has been reached, the EMCS shall switch the unit in to occupied mode.

**Cool-down Mode:** The EMCS shall determine the required cool-down period based on the optimized start algorithm. When the unit is indexed to this mode, the unit fan shall run continuously at maximum supply air CFM, the chilled water valve shall modulate to maintain the scheduled cooling supply air temperature set point, the hot water valve shall be closed to their coils, the return air damper shall be open to the return air, and the outside air damper shall be closed to the outside air. Once the set point has been reached, the EMCS shall switch the unit in to occupied mode.

**Occupied Heating:** The EMCS shall index the unit to the occupied mode based on the programmed occupancy schedule. When the space temperature falls below the space temperature set point of 69°F (adj.), the DDC controller shall index the air handling unit to heating. During this mode, the unit supply air fan shall run continuously, and the hot water valve shall modulate to maintain the scheduled supply air temperature set point. The outside and return air dampers shall be positioned to their respective positions to maintain CO2 levels. Upon a rise in space temperature above the occupied heating set point, the hot water valve shall modulate closed to maintain the scheduled supply air temperature set point. Space set point shall be user adjustable within  $\pm 2^\circ\text{F}$  (adj.).



**Occupied Cooling:** The EMCS shall index the unit to the occupied mode based on the programmed occupancy schedule. When the space temperature rises above the space temperature set point of 74°F (adj.), the DDC controller shall index the air handling unit to cooling. During this mode, the unit supply air fan shall run continuously, and the chilled water valve shall modulate to maintain the scheduled supply air temperature set point. The outside and return air dampers shall index to their respective positions to maintain CO2 levels. Whenever the supply air temperature rises above the set point of 55°F (adj.), the EMCS shall modulate the chilled water valve open to the coil. As the supply temperature approaches the set point, the EMCS shall modulate the chilled water valve to maintain the supply air temperature set point. Space set point shall be user adjustable within  $\pm 2^\circ\text{F}$  (adj.).

**Unoccupied Mode:** The EMCS shall index the unit to the unoccupied mode based on the programmed occupancy schedule. During this mode, the unit outside air damper shall be fully closed and the supply fan shall cycle with the units heating and cooling modes. The DDC controller shall enable the heating or cooling as required to maintain the unoccupied heating and cooling set points of 60°F and 80°F, respectively. Upon a rise in space temperature above the unoccupied cooling set point, the supply air fan and the chilled water valve shall modulate to maintain the unoccupied space set point. On a drop in space temperature below the unoccupied heating set point, the supply air fan and hot water coil shall modulate to maintain the unoccupied space set point. The space temperature sensor shall have an override pushbutton. Whenever the override pushbutton is depressed, the unit shall operate in the occupied mode for an adjustable period of time (initially 1 hour). After the override time period has expired, the unit shall revert back to the unoccupied mode.

**Economizer Cycle:** The EMCS shall index the unit to economizer mode whenever the outside air dry bulb temperature is between 50°F and 60°F (adj.). The EMCS shall modulate the outside air damper fully open and the return air damper fully closed. The fan speed shall modulate to maintain the space temperature set point. System must be able to accomplish economizer fault detection and diagnostics. Upon a rise in space

temperature above space set point, the unit shall index to occupied cooling. Upon a drop in space temperature below space set point, the unit shall index to occupied heating.

**Freeze Protection:** Upon the outside air temperature dropping below an adjustable set point, the EMCS shall close the unit's outside air damper and the chilled water valve shall open to 30%.

## **MULTI-ZONE AIR HANDLING UNITS**

- Space temperature – AI
  - Space humidity – AI
  - Discharge air temperature – AI
  - Pre-heat/cool discharge air temperature – AI
  - Air handler fan status – current switch – DI
  - Chilled water valve – AO
  - DX Cooling – As noted only DO
  - Pre-Cooled chilled water valve – AO
  - Pre-heat hot water valve – AO
  - Hot water valve – AO
  - Air handling unit fan start/stop – DO
  - Exhaust fan start/stop – DO
  - Outdoor air damper - AO
- A. Each zone shall be controlled by a space temperature sensor through a dedicated DDC controller, which shall modulate its zone mixing damper to maintain set point.
  - B. Provide discharge temperature data on every supply or discharge to zones for multi-zone units after reheat coil.
  - C. Temperature Control:

**Cold Deck Reset:** Monitor the zone damper positions. When the highest damper position is above 95%, then the cold deck setpoint will be 55 degrees. When the highest damper is below 65% then the cold deck setpoint will be 58 degrees. When the high damper position is between 65-95% then the cold deck setpoint will modulate between 55 and 58 degrees.

**Hot Deck Reset:** Monitor the zone damper positions. When the lowest damper position is below 5% then the hot deck setpoint will be 100 degrees (high value). When the lowest damper position is above 35% then the hot deck setpoint will be 69 degrees (low value). In order to prevent room overheating based on one damper position, the average zone temperature will be monitored for the air handler. When the average zone temperature is above 72 degrees (adj.), then the hot deck setpoint (high value) will be lowered by 10 degrees.

Chilled Water valve shall be modulated to satisfy cold deck supply air temperature set point (55°F adj.). Heating Coil valve shall be similarly controlled to satisfy hot deck temperature set point (110°F adj.) and shall also include automatic reset control inversely proportional to outside air temperature.

**D. Supply Fan Control:**

As an energy saving mechanism, once all zone dampers are between 50% terminal load (adj.) and -50% terminal load (adj.), the supply fan VFD shall modulate down by 5 Hz (adj.). If after 5 minutes (adj.) all terminal loads are still between 50% and -50%, the VFD shall modulate down by an additional 5 Hz. If after 5 minutes, one zone damper rises above 50% or -50%, the VFD shall modulate up to its previous state.

**Supply Fan Reset:** Determine average zone damper position. Based on that position, the supply fan speed shall be set as follows.

Average Zone Damper Position	Supply Fan Speed
>80%	100%
Between 80% and 70%	Modulate between 100% and 50%
Between 70% and 30%	50%
Between 30% and 20%	Modulate between 50% and 100%
<20%	100%

**E. Outside Air Damper:**

During occupied mode, ventilation outside air dampers shall open to minimum scheduled ventilation position upon system operation, and shall close upon system turning off. Damper shall not open based on low outside air temperatures.

A return air CO2 sensor shall modulate the outside air damper to maintain CO2 set point of 700 ppm. Outside air dampers shall remain closed during unoccupied, setback, and preconditioning modes.

**F. Economizer Cycle:**

Unit to provide 100 percent cooling capacity required when O/A enthalpy is below 20 BTU/lb. for one hour. The EMCS shall modulate the outside air damper and return air damper(s) to maintain supply air temperature at set point between 55° F and 70° F (adjustable) depending on the space temperature deviation from space temperature set point. When the outside air damper position closes to minimum outside air to maintain CO<sub>2</sub>, the outside air damper shall not close any further. System must be able to accomplish economizer fault detection and diagnostics.

#### D. Outside Air Damper Position:

The outside air damper will be closed whenever the outside air temperature is below 35 degrees.

The outside air damper should modulate between its minimum position and maximum position based on the return air CO<sub>2</sub> sensor. When the carbon dioxide level is above 1100ppm, then the outside air

damper shall modulate to its maximum position. When the carbon dioxide level is below 1000ppm, the outside air damper shall modulate to its minimum position. If the carbon dioxide level is between 1000 and 1200ppm, the damper shall modulate between its minimum and maximum positions.

### **4 PIPE CHILLED WATER/ HOT WATER FAN COIL UNITS**

- Space temperature – AI
- FCU fan status – current switch - DI
- Chilled water valve - AO
- Fan Coil unit fan start/stop - DO
- Discharge air temperature – AI
- Space occupancy sensor - DI Zone Occupancy

#### GENERAL:

Each fan coil unit shall be provided with a cooling section, heating section, supply fan section, control board, and an outside air damper. The space temperature sensor shall be provided with a local override button. The EMCS contractor shall provide a dedicated stand-alone DDC controller for each unit. The occupied/ unoccupied mode of operation shall be defined by the EMCS optimum start/ stop schedule.

Each unit shall be started and stopped by the EMCS. Each unit will be equipped with a sensor located in the supply air plenum to monitor the supply air temperature. Each unit shall be provided with a current sensing relay to monitor fan status.

#### FAN CONTROL:

Fan speed shall be controlled by the fan coil unit, based on its internal controls. The fan shall run in low speed during first stage of heating/ cooling, and high speed during second stage of heating/ cooling.

#### OUTSIDE AIR CONTROL:

During unoccupied operation, the outside air damper shall be fully closed.

During occupied mode, the outside air damper shall be closed when the outside air temperature is below 34°F (adj.).

During occupied operation, the outside air damper shall be set to its outside air position (reference scheduled CFM).

#### TEMPERATURE CONTROL:

Unoccupied Mode: In the unoccupied mode of operation, the unit outside air damper shall be fully closed and the unit fan shall cycle with a call for heating or cooling. The DDC controller shall enable the heating or

cooling as required to maintain the unoccupied heating and cooling setpoints (initially 55°F heating and 82°F cooling) as sensed by the space temperature sensor. Upon a rise in space temperature above the unoccupied cooling setpoint, the DDC controller shall enable the mechanical cooling. On a drop in space temperature below the unoccupied heating setpoint, the DDC controller shall enable the heating. The controller shall modulate the chilled water or hot water valve as required to maintain space temperature

The space temperature sensor shall have an override pushbutton. Whenever the override pushbutton is depressed, the unit shall be indexed to the occupied mode for an adjustable period of time (initially 1 hour). After the override time period has expired, the unit shall revert back to the unoccupied mode.

**Occupied Mode:** In the occupied mode of operation, the unit supply fan shall cycle with a call for heating or cooling. The DDC controller shall modulate the chilled water or hot water valve as required to maintain the occupied heating and cooling setpoints (initially 69°F heating, 74°F cooling) as sensed by a space temperature sensor with digital display and pushbutton override. Space set point shall be user adjustable within  $\pm 2^\circ\text{F}$  (adj.). On a rise in space temperature above the occupied cooling setpoint, the DDC controller shall modulate the chilled water valve open. On a drop in space temperature below the occupied cooling setpoint, the reverse shall occur. On a further drop in space temperature below the occupied heating setpoint, the DDC controller shall modulate the hot water valve open. On a rise in space temperature above the heating setpoint, the reverse shall occur.

**Economizer Mode:** In unoccupied or occupied mode, anytime there is a call for cooling in the space, and the outside air temperature is 55°F (adj.) or below, the unit's economizer mode is to provide free cooling to the space until the space is satisfied. System must be able to accomplish economizer fault detection and diagnostics.

#### **DECOUPLED, DEDICATED OUTSIDE AIR UNIT**

- Supply air temperature – AI
- Preheat air temperature – AI
- Air handling unit fan status – current switch - DI
- Freeze alarm – freeze stat mounted upstream of CHW coil - DI
- CHW valve control - AO
- HW preheat valve control - AO
- Fan speed control – AO
- Outdoor air damper – DO
- Outdoor air handling unit start/stop - DO
- Leaving air temperature - AI

#### **GENERAL:**

The decoupled, dedicated outside air unit shall have a cooling section, heating section, supply fan section, integral control board, and an outside air damper provided by the unit manufacturer. The remote condensing unit shall also be provided by the unit manufacturer. The unit manufacturer shall provide an outdoor air temperature and humidity sensor and shall configure them to be the mode enable sensors during occupied mode. The temperature and humidity at these sensors shall determine whether the unit is in heating, cooling, or dehumidification. The EMCS contractor shall monitor occupied/ unoccupied operation, supply fan status, compressor status, supply air temperature, and outside air temperature and relative humidity.

#### **FAN CONTROL:**

Fan speed shall be controlled by the outside air units internal controls. During occupied operation, the fan shall be enabled. During unoccupied operation, the fan is to remain disabled.

#### **TEMPERATURE CONTROL:**

Unoccupied Operation:

The outside air unit supply fan shall remain off during unoccupied mode. The outside air damper shall remain fully closed.

#### Occupied Cooling Operation:

The outside air units cooling mode is enabled when the outside air temperature rises one deadband above the cooling set point (initially 74°F adj.) and the outdoor air relative humidity is below 55% (adj.). Cooling is disabled when the outside air temperature falls one deadband below the cooling set point. Set points and deadbands are user adjustable. In the cooling mode, as supply air temperature rises above the supply air cooling setpoint, the compressors shall stage on and modulate to control the supply air temperature. If additional cooling is required, the units compressors shall stage to maintain the cooling supply air setpoint (74°F adj.).

#### Occupied Heating Operation:

The outside air units heating mode is enabled when the outside air temperature falls one dead band below the heating set point (initially 68°F adj.) and the outside air relative humidity is below 55% (adj.). Heating is disabled when the outside air temperature rises one deadband above the heating set point. Set points and deadbands are user adjustable. In the heating mode, as the supply air temperature falls below the supply air heating set point, the heat pump reversing valve shall activate and heating shall modulate to maintain the supply air heating setpoint (68°F adj.). If the supply air temperature is not maintained during heat pump operation, the unit shall stage the backup electric heat in order to maintain supply air heating set point.

#### Occupied Dehumidification Operation:

The outside air units dehumidification mode is enabled when the outside temperature rises one deadband above the cooling set point (initially 74°F adj.) and the outside air relative humidity is above 55% (adj.). Once in dehumidification mode, the units compressors shall stage on/ off and modulate to maintain the evaporator coil suction temperature set point. A coil suction pressure sensor shall be provided by the unit manufacturer. The supply air shall then be reheated to the neutral supply air temperature set point (initially 72°F adj.). Reheat shall be accomplished through modulating hot gas reheat.

#### Occupied Ventilation Operation:

The outside air units ventilation mode is enabled any time there is no demand for heating or cooling. This initially occurs when the outside air temperature is between 68°F and 74°F, and the outside air relative humidity is below 55% (adj.). All temperature and humidity set points shall be user adjustable. System must be able to accomplish economizer fault detection and diagnostics.

### COOLING TOWER CONTROL

- Tower CW supply temperature - AI
- Tower CW return temperature - AI
- Tower Fan status, each fan - DI
- Vibration alarm, each fan - DI
- Tower Fan start/stop, each fan – DO
- Tower ISO valves, each tower - DO
- Tower Fan speed, each fan - AO
- CW Bypass Valve control – AO
- CW pump start/stop
- CW pump status

#### Cooling Tower Activation

A cooling tower cell shall be activated by opening the tower ISO valves. The operator shall have the option of maintaining the lead towers ISO valves open at all times. The towers shall be lead-lag alternated weekly by the BAS based upon accumulative runtime.

#### Condenser Water Temperature Control

The condenser water supply temperature shall be maintained by modulating the cooling tower dump valve, staging on/off the tower fans and modulating the tower fan speed on the active towers to maintain set point. The operator shall have the option of maintaining a fixed set point of 85 degrees F (operator adjustable) or resetting the set point based on the outdoor air wet- bulb temperature. The reset set point shall be 6 degrees F (adjustable) above the outdoor air wet-bulb temperature down to a minimum of 65 degrees F (operator adjustable) and a maximum of 85 degrees F (operator adjustable).

If the condenser water supply temperature is below set point, the dump valve shall be modulated open to the cooling tower basin. As the condenser water supply temperature rises, a PID control loop shall modulate the dump valve closed forcing the water over the top of the active tower. If the condenser water temperature rises 2 degrees F (adjustable) above set point, the B.A.S. start the lead cooling tower fan. A current switch shall prove status to the B.A.S. and shall alarm at the central site if the switch is not made within 20 seconds (adjustable). There shall also be a 5 second (adjustable) de-bounce time to prevent nuisance alarms from a bouncing switch. The B.A.S. shall monitor a vibration switch mounted at each tower; the B.A.S. shall cancel the run request to that tower, automatically enable the remaining tower and alarm the central site if the vibration switch detects a fault. The B.A.S. shall modulate the cooling tower fan speed from 20 Hz (adjustable) to 60 Hz (adjustable) to maintain the condenser water supply temperature at set point. If the condenser water temperature continues to rise and more than one tower is enabled the lag tower fan shall be energized and controlled in the above manner.

#### Freeze Protection

When the outdoor air temperature drops to 34°F (adjustable) or below, the BAS shall open the cooling tower bypass valves for flow for freeze protection and the pump system shall be activated to run until the low ambient temperature ceases to exist.

### **PRIMARY/SECONDARY CHILLED WATER SYSTEM**

- Building CHW supply temperature - AI
- Building CHW return temperature - AI
- Building CHW differential pressure - AI
- Decouple Loop temperature - AI
- Chiller amps/status, each chiller -AI
- Chiller CHW supply temperature, each chiller- AI
- Chiller alarm, each chiller - DI
- CHW pump status, each pump - DI
- CW pump status, each pump - DI
- SCHW pump status, each pump - DI
- Chiller start/stop, each chiller - DO
- SCHW pump start/stop, each pump – DO
- SCHW pump speed control - AO Chilled Water System Activation

### **CHILLED WATER COOLING SYSTEM:**

#### General:

The chilled water cooling system shall be provided, as specified elsewhere. Each chiller will have a dedicated primary water pump. After initial startup is accomplished, the system will be allowed to operate on a continuous basis. The EMCS shall energize the chiller(s) and the corresponding primary water pump(s) as required by the building load. Building water temperature setpoint shall be 43°F(adj.)

### **CHILLERS:**

#### General:

The chillers will function in unison to meet building load. There will be an automatic isolation valve on the inlet of each chiller. Each valve should be non-spring, fail-in-place and send an alarm to the operator's workstation.

The energy management control system (EMCS) shall monitor and control the system supply water temperature setpoint.

The EMCS shall also provide a chilled water temperature setpoint to each chiller via a 0-10 VDC input signal.

The EMCS shall monitor the run load amperes (RLA) of each chiller and total operating amperage.

The EMCS shall monitor the number of machines operating.

The EMCS shall monitor the building supply and return temperature, bypass temperature, chiller supply and return temperature.

The mechanical contractor shall install two (2) venturi type flow meters with an accuracy of +/- 5% of full scale. One flow meter shall be installed in the primary loop and one meter in the secondary loop. The flow meters shall be furnished by the EMCS contractor. The EMCS contractor shall calculate the actual building load (tons) with the flow meter and the temperature difference in each loop and display this in the graphics of the central plant.

The primary chilled water pump for each chiller shall be controlled by the chiller control panel (UCP)

#### Chiller Sequencing:

##### Loading:

When the building water temperature is 2° F above setpoint for 15 minutes the first chiller in the sequence shall be started. The chiller control panel shall start the primary chilled water pump. The chiller control panel safety controls shall remain in effect. The chiller shall load and unload according to the algorithms of the chiller control panel. If after fifteen (15) minutes (adjustable), the building supply water temperature does not drop below the setpoint, the next chiller in sequence shall be started. The building supply water temperature shall remain 2° F above the supply water temperature setpoint for a continuous fifteen (15) minutes, before the next chiller in sequence can be started. Subsequent chillers will be enabled in the same manner, regardless of quantity.

##### Unloading:

Chillers shall be stopped using the following concept. If one or more chillers are operating and building supply water temperature is 1° F below setpoint or more, the last on chiller shall be first off, based on the operating amperage being 90% of the total number of chillers minus one. For example, if supply water temperature is 42° F and if there are two (2) chillers operating, the last on chiller will be disabled when the total amperage being monitored is equal to  $(\# \text{ of chillers } (2) - 1) \times 0.90 \times \text{RLA (each machine)}$ . Assume an RLA of each chiller at 100 A and 2 chillers operating. The last on machine will be disabled when amperage is below  $(2-1) \times 0.9 \times 100 = 90 \text{ A}$ . Additionally, when the current measured drops below that calculated from the above algorithm, a timer will start. If the current measured continues to be below the calculated value outlined, for a period of fifteen (15) minutes (adjustable) the chiller and its corresponding pump shall be stopped. When only one machine is operating, it shall be allowed to operate on its own temperature controller.

##### Chiller Start Up:

When a chiller is called to be started, the isolation valve will be opened and the chiller will start its primary pump. The chiller will then be started upon proving flow.

##### Chiller Shut Down:

When a chiller is called to be stopped, the EMCS will stop the chiller after confirmation that all compressors have shut down and close the chiller's isolation valve.

#### Failure Recovery:

Upon sensing a chiller failure the chiller sequencing software shall lockout that chiller and pump and immediately initiate the start of the next chiller in the rotation sequence and send an alarm to the

operator's workstation.

#### Chiller Status Report:



Provide an operating status report for each chiller. The report(s) shall provide the present status of all binary information and for analog information present value, today's average, and the month to date average for the following information to provide the operator with critical chiller operating data.

Compressor On/Off Status.  
 Compressor Starts/Run Hours  
 Active Chiller Diagnostics or Alarms  
 Leaving Chilled Water Temperature  
 Entering Chilled Water Temperature  
 Chilled Water Setpoint.  
 Operating Mode  
 Chiller Model and Serial Number  
 Outside Air Temperature

#### TEMPERATURE CONTROL:

The chiller supply water control shall be performed by the chiller manufacturer's control panel (UCP). The EMCS shall start/stop the chiller through the UCP using a remote signal. The EMCS shall reset the UCP supply water setpoint by an external signal using either milliamperes or voltage. The UCP shall be provided with the external start/stop and reset options by the chiller manufacturer. The UCP shall be provided with all safeties to assure the manufacturer's warranty requirements are met. The UCP shall additionally be provided with a common alarm contact closure for the EMCS "chiller alarm" interface.

#### CHILLED WATER PUMPING SYSTEM:

The secondary pump and primary pumps shall run on a continuous basis and be controlled as specified. The secondary pumping system shall be controlled by a variable speed drive (VFD). The EMCS contractor shall supply a VFD for each chilled water secondary pump and assure complete compatibility between the EMCS and VFD. The EMCS shall increase or decrease the pump speed based on the differential pressure setpoint between the supply and return for each of the systems. Sensor to be located on plans or located by engineer.

#### SYSTEM START UP SEQUENCE FROM SHUT DOWN:

##### Cooling Mode:

The EMCS shall enable first chiller and its primary pump. When primary water temperature reaches 45 degree the EMCS shall enable the secondary chilled water pump. The EMCS shall enable one fourth (25%) of the buildings 2-way valve load. Upon enabling a units 2-way control valve, the associated TCS of the unit shall be set to control at normal occupied load. Once one-fourth of the building load is enabled, enable the first chiller and its associated primary pump. Allow the chiller to cycle per normal schedule. After fifteen minutes, enable an additional one fourth (50%) of the 2-way valve load. After thirty minutes, enable an additional one fourth (75%) of the 2-way valve load. After forty-five minutes, enable the final one fourth (100%) of the 2-way valve load. Once this system is complete, the building will be functioning in normal occupied mode.

##### Freeze Protection

When the outdoor air temperature drops to 34°F (adjustable) or below, the BAS shall open the chilled water valves for flow through the coils for freeze protection and the secondary chilled water pump system shall be activated to run until the low ambient temperature ceases to exist.

#### **SEQUENCE OF OPERATION - HOT WATER SYSTEM**

- Building HW supply temperature - AI
- Building HW return temperature - AI
- Boiler HW supply temperature, each boiler – AI
- HW pump status – current switch, each pump - DI
- Boiler status – dry contacts, each boiler- DI
- Boiler enable, each boiler - DO
- HW Pump enable, each pump - DO Heating Water System Activation

- A. System Off - When the system is off:
1. The hot water pumps shall be off.
  2. The boiler units shall be disabled.
  3. All control loops shall be disabled.
- B. Initiation of System Start-Up - The system shall be started:
1. By an operator manually entered command at the EMCS.
  2. Automatically when there is a requirement for the hot water at any of the AHUs after an operator defined time delay.
- C. System Operation - When system start-up has been initiated, the following sequences shall be implemented:
1. The EMCS shall enable the hot water system through boiler sequencer. Sequencer shall stage boilers as needed.
  2. The lead boiler and boiler feed pump and lead heating water pump shall be enabled and the boiler unit shall start under control of the unit mounted control panel.
  3. The lead heating water pump shall be modulated by its VFD to maintain the pressure setpoint at the location of the most remote heating load. The lag pump shall be enabled as required to satisfy the pressure setpoint. When both pumps are enabled, the pumps shall be modulated by their VFD to operate at the same speed and satisfy the pressure setpoint.
  4. As required to meet the heating load, the lag boilers and boiler feed pumps shall be automatically enabled and the boilers shall start under control of the unit mounted control panel.
  5. All boilers and heating water pumps shall be rotated as lead and lag to equalize the run time of the equipment.
  6. Boilers and heating water pumps shall be automatically disabled in reverse of the enable sequence as dictated by heating system load requirements.
  7. Sequencer shall provide a linear setpoint reset schedule based on outside air temperature in accordance with the following:

	40°F. OAT	70°F. OAT
Hot water supply temperature setpoint	180°F	130°F.

8. Setpoints - The setpoints for the system shall be determined as follows:
  - a. The hot water supply temperature setpoint shall be initially set to 180°F.
9. Initiation of System Shutdown - System shutdown shall be initiated:
  - a. By operator entered manual command.
  - b. Automatically by the EMCS based on a time schedule basis.
10. Alarms - The EMCS shall generate an alarm:
  - a. If a boiler is operating without an associate pump operating and vice versa.
  - b. If the hot water supply temperature is outside the operator established low and high alarm limits, which shall be initially set at + of - 3 deg F around the current set point.
11. Failure positions - When a EMCS component failure occurs:
  - a. Pump shall remain at the last commanded state.
  - b. Boiler shall remain at the last commanded state.

If any operating pump or boiler fails, the units shall be disabled and the standby pumps and/or boilers shall operate without any time delays.

#### Freeze Protection

When the outdoor air temperature drops to 34°F (adjustable) or below, the BAS shall open the hot water valves for flow through the coils for freeze protection.

### **EXHAUST FANS**

- Fan start/stop – DO
- Fan status – DI

Interlock exhaust fans to run with AHU's serving the same area and run when the AHU's are operating in the occupied mode with their OA Dampers open. The exhaust fans shall remain off even during the scheduled occupancy time based on a global command from a shelter in place (building shutdown) button or based on a summer mode schedule.

Fans controlled by local thermostat shall be monitored.

### **OUTDOOR AIR CONDITIONS**

- Outdoor air temperature – AI
- Outdoor air humidity – AI

The sensors shall be mounted in an area on the North side of the building where the representative temperature and humidity can be monitored, both shall have sun shields. Based on the outside air temperature and humidity the B.A.S. shall calculate the outdoor enthalpy, wet bulb, and dew point temperatures. The outdoor air temperature and humidity shall be broadcast as global information for use by the other control programs.

### **TIMED LOCAL OVERRIDE**

- TLO momentary input - DI

A momentary push button switch shall be located in the principal's office and shall activate the HVAC system (user defined equipment). Each time the momentary button is pushed the assigned equipment will be energized for one hour (adjustable), up to a maximum of four hours (adjustable). If the switch is pushed continuously for seven seconds (adjustable), the override will be canceled.

### **IDF and MDF ROOMS**

- Space temperature – AI

Unit needs a VERTIV communications system that is connected to the data network for remote maintenance and monitor the space temperature in the MDF and IDF rooms.

### **UNIT HEATER**

- Space temperature - AI
- UH start/stop and hot water valve open/close - DO

A space temperature sensor shall monitor the air temperature in the space. If the space temperature falls below 60 degrees F (operator adjustable) the Unit Heater fan shall be energized and the hot water valve shall be opened. The fan shall continue to run with the hot water valve open until the space temperature rises by 4 degrees F (operator adjustable).

### **KITCHEN HOOD EXHAUST AND SUPPLY FANS**

- Fan start/stop – DO
- Fan status – DI

Enable fans through scheduling. Fans will be controlled through local switches but will be enabled through scheduling to allow fan shut down remotely if left operational after staff leaves. The exhaust fans shall remain off even during the scheduled occupancy time based on a global command from a shelter in place (building shutdown) button.

Must be interlocked with fire alarm and fire suppression systems.

### **SINGLE ZONE DX/ GAS, 2 STAGE COMPRESSOR RTU WITH HOT GAS REHEAT AND CO<sub>2</sub>**

- Space temperature – AI
- Discharge air temperature – AI
- Return air temperature - AI
- RTU fan status – current switch - DI
- DX Cooling – Multiple stages as necessary- DO
- Heating – multiple stages as necessary - DO
- RTU fan start/stop - DO
- Exhaust fan start/stop - DO
- Outdoor air damper – AO
- Return Air CO<sub>2</sub> - AI

#### **GENERAL:**

Each rooftop unit shall be provided with a cooling section, heating section, supply fan section, microprocessor control board and an outside air damper by the unit manufacturer. The unit manufacturer shall provide a 0-100% modulating outside air damper with spring return. The unit manufacturer shall provide a 0-100% actuator. The temperature control system contractor shall provide CO<sub>2</sub>, temperature and humidity sensors. The space temperature sensor shall be provided with a local override button. The space carbon dioxide sensor shall be provided with a digital display covered with a blank faceplate. The temperature control system contractor shall provide a dedicated stand-alone DDC controller for each unit. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.

#### **FAN CONTROL:**

Fan speed shall be controlled by the RTU, based on its internal controls. The RTU fan shall run in low speed during first stage heating or cooling and high speed during second stage heating or cooling.

#### **OUTSIDE AIR CONTROL:**

During unoccupied operation, the CO<sub>2</sub> controls will be disabled and the outside air damper shall be fully closed.

During occupied mode, the outside air damper shall be closed when the outside air temperature is below 20°F (adj.).

During occupied operation, the outside air damper shall be set to its minimum position (reference scheduled CFM). The EMCS shall monitor the CO<sub>2</sub> level in the space and verify the level of CO<sub>2</sub> is below setpoint of 1100 ppm. Upon a rise in CO<sub>2</sub> above setpoint of 1100 ppm, the outside air damper shall modulate open from the minimum position to return the CO<sub>2</sub> level below 1100 ppm. A linear progression shall be set so that at a CO<sub>2</sub> level of 1190 ppm, the outside air damper shall modulate open to the maximum set position (e.g. maximum scheduled value of outside air CFM). An algorithm shall be set so that the outside air CFM follows a linear trend between maximum and minimum CFM for values between 1100 ppm and 1190 ppm. The outside air damper shall never open more than the schedule maximum outside air for the respective mode. Once the CO<sub>2</sub> value falls below setpoint of 1100 ppm, the outside air damper shall modulate to its minimum position.

#### **TEMPERATURE CONTROL:**

**Warm-up:** The EMCS shall determine the required warm-up period based on the optimized start algorithm. In this mode, the outside air damper shall be fully closed and the EMCS will control the unit to reach occupied heating setpoint of 69°F (adjustable). Once the occupied heating setpoint temperature has been reached, the EMCS shall switch the unit to the occupied mode.

**Cool-down:** The EMCS shall determine the required cool-down period based on the optimized start algorithm. In this mode, the outside air damper shall be fully closed and the EMCS will control the unit to reach occupied cooling setpoint temperature of 74°F (adjustable). Once the occupied cooling setpoint temperature has been reached, the EMCS shall switch the unit to the occupied mode.

**Dehumidification Mode:** When the space temperature set point is satisfied, and the relative humidity in the space is above 58% (adj.) the unit shall operate in dehumidification mode. The unit's compressor(s) and fan shall operate, and the hot gas valve shall open. Dehumidification mode shall be energized by the unit's internal controller.

**Unoccupied Mode:** In the unoccupied mode of operation, the unit outside air damper shall be fully closed and the supply fan shall cycle with the unit's heating and cooling modes. The DDC controller shall enable the heating or cooling as required to maintain the unoccupied heating and cooling setpoints (initially 55°F heating and 82°F cooling) as sensed by the space temperature sensor. Upon a rise in space temperature above the unoccupied cooling setpoint, the DDC controller shall enable the mechanical cooling. On a drop in space temperature below the unoccupied heating setpoint, the DDC controller shall enable the gas heating. If the relative humidity rises above set point (initially 58%), then the unit shall energize the dehumidification mode until the relative humidity is lowered to 56% (adj.).

The space temperature sensor shall have an override pushbutton. Whenever the override pushbutton is depressed, the unit shall be indexed to the occupied mode for an adjustable period of time (initially 1 hour). After the override time period has expired, the unit shall revert back to the unoccupied mode.

**Occupied Mode:** In the occupied mode of operation, the unit supply fan shall cycle with a call for heating or cooling. The DDC controller shall energize the heating and cooling as required to maintain the occupied heating and cooling setpoints (initially 69°F heating, 74°F cooling) as sensed by a space temperature sensor with digital display and pushbutton override. Space set point shall be user adjustable within ±2°F (adj.). On a rise in space temperature above the occupied cooling setpoint, the DDC controller shall energize the first stage of mechanical cooling. Upon a further rise in space temperature of 2°F (adj.) above the occupied cooling setpoint, the DDC controller shall energize the second stage of mechanical cooling. On a drop in space temperature below the occupied cooling setpoint, the reverse shall occur. On a further drop in space temperature below the occupied heating setpoint, the DDC controller shall energize the first stage of gas heating. Upon a further drop in space temperature below the occupied heating setpoint, the DDC controller shall energize the second stage of gas heating. On a rise in space temperature above the heating setpoint, the reverse shall occur. If the space relative humidity rises above set point (initially 58%), and the space temperature is satisfied, then the unit shall energize its dehumidification mode until the relative humidity is 55% (adj.).

**Dry Bulb Economizer Mode:** In unoccupied or occupied mode, anytime there is a call for cooling in the space, and the outside air temperature is 65°F (adj.) or below, the unit's economizer mode is to provide free cooling to the space until the space is satisfied. For the larger units equipped with a power exhaust, the power exhaust is to be enabled any time the unit is in economizer mode. The power exhaust is to only be enabled during economizer mode. System must be able to accomplish economizer fault detection and diagnostics.

## **END OF DIVISION 25**

## Division 26

# Electrical Systems

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### DIVISION 26 – ELECTRICAL SYSTEMS

#### 26 00 00 - General Requirements for Electrical

- 1.0 Provide surge and phase loss protection on the main service and for all variable frequency drives and chillers.
- 2.0 Provide conduit and cabling for connection of fire sprinkler vaults to fire alarm system.
- 3.0 Avoid aerial secondary service to the building; coordinate with FBISD Design Manager.
- 4.0 Locate transformer in as inconspicuous a location as possible.
- 5.0 Coordinate electrical service with CenterPoint for service size, pad mount location and service routing information. Locate service pad mount as close to building as possible to limit distance of secondary conductors to switchgear.
- 6.0 Comply with all applicable codes, AHJ, ADA/TAS including Texas Energy Code.
- 7.0 Coordinate specific electrical requirements for all equipment scheduled to be installed for CATE shop areas.
- 8.0 Coordinate power locations with all A/V equipment on project such as projectors and wall mounted

displays.

- 9.0 Provide lockable disconnect switch for car power and main power service at all elevators.
- 10.0 Provide electrical power in elevator pit for sump pump, including audio/visual devices and service lighting.
- 11.0 Provide electrical room layouts at 50% CD for review.
- 12.0 All electrical work dealing with electrical circuits or power requirements of 120V or higher shall be installed by licensed journeyman electricians.
- 13.0 For all main switchgear, provide 25% spare capacity (service size and physical size of equipment/breakers) for future growth / expansion. All downstream panels and transformers shall be sized to allow for 10% growth and expansion both in amperage and physical breakerspaces.
- 14.0 Electrical power drawings shall be coordinated with the project technology consultant to show power and conduit requirements to accommodate technology and low voltage systems.

## **26 01 00 – Operation and Maintenance of Electrical Systems**

- 1.0 Provide training/demonstration for minimum of 6 hours with video recording. Demonstration to include:
  - 1.1. Maintenance of equipment
  - 1.2. Locations of equipment
  - 1.3. Locations of in-ground junction boxes
  - 1.4. Underground conduit
  - 1.5. Lighting controls
  - 1.6. Occupancy sensors
  - 1.7. Generator
  - 1.8. Specialized or unique equipment

## **26 05 09 – Electrical Service Requirements**

- 1.0 Utility poles and service entrance ductbank locations shall be staked and surveyed prior to pole installation by contractor. Contractor to verify by survey that the pole and service entrance ductbank location and easements don't interfere with existing easements, right of ways or other restricted properties.
- 2.0 Contractor shall initiate contact with the power provider (retail seller), utility (transmission and distribution) and owner within 14 days of Notice to Proceed to ensure permanent power will be available to the site. Any delays resulting from the lack of coordination shall be the responsibility of the contractor.

## **26 05 43 - Underground Ducts and Raceways**

- 1.0 Use locator tape 12" above conduits for all conduit outside slab area.
- 2.0 Provide three (3) 4" conduits to MDF from street utility easement. Coordinate with local telecom utility for exact location at street easement to route conduit. All telecom conduits shall be installed at 48" below surface for entire run. Provide locator wire and warning tape. Concrete cover not required. Stub up at wall in building MDF room behind telecom racks.
- 3.0 For conduits located underground to be used in the future, provide a concrete marker 12"x12" directly above termination point.
- 4.0 Provide one (1) 3" conduit from main electrical room to future portable building locations.



- 5.0 Provide two (2) 2" conduits from MDF to future portable building locations. Provide tracer wire in conduits for full length of run.
- 6.0 Do not route branch circuiting under slab unless to floor boxes, half walls or casework islands.
- 7.0 Install primary electrical service conduit in red concrete encasement.

### 26 05 33 - Raceways and Boxes

- 1.0 Acceptable manufacturers for floor boxes are **Hubbell, Wiremold or FSR**. Cast iron for all first floor slab applications. Floor boxes shall be multi-gang recessed style with flip top cover. No cast metal fittings.
- 2.0 All floor boxes to be recessed and to have flush-mounted brass or stainless steel cover. (Kitchen and other wet area are the exception.)
- 3.0 For kitchen and wet areas provide tombstone outlet installed above floor surface area. Do not install floor boxes in wet areas such as kitchen, locker rooms or training rooms.
- 4.0 All disconnects, panel covers and starters in kitchen areas and adjacent to cooling towers shall be stainless steel.
- 5.0 MC cable is not the standard for FBISD. MC cabling is only acceptable for light fixture whips no greater than 6' in length.
- 6.0 All exterior conduit shall be rigid galvanized.

### 26 05 53 - Identification of Electrical Systems

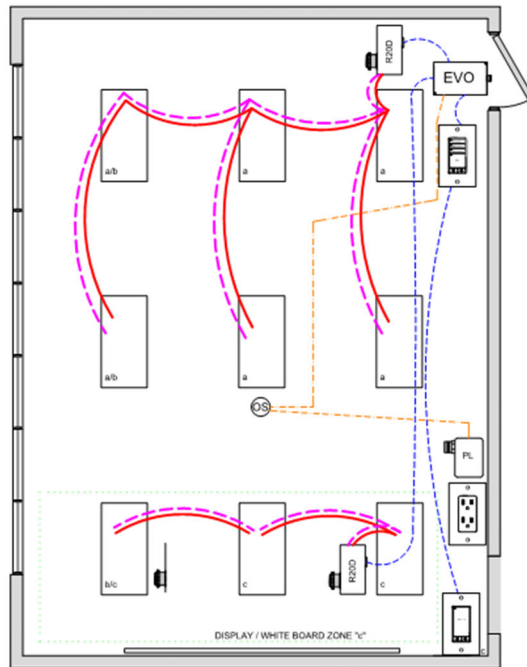
- 1.0 Identify all equipment and circuit breakers.
- 2.0 Identify all J-box covers with panel and circuit numbers.
- 3.0 On front of all device wall plates, indicate panel and circuit number feeding the device.
- 4.0 All electrical panels shall have type written panel schedules with room descriptions using actual room signage numbers, not the numbers on architect's drawings.
- 5.0 Electrical systems shall be identified by painted junction boxes and covers with the following scheme:
  - 5.1. Lighting system: Yellow
  - 5.2. Emergency power system: Red
  - 5.3. 120 power system: Blue
  - 5.4. HVAC system power: Green
  - 5.5 Panel and circuit number must be readable on junction box cover at the completion of the project.
- 6.0 Electrical panel identification shall include the following:
  - 6.1. Panel Name
  - 6.2. Voltage
  - 6.3. Amperage
  - 6.4. General description such as: "Lighting Area B" or "Power AreaC"
  - 6.5. Appropriately colored for emergency.
  - 6.6. Feeder panel designation must be clearly identified.
  - 6.7. Labels on electrical panels and equipment must be engraved lamacoid style labels, black

background with white lettering. All emergency panels shall have a red background with white lettering.

## 26 09 00 - Lighting Control Systems

- 1.0 Acceptable Manufacturers: **Intelligent Lighting Controls (ILC), Cooper, Acuity or Lutron.**
- 2.0 For each FBISD project that includes lighting controls, a "Lighting Control" meeting shall be held prior to 50% CD.
- 3.0 All lighting control systems shall be a complete wired solution, no wireless solutions or battery operated devices are allowed for any component of the lighting control system.
- 4.0 All lighting control systems shall be setup to control lighting local to that room/space only. No networked systems are allowed.
- 5.0 Provide 5-year warranty on all components of lighting control system.
- 6.0 Provide generator transfer device (GTD) on all fixture designated as emergency egress fixtures to allow local switch control.
- 7.0 Light fixtures located above fire alarm annunciator panel and intrusion detection keypads shall be 100% on at all times.
- 8.0 Keyed override switches shall have full size key cylinders that can utilize district standard key way locks. Coordinate with FBISD Design Manager for key way type.
- 9.0 Spaces with clerestory or full height windows shall design daylight harvesting sequences into overall lighting control system.
- 10.0 Common areas such as corridors, cafeteria, kitchen, gymnasiums and library shall be controlled via local on/off switch and connected to magnetically held contactors with interface to building automation system.
  - 10.1 Local switch control in cafeteria and library shall be capable of dimming. Dimming shall also be provided in areas where projection systems are installed such as cafeteriums or large group instruction areas.
  - 10.2 For corridors designed under ASHRAE 90.1, from the hours of 7 am to 4 pm, all corridor lighting to be "on" for every fixture. All remaining hours, every other fixture in the corridor shall be controlled via contactor with BAS scheduling. Remaining fixtures to be controlled via local occupancy sensor.
  - 10.3 For corridor lighting, provide local corridor lighting override keyed switch outside of electrical room where local lighting contactor is installed. This local switch will provide bypass around contactor in case contactor fails to operate.
- 11.0 Provide local on/off lighting control switch in gymnasium. Locate switch in same lockable cabinet as bleacher and goal motor operators.
- 12.0 Restroom lighting shall be controlled via local occupancy sensor with manual key switch override. Configure sensor for 100% output when active.
- 13.0 For individual spaces such as office, storage rooms and workrooms, provide ceiling/wall mounted vacancy sensor with local dimming control switch at door.
- 14.0 Occupancy sensors shall be dual technology (PIR and Ultrasonic) type and ceiling mounted with two independent relay outputs.
- 15.0 Classroom lighting control shall be setup per the following requirements:
  - 15.1 Control shall be setup to 50% occupancy mode when occupant enters the room.

- 15.2 Provide local 3 zone scene control switch adjacent to classroom door. Zones shall be configured for 100%, 50% and local a/v mode. Button shall also have "off" and up/down dimming control arrows.
- 15.3 At front presentation wall of classroom, provide on/off A/V switch to control lights nearest presentation wall.
- 15.4 Provide daylight harvesting as required by code.
- 15.5 Reference diagram below for classrooms designed under ASHRAE 90.1 with no daylight harvesting. Note: Plug load control is not required under projects designed with IECC 2015.



#### SEQUENCE OF OPERATION:

Lights turn on automatically with motion to 50%. Lights can be turned to 100% at digital switch station. Occupancy sensor input set for auto-on to 50%. Dimmer outputs provide smooth full range control. Digital switch station at room entry provides (3) preset scenes: 100% - 50% - AV scene. Secondary digital switch provided by white board for isolated zone control of the AV zone.

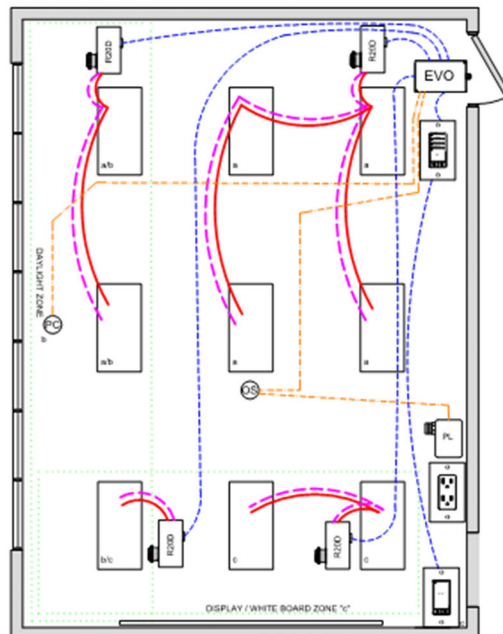
Plug load control is provided with power pack connected to occupancy sensor. Power pack is energized upon occupancy of room and de-energized when room is unoccupied.

Emergency lighting control bypass relay for UL-924 can be added as needed.

#### WIRE LEGEND

<span style="color: red;">—</span>	Line voltage
<span style="color: magenta;">---</span>	0-10V Dimming
<span style="color: blue;">---</span>	CAT-5e Data cable
<span style="color: orange;">---</span>	3-Wire Occupancy Sensor or Photo Cell

- 15.6 Reference diagram below for classrooms designed under ASHRAE 90.1 with daylight harvesting. Note: Plug load control is not required under projects designed with IECC 2015.



#### SEQUENCE OF OPERATION:

Lights turn on automatically with motion to 50%. Lights can be turned to 100% at digital switch station. Occupancy sensor input set for auto-on to 50%. Dimmer outputs provide smooth full range control. Digital switch station at room entry provides (3) preset scenes: 100% - 50% - AV scene. Secondary digital switch provided by white board for isolated zone control of the AV zone.

Photo cell monitors daylight zone B and limits the maximum light level in the daylight zone. Multiple zones can be controlled from one sensor with independent level settings for each.

Plug load control is provided with power pack connected to occupancy sensor. Power pack is energized upon occupancy of room and de-energized when room is unoccupied.

Emergency lighting control bypass relay for UL-924 can be added as needed.

#### WIRE LEGEND

<span style="color: red;">—</span>	Line voltage
<span style="color: magenta;">---</span>	0-10V Dimming
<span style="color: blue;">---</span>	CAT-5e Data cable
<span style="color: orange;">---</span>	3-Wire Occupancy Sensor or Photo Cell

## 16.0 Exterior Lighting:

- 16.1 Marquee sign is controlled separately. (See Division 32 for the marquee requirements)
- 16.2 Canopies are controlled separately from security lighting.
- 16.3 Security lighting (wall packs and soffit lighting) shall be controlled separately on each building elevation. (North side controlled separately from South side, etc...).
- 16.4 Parking lot lighting shall be circuited and controlled by zones (Staff parking, gym parking, auditorium parking, visitor parking, etc.)
- 16.5 Provide photo cell input to BAS.
- 16.6 All exterior lighting should be LED technology.

## 17.0 Interlocks:

- 17.1 Interlock with fire alarm to enable all contactor controlled fixtures to "on" status upon activation.
- 17.2 Interlock with security system to turn off all contactor controlled fixtures upon arming of system.
- 17.3 Interlock with security system to turn on all contactor controlled fixtures upon intruder activation.
- 17.4 Interlock with security system to enable partial lighting when system is first disarmed via contactor schedule.
- 17.5 Intent is to have three inputs from security system: armed, disarmed and activated

18.0 Lighting control system shall be configured to fail "on".

19.0 All light fixtures shall be LED.

20.0 All low voltage lighting control cabling shall be lime green, no exceptions.

## 26 20 00 – Electrical Distribution Equipment

- 1.0 Acceptable manufacturers for transformers, motor control centers and switchgear shall be: **Square D, Schneider Electric, General Electric and Siemens.** All products shall be manufactured in the USA.
- 2.0 All floor mounted transformers shall be located on 4" housekeeping pads.
- 3.0 The contractor shall provide a thermographic test using an independent testing laboratory using an infrared scanning device. This test shall include but not limited to
  - 3.1. Switchboards
  - 3.2. Distribution panelboards
  - 3.3. Panelboards
  - 3.4. Automatic transfer switches
  - 3.5. Other electrical distribution devices.

This test shall be conducted to locate high temperature levels. This test shall be conducted between 6 and 12 months after substantial completion, but not beyond the one year warranty period. All unacceptable conditions shall be corrected prior to the end of the warranty period.

- 4.0 Install digital metering device on all main switchgear, main distribution panels serving gyms, kitchen, cafeteria, exterior athletic areas, auditoriums and extended day area.
- 5.0 For renovation projects, the new panel schedules placed into panels shall show existing and new load descriptions. Schedule shall match existing load descriptions for any existing panelboard schedules on new panelboard inserts.

## 26 27 26 - Wiring Devices

- 1.0 Acceptable manufacturers: **Leviton, Pass and Seymour, Hubbell and Lutron (dimmers).**
- 2.0 All devices shall be specification grade.
- 3.0 All grounds on receptacles shall be installed with grounds in the “up” position.
- 4.0 Wiring device color shall be reviewed with the owner/architect and required local codes and standards.
  - 4.1. General purpose receptacles: Gray
  - 4.2. Isolated ground receptacles: Orange
  - 4.3. Emergency receptacles: Red
- 5.0 Device wall plates shall be stainless steel.
- 6.0 Devices shall be rated for 20 amps, minimum.
- 7.0 Keyed override switches shall have full size key cylinders that can utilize district standard key way locks. Coordinate with FBISD for key way type.
- 8.0 Receptacles
  - 8.1. Provide one duplex receptacle at each Kronos time clock. Coordinate location of rough in box with Kronos model template prior to rough in. Provide data outlet at each Kronos location.
  - 8.2. Housekeeping receptacles minimum every 50' maximum in corridors.
  - 8.3. No more than four computer work stations per 20 amp circuit.
  - 8.4. At severe and profound changing table provide two 120V receptacles one at 18" AFF and one at 6" below finished ceiling both can be on same circuit.
  - 8.5. At each identified copier location provide one 208/240V, 30-amp circuit and one 120V, 20-amp circuit.
  - 8.6. Provide minimum one duplex receptacle for each data drop. If there is a workstation countertop, locate the electrical above the workstation surface (unless there is a knee space below counter). (Generally this will be at 42" AFF to avoid locating within a backsplash, etc. Coordinate with actual floorplan.)
  - 8.7. Provide GFCI outlets at all code required locations.
  - 8.8. Minimum one quad receptacle at each teacher workstation. Provide one quad receptacle centered on each wall in a classroom. Connect these 5 receptacles to one dedicated 120v, 20A circuit.
- 9.0 Telecommunication Rooms (MDF/IDF)
  - 9.1. The MDF shall be equipped with a minimum of (4) dedicated 208 VAC 30-amp circuits terminated with L6-30R receptacles and the IDF shall be equipped with (2) dedicated 208 VAC 30-amp circuits terminated with L6-30R receptacles. The MDF and each IDF shall be equipped with a minimum of (1) dedicated 120 VAC 20-amp circuit terminated in a quad 5-20R receptacle and (1) dedicated 120 VAC 20-amp circuit terminated in a duplex 5-20R.
    - A. (2) 208 VAC 30-amp L6-30R shall be mounted at 18 inches AFF on wall behind each equipment rack.
    - B. 120 VAC 20-amp 5-20R shall be mounted at 18 inches AFF on wall behind each equipment rack.
    - C. 120 VAC 20-amp 5-20R shall be mounted at 18 inches AFF on wall in front of the equipment racks near the entry door.
  - 9.2. Additional power requirements allocated to security, paging, and service provider equipment shall be considered and coordinated at the time of building design.
  - 9.3. All receptacles in room shall be connected to emergency generator fed panel source.
  - 9.4. All other power to panels and equipment in room shall be separate and dedicated for each system such as access control, fire alarm, public address, intrusion or building automation. Coordinate outlet mounting heights required for each building system.
  - 9.5. Each room shall be equipped with 120 VAC 20-Amp duplex NEMA 5-20R receptacles as convenience outlets, with maximum (3) receptacles on each circuit. The originating

- electrical panel shall be equipped with a 20-amp breaker per circuit.
  - 9.6. A duplex receptacle shall be spaced at least 1 foot from an adjacent wall and every 6 feet thereafter. A minimum of (1) duplex receptacle shall be placed on each wall and be flush mounted to the finished wall surface at 18 inches above finished floor.
  - 9.7. All metal components in the MDF/IDF shall be grounded with #6 AWG insulated conductor or larger and terminated on both ends with long barrel 2 hole lug Part #LCC6-14JAWH-L. Ground bar shall be located behind racks, mounted to wall and properly grounded to building grounding system. Labels shall be installed on conductors terminating on ground bar identifying where the wiring originates (racks, equipment, ladder tray, etc.)
  - 9.8. Install wall mounted outlet at 42" AFF in each MDF/IDF closet for IP handset. Outlet shall be centered along the wall facing the front of the network racks.
  - 9.9. UPS equipment to be provided and installed by FBISD.
  - 9.10. Coordinate final outlet locations and load ratings with project technology consultant prior to release of drawings to contractors.
10. Controlled receptacles
- 10.1. For projects where controlled receptacles are required, color of receptacle shall be green in color.
  - 10.2. Connect interface to receptacle via local room lighting occupancy sensor to turn off receptacle after designated time of no activity in the space.
  - 10.3. Do not connect teacher workstation power or classroom projection systems to the controlled receptacles design.

## 26 32 00 - Packaged Generator Assemblies

- 1.0 Acceptable Manufacturers: **Caterpillar, Kohler, and Cummins**
- 2.0 Generator "exercise" schedule shall be coordinated with FBISD MEP Manager for day and time.
- 3.0 Generators shall be natural gas, no exceptions.
- 4.0 Automatic Transfer Switch shall be of the same manufacturer as the generator.
- 5.0 Locate remote annunciator panel in custodial office area.
- 6.0 Provide emergency power for the following items.
  - 6.1. Building Intrusion Alarm Control Panel
  - 6.2. Building Access Control Panel and power supplies
  - 6.3. Intercommunications Rack
  - 6.4. Egress lighting
  - 6.5. Kitchen refrigeration equipment and walk-in freezers/coolers
  - 6.6. MDF and IDF rooms
  - 6.7. MDF and IDF rooms stand-alone HVAC systems
  - 6.8. Special education receptacles (two). One in each room.
  - 6.9. Clinic receptacles (two)
  - 6.10. Clinic refrigerator
  - 6.11. Fire alarm panel
  - 6.12. Telephone equipment
  - 6.13. Other life safety or security items not listed
- 7.0 Testing: Generator shall be field tested with all building loads connected by factory authorized representative. Test shall be witnessed by FBISD MEP Manager and engineer.
- 8.0 Generator shall receive a load bank test performed upon installation. Test results to be provided as part of close out documents.
- 9.0 Training: Provide 4 hours training minimum.



## 26 43 00 - Transient Voltage Suppression

- 1.0 Acceptable manufacturers shall be **Liebert, Current Technology and MTE.**
- 2.0 Design a full facility Transient Voltage Suppression System. Including:
  - 2.1. Main Service Entrance
  - 2.2. Power distribution panels
  - 2.3. Local equipment permanently fastened to building such as PA system, fire alarm system, local sound systems, etc.
  - 2.4. Surge protection including line and load reactors and filters.

## 26 50 00 - Lighting

- 1.0 Acceptable manufacturers shall be **Philips, Cooper, Lithonia or Lutron.**
- 2.0 Design shall comply with Texas Building Energy Code.
- 3.0 All designed light levels shall comply with IESNA Guidelines for the area they serve.
- 4.0 All athletic areas shall comply with all current UIL Guidelines.
- 5.0 Provide 10 year warranty on all LED lighting, drivers and components.
- 6.0 A/E shall verify all light levels with FBISD Design Manager prior to finalizing design.
- 7.0 Interior Lighting
  - 7.1. In all rooms with two entry/exit doors, provide 3-way switching for lighting.
  - 7.2. No parabolic fixtures; prismatic preferred.
  - 7.3. All lighting shall be LED.
  - 7.4. Provide wire guards on all gym fixtures.
  - 7.5. Prismatic lenses shall be .125" thick
  - 7.6. Classroom lighting shall be based on performance. A/E team will present day lighting schemes for review and approval by FBISD Design Manager.
  - 7.7. Auditorium lighting shall be designed to allow maintenance.
  - 7.8. Provide catwalk above ceiling to access all light fixtures.
  - 7.9. Provide a switched light over each cot in the clinic.
  - 7.10. LED fixtures shall be 4000K color.
  - 7.11. Display case lighting is to be circuited with the general lighting of the area in which they are located and controlled by local switch.
  - 7.12. For stairwells, locate light fixtures in ceiling above stair landing areas, not above stair risers or wall mounted.
- 8.0 Telecommunication Rooms (MDF/IDF)
  - 8.1. Fixtures shall be LED, design shall be minimum 50 foot candles at 2 feet above finished floor.
  - 8.2. Install fixtures chain hung supported from structure. Locate fixtures in front of network racks and behind network racks, not directly above network racks. Install fixtures 36" above network racks supported from structure utilizing chains. Coordinate fixture location with horizontal ladder racks in room.
  - 8.3. Room shall have at least one light fed from emergency circuit to provide lighting during power outage.
- 9.0 Emergency Lighting
  - 9.1. When required (if no emergency generator is provided in contract), provide a battery back-up in one of the spaces regular light fixtures. Avoid the wall mounted "bug eye"



type fixture.

- 9.2. Egress lighting, provide a generator transfer device for switching of emergency circuits.
- 9.3. Provide LED exit signs. Provide wire cages for gyms and locker rooms.
- 9.4. Refer to Div. 11 of Technical Design Guidelines to review requirements required for theatrical lighting and fine arts spaces.

#### 10.0 Site Lighting

- 10.1. New outdoor lighting fixtures must comply with Texas Health and Safety Code Chapter 425 - <https://statutes.capitol.texas.gov/Docs/HS/htm/HS.425.htm>
- 10.2. Match the parking lot lighting lamp color with the wall packs on the building.
- 10.3. Use cut-off fixtures where applicable.

#### 11.0 Exterior Athletic Lighting

- 11.1. Acceptable manufacturers: **Pro Sports Lighting or Musco.**
- 11.2. Light poles are to be outside the perimeter fence of baseball and softball fields. Include glare shields.
- 11.3. Consult project AHJ for lighting ordinance requirements; ensure compliance.
- 11.4. Sports lighting controls shall be set up so groups of lights can be sequenced “on”.

### 26 99 00 – Sustainable Design Items

#### 1.0 Solar Design

- 1.1. Solar Panel acceptable manufacturers shall be **Manwha-QCells or Canadian Solar** or FBISD Design Manager approved equal.
- 1.2. Inverter acceptable manufacturers shall be **Sungrow or Solectria** or FBISD Design Manager approved equal.
- 1.3. Maximum solar panel voltage is between 1000 and 1500 volts DC. 60 or 72 cells with 320V nominal power rating.
- 1.4. Provide 10 year product warranty and 25 year linear power output warranty on all panels.
- 1.5. Panels shall comply with UL 1703.
- 1.6. Design of photovoltaic system and supports shall be performed by licensed professional engineer based on soil reports from site.
- 1.7. Design shall comply with all local electric utility grid connection requirements showing relays, disconnects and utility grade network equipment.
- 1.8. Provide general security lighting around PV field and equipment.
- 1.9. Provide lightning protection per NFPA 780 with air terminals and down leads protecting system.
- 1.10. Provide perimeter fencing of PV field and equipment.
- 1.11. All solar panels and electrical junction boxes shall be a minimum of 24” above 500 year flood plain elevation based on county flood control maps.
- 1.12. System shall utilize Helioscope or PV Watts modeling software to show projected annual power collection and output data.

#### 2.0 Leadership in Energy and Environmental Design (LEED)

- 2.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
- 2.2 Related Credits (as applicable)
  - 2.2.1 SS Credit: Lighting Pollution Reduction
  - 2.2.2 EA Prerequisite: Minimum Energy Performance
  - 2.2.3 EA Prerequisite: Building-Level Energy Metering
  - 2.2.4 EA Credit: Optimize Energy Performance
  - 2.2.5 EA Credit: Advanced Energy Metering

- 2.2.6 EA Credit: Demand Response
- 2.2.7 EA Credit: Renewable Energy Production
- 2.2.8 EA Credit: Green Power and Carbon Offsets
- 2.2.9 EQ Credit: Interior Lighting
- 2.2.10 EQ Credit: Daylight
- 2.2.11 IN Credit: Innovation

**END OF SECTION 26**

## Division 27

# Audiovisual Systems

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### DIVISION 27 – AUDIOVISUAL SYSTEMS

#### 27 01 00 – General Requirements for Audiovisual Systems

- 1.0 Designers shall not deviate from these standards without explicit written approval from the FBISD Design Manager.
- 2.0 Comply with applicable codes, standards, AHJ.

- 3.0 Designer shall coordinate all systems with the respective divisions (architectural, mechanical, electrical, communications, etc.)
- 4.0 Full system functionality must be maintained in unaffected areas during additions and renovations.
- 5.0 Prior to commencing any work in an existing building, the systems shall be fully tested to document the condition of the systems.
- 6.0 Remove and disconnect abandoned AV equipment. Remove any abandoned cabling above ceilings and patch wall and floor penetrations.
- 7.0 All removed equipment shall be returned to FBISD unless, otherwise directed by FBISD project manager.
- 8.0 Prior to the commencement of the Audiovisual equipment installation at campus projects, Contractor shall complete two (2) mockup classrooms meeting the requirements of the construction documents. The classroom mock up shall consist of TWO reviews to be conducted at different times in construction. The first Mockup shall be to review conduit pathways for the end point devices. The second mockup will be conducted much later in construction and will be to review system functionality. Classrooms shall be selected by Owner and shall be fully completed by the Contractor. Audiovisual equipment installation shall not commence until mock up rooms have received written approval from Owner's design manager and consultant.
  - 8.1 Functionality Mockup is also necessary when performing multiple deployments of a given similar system i.e. multiple conference rooms, collaboration areas, cafeterias, gymnasiums, etc.)
- 9.0 The Contractor shall include a one (1) year labor, materials and workmanship warranty on the work performed in the execution of all projects to include any alterations or changes to the scope of the projects through system completion and system acceptance. The warranty period shall not commence until all system commissioning is 100% complete and accepted by FBISD Design Manager in writing.
- 10.0 Audiovisual Systems System Contractor's Qualifications:
  - 10.1 Minimum of 5 years relevant experience.
  - 10.2 The Contractor shall have completed three (3) successful installations at different buildings of equivalent systems at a school district(s). To qualify as a valid installation, projects must consist of projects of similar cost, scope and complexity.
  - 10.3 The contractor's project team (project engineer, project manager, site lead/superintendent) shall possess two or more of the following certifications in good standing: AVIXIA (Infocomm) CTS, AVIXIA (Infocomm) CTS-I, AVIXIA (Infocomm) CTS-D.
  - 10.4 An AVIXIA (Infocomm) CTS-I technician will be on site at all times to supervise any and all audiovisual work being performed.
  - 10.5 The AVIXIA (Infocomm) CTS-I technician will be present at the following meetings
    - 10.5.1 Low Voltage Preinstallation Meeting
    - 10.5.2 Audiovisual System Pathway Mockup
    - 10.5.3 Audiovisual Systems Functionality Mockup (Needed when performing multiple deployments of a give similar system i.e. multiple conference rooms, collaboration areas, cafeterias, gymnasiums, etc.)
    - 10.5.4 Owner walks /System inspections
    - 10.5.5 Coordination Meetings

- 10.5.6 Substantial completion punch
- 10.5.7 11-month warranty
- 10.5.8 And Other events as requested by the Owner
- 10.6 Contractor shall Provide 24-hour support, 7 days a week within 2 hours during normal business day and 4 hours during non-business hours during the warranty period. Contractor shall expect for any corrective work to be performed during non-business ours or after school hours.
- 11.0 Wireless Frequency Coordination.
  - 11.1 The system designer for every location shall coordinate the wireless frequency with local conditions. Wireless frequencies shall be coordinated to be in bands and channels specifically reserved for wireless microphones.
  - 11.2 For value microphone selection with less than five microphones in the immediate area, the system designer shall use Shure SLX series in the J3 band (572-596 MHz). The G5 band (494-518 MHz) shall be an alternate band as required.
  - 11.3 For performance wireless microphone systems with more required channels, the system design shall utilize the Shure ULX-D series microphones. The X52 band (900 MHz) is the preferred band. Under site conditions where the 900MHz is not free and clear of interfering systems, a combination of J50A band (572-620 MHz) and H50 band (530-602 MHz) is also acceptable.
  - 11.4 Alternate wireless microphone manufacturers are subject to the same frequency coordination requirements as stipulated.
- 12.0 Audiovisual systems in renovations will need to be coordinated with FBISD Design Manager and FBISD IT depending on the space(s) being renovated. The extent of the system modification and/or replacement will be determined at time of design dependent on the project budget and extents of renovation and the spaces being renovated.

## **27 01 40 – Operation and Maintenance for Audiovisual Systems**

- 1.0 Provide for (2) hours of training for two (2) persons on each system at the “System Administrator” level covering advanced functions of the system, troubleshooting techniques, etc.
- 2.0 Provide for (2) hours of training on each system at the “End User” level covering basic functions and operation of the system. Multiple training sessions will be required to provide for training of all faculty at each campus.
- 3.0 Training shall be conducted on-site with a manufacturer's representative.
  - 3.1 Training should be scheduled at least 3 weeks prior to students returning to school when possible or no more than 1-2 weeks after punch sign off, whichever comes first.
  - 3.2 Training schedule shall be coordinated with GC, FBISD Design and Construction PM, and FBISD IT departments to ensure the training scheduled when the end users are on contract and available
- 4.0 Training / demonstration shall provide for a “user's manual” written for the school personnel onsite, for operations of the system. A “Quick Start” guide shall also be provided as a supplement to the “user manual” offering condensed instructions of the system
  - 4.1 As part of the “user manual”, a recorded video of system function and use will be provided to FBISD for training others not present at training or for reinforcement of training of the school staff.

- 5.0 Provide a test report showing the system has been 100% tested and is 100% operational prior to training / demonstration. Reference Index for sample test report.
- 6.0 Electronic, pdf, as-built drawings will be required for final closeout. Close out drawings must include final installed locations, model numbers, serial numbers, software license keys, MAC addresses, and static IP addresses, all installed equipment, codes, lock and key manufacturer's codes for duplicates or additional copies, and custom programming. FBISD Design and Construction will transmit or share a copy of all electronic as-builts, training manuals, and training videos with FBISD IT Department.

## **27 05 00 – Common Work Results for Audiovisual Systems**

- 1.0 All cabling shall be properly supported from the structure using j-hooks. Installation must follow BICSI standards.
- 2.0 J-hooks shall not be installed in open ceiling spaces.
- 3.0 Pathways shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill rate.
- 4.0 J-hooks shall be installed every 4-5 feet on center starting at the end of the wire basket cable tray.
- 5.0 J-hooks shall be installed utilizing appropriate hardware to support, join and attach j-hooks to structures.
- 6.0 No grid wire shall be utilized for support. J-Hooks shall be mounted to the structure or solid support. Solid support is an item that will not move, Examples: all thread supported from structure, walls, structural beams, and ceiling joists.
- 7.0 Provide spare conduits at bulk heads, furr downs and at hard ceiling areas separating sections of buildings. Intent is to provide a future cabling pathway through inaccessible areas.
- 8.0 All equipment shall be "commercial grade".
- 9.0 All HDMI wall plate connectors shall be recessed or flush with the face of the plate.

## **27 08 00 – Commissioning of Audiovisual Systems**

- 1.0 All Audiovisual systems shall be commissioned ensuring 100% system functionality and operation. Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

## **27 41 00 – Integrated Audiovisual Systems**

### **1.0 Classroom Audiovisual Systems**

- 1.1 The classroom shall feature an Owner Furnished Owner Installed (OFOI) Interactive Flat Panel Display on a Mobile Height Adjustable Mount. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the on-board selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar.

## 1.2 Typical Placement of Power and Data for in Classroom

1.2.1 Refer to typical wall elevations and layouts in appendix and FBISD ED specs and Technical Design Standards.

## 1.3 Audiovisual Sources

1.3.1 The classroom Audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the on board PC. A pathway through wall from teacher's location to display for Audiovisual connectivity is NOT needed.

1.3.2 USB-C Patch cable for teacher's device is OFOI

## 1.4 Audiovisual Infrastructure

1.4.1 Classroom Audiovisual Infrastructure shall consist of OFOI localized cabling between the Audiovisual system components.

## 1.5 Power Requirements

1.5.1 All Audiovisual power requirements shall be coordinated with "Division 26".

1.5.2 One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power on each of the solid walls. All four to five outlets will be on one dedicated 120V 20A Circuit.

1.5.3 Refer to classroom elevation in the Appendix.

## 2.0 Collaboration Area Audiovisual Systems

2.1 The Collaboration Area shall feature an Owner Furnished Owner Installed (OFOI) Interactive Flat Panel Display on a Mobile Height Adjustable Mount. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the on-board selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar.

## 2.2 Display Mounts

2.2.1 An electric height adjustable mount shall be provided through the construction contract. Electrified mount shall not be spring loaded. Consultant shall coordinate with FBISD IT for preferred mount

## 2.3 Typical Placement of Display in Collaboration Area

2.3.1 Refer to typical wall elevations and layouts in appendix.

2.3.2 The display shall be mounted on the teaching wall in the collaboration space.

2.3.3 The display mounting height shall be situated in such a way that in the lowered position, the display is ADA compliant.

2.3.4 Display mounting locations at gypsum walls will receive ¾" plywood in-wall blocking. Blocking will be determined by the mount and display manufacturer's recommendation. Coordinate mount and display type with FBISD.



## 2.4 Power and AV Pathway Requirements

- 2.4.1 All audio-visual power requirements shall be coordinated with “Division 26”.
- 2.4.2 One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power one quad at the display. Both outlets will be on one dedicated 120V 20A Circuit.
- 2.4.3 Refer to classroom elevation in the Appendix.

## 2.5 Audiovisual Sources

- 2.5.1 The Collaboration Area Audiovisual systems shall display content from a USB-C direct connection to the display from the teacher’s device or utilize the on-board PC. A pathway through wall from teacher’s location to display for Audiovisual connectivity is NOT needed..

## 2.6 Audiovisual Infrastructure

- 2.6.1 Collaboration Area Audiovisual Infrastructure shall consist of OFOI localized cabling between the audiovisual system components

## 3.0 Medium and Large Conference Room Audiovisual Systems

- 3.1 Medium and Large Conference Rooms are defined as conference areas with seating for over five (5) people.
- 3.2 Medium and Large Conference Room shall feature an Owner Furnished Owner Installed (OFOI) Interactive Flat Panel Display. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the on-board selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar.
- 3.3 Display Mounts
  - 3.3.1 An electric height adjustable mount shall be provided through the construction contract. Electrified mount shall not be spring loaded. Consultant shall coordinate with FBISD IT for preferred mount
- 3.4 Typical Placement of Display in Medium and Large Conference Room
  - 3.4.1 Refer to typical wall elevations and layouts in appendix.
  - 3.4.2 The display shall be mounted on the teaching wall in the Conference Room. Teaching wall is typically the ‘shorter’ wall in a rectangular shaped room
  - 3.4.3 The display mounting height shall be situated in such a way that in the lowered position, the display is ADA compliant.
  - 3.4.4 Display mounting locations at gypsum walls will receive ¾” plywood in-wall blocking. Blocking will be determined by the mount and display manufacturer’s recommendation. Coordinate mount and display type with FBISD.
- 3.5 Power and Requirements
  - 3.5.1 All Audiovisual power requirements shall be coordinated with “Division 26”.


3.5.2 One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power one quad at the display. Both outlets will be on one dedicated 120V 20A Circuit.

3.5.3 Refer to large conference room elevation in the Appendix.

### 3.6 Audiovisual Sources

3.6.1 The Medium and Large Conference Room audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the on board PC. A pathway through wall from teacher's location to display for audiovisual connectivity is NOT needed.

### 3.7 Audiovisual Infrastructure


3.7.1 Medium and Large Conference Room audiovisual infrastructure shall consist of OFOI localized cabling between the audiovisual system components. 

3.7.2 Refer to elevation in the Appendix.

3.8 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

## 4.0 Small Conference Room Audiovisual Systems

4.1 Small Conference Rooms are defined as conference areas with seating for less than five (5) people.

4.2 Small Conference Room shall feature an Owner Furnished Owner Installed (OFOI) Interactive Flat Panel Display. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the on-board selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar. 

### 4.3 Display Mounts

4.3.1 An electric height adjustable mount shall be provided through the construction contract. Electrified mount shall not be spring loaded. Consultant shall coordinate with FBISD IT for preferred mount

### 4.4 Typical Placement of Display in Small Conference Room

4.4.1 Refer to typical wall elevations and layouts in appendix.

4.4.2 The display shall be mounted on the teaching wall in the Small Conference Room. The teaching wall is typically the 'shorter' wall in a rectangular shaped room

4.4.3 The display mounting height shall be situated in such a way that in the lowered position, the display is ADA compliant.

4.4.4 Display mounting locations at gypsum walls will receive 3/4" plywood in-wall blocking. Blocking will be determined by the mount and display manufacturer's recommendation. Coordinate mount and display type with FBISD.


#### 4.5 Power Requirements

- 4.5.1 All Audiovisual power requirements shall be coordinated with “Division 26”.
- 4.5.2 One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power one quad at the display. Both outlets will be on one dedicated 120V 20A Circuit.
- 4.5.3 Refer to classroom elevation in the Appendix.

#### 4.6 Audiovisual Sources

- 4.6.1 The Small Conference Room audiovisual systems shall display content from a USB-C direct connection to the display from the teacher’s device or utilize the on board PC. A pathway through wall from teacher’s location to display for audiovisual connectivity is NOT needed.


#### 4.7 Audiovisual Infrastructure

- 4.7.1 Small Conference Room audiovisual infrastructure shall consist of OFOI localized cabling between the audiovisual system components. 

- 4.8 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

### 5.0 Huddle Room Audiovisual Systems

- 5.1 Huddle rooms are defined as small conference areas with seating for up to (4) people.

- 5.2 Huddle Room shall feature an Owner Furnished Owner Installed (OFOI) Interactive Flat Panel Display on a Mobile Height Adjustable Mount. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the on-board selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar. 

#### 5.3 Display Mounts

- 5.3.1 An electric height adjustable mount shall be provided through the construction contract. Electrified mount shall not be spring loaded. Consultant shall coordinate with FBISD IT for preferred mount

#### 5.4 Typical Placement of Display in Huddle Room

- 5.4.1 Refer to typical wall elevations and layouts in appendix.
- 5.4.2 The display shall be mounted on the teaching wall in the huddle space. The teaching wall is typically the ‘shorter’ wall in a rectangular shaped room
- 5.4.3 The display mounting height shall be situated in such a way that in the lowered position, the display is ADA compliant.
- 5.4.4 Display mounting locations at gypsum walls will receive ¾” plywood in-wall blocking. Blocking will be determined by the mount and display

manufacturer's recommendation. Coordinate mount and display type with FBISD.

## 5.5 Power and AV Pathway Requirements

5.5.1 All Audiovisual power requirements shall be coordinated with "Division 26".

5.5.2 One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power one quad at the display. Both outlets will be on one dedicated 120V 20A Circuit.


5.5.3 Refer to huddle room elevation in the Appendix.

## 5.6 Audiovisual Sources

5.6.1 The Huddle Room audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the on board PC. A pathway through wall from teacher's location to display for Audiovisual connectivity is NOT needed.

5.6.2 USB-C Patch cable for teacher's device is OFOI

## 5.7 Audiovisual Infrastructure

5.7.1 Huddle Room audiovisual Infrastructure shall consist of OFOI localized cabling between the audiovisual system components. 

5.7.2 Refer to Huddle Room Elevation in the Appendix

5.8 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

## 6.0 Principal's Office Audiovisual Systems

6.1 The Principal's Office System shall consist of a wall mounted a commercial flat panel display and wall mounted HDMI input plate. The flat panel display's remote control will be used for system control.

6.2 Elementary School, Middle School and High School Assistant Principal's Offices shall receive identical systems to the Principal's office.

6.3 Other select administrative spaces as defined by FBISD shall receive displays similar to the displays for Principal's Office meeting the requirements noted below

6.4 The Principal's Office flat panel display shall be at minimum 55", with a minimum resolution of 3,840x2,160 and a minimum brightness of 350 nit.

6.5 Acceptable manufacturers for flat panel display shall be **Samsung, LG** or FBISD Design Manager approved equal.

### 6.6 Source Interfaces

6.6.1 The display shall have a minimum of two (2) HDMI inputs.

### 6.7 Flat Panel Display Mounts

6.7.1 The flat panel display mount shall be a low-profile tilting mount that is

rated for the size and weight of the display. The mount shall have tilt and articulating arm features. Acceptable manufacturers for flat panel display mount shall be **Chief, Peerless** or FBISD Design Manager approved equal.

#### 6.8 Typical Placement of Flat Panel Display in Principal's Office

- 6.8.1 Refer to elevations in Appendix.
- 6.8.2 The flat panel display shall be mounted on the Owner / Architect designated wall in the Office.
- 6.8.3 The flat panel display mounting height will generally be 40-inches above finished floor to the bottom of the screen.
- 6.8.4 Flat panel display mounting locations at gypsum walls will receive  $\frac{3}{4}$ " plywood in-wall blocking. Blocking will extend 24" vertically and laterally from the center of the mounting point.

#### 6.9 Power and AV Pathway Requirements

- 6.9.1 All Audiovisual power requirements shall be coordinated with "Division 26".
- 6.9.2 One (1) Quad power is required adjacent to the HDMI input plate.
- 6.9.3 flat panel display will receive two 110VAC duplex outlets at the AV back box location
- 6.9.4 All three outlets will be on one dedicated 120V 20A Circuit.
- 6.9.5 The multimedia input plate shall receive a single 2-1/8" x 4-11/16" wall box with dual gang plaster-ring and bulk cable feedthrough plate. These boxes and associated conduits will be used for routing of AV and network cabling from the accessible ceiling space to the multimedia input plate.
- 6.9.6 Each flat panel display location will receive a 14.25" x 14.25" x 3.9" (HxWxD) in-wall storage box. The storage box will be used to house power, data, and AV connections and infrastructure as well as any associated AV equipment.
- 6.9.7 The in-wall storage box will be mounted at 60" above finished floor to vertical center.
- 6.9.8 The flat panel display will receive two EMT conduits providing a pathway from the in-wall storage box to the above accessible ceiling space.
- 6.9.9 All AV conduit shall be 1.25" EMT.

#### 6.10 Audiovisual Sources

- 6.10.1 The Principal's Offices room's Audiovisual systems shall display content from one (1) HDMI input plate.
- 6.10.2 One Input plate shall be located at the Principal's desk/computer location.
- 6.10.3 The multi-media input plate shall be an HDMI type which transmits video via HDBaseT protocol. Acceptable manufacturers shall be **Hall**

Research, **Extron** or FBISD Design Manager approved equal.

6.10.4 The multi-media plate and accompanying power and data shall be mounted in the wall below the in-wall storage box.

#### 6.11 Audio Reinforcement

6.11.1 Audio will be played back via the flat panel display's internal speaker.

#### 6.12 Audiovisual Control System

6.12.1 The principal's Audiovisual system will be controlled by the flat panel display's included infrared remote control.

#### 6.13 Audiovisual Infrastructure

6.13.1 Audiovisual Infrastructure shall consist of localized specific cabling between the Audiovisual system's components.

6.13.2 Category cabling used for video transmission shall be shielded Cat6A premade patch cables with boots. Acceptable manufacturers for cable shall be **Liberty, Middle Atlantic** or FBISD Design Manager approved equal.

6.13.3 All cabling shall be plenum rated.

6.13.4 Each office shall receive (1) 10' HDMI Male to Male, high retention gold plated, high quality cable. Cable shall be rated at least 18Gbps (gigabits per second). Acceptable manufacturers for cable shall be **Middle Atlantic, Comprehensive** or FBISD Design Manager approved equal.

6.13.5 All patch cables should be turned over to FBISD IT department at time of system commissioning.

#### 6.14 Power Requirements

6.14.1 One power outlet is required on the wall adjacent to the HDMI input plate.

6.14.2 Two Duplex power outlets are required in the in-wall storage box at the flat panel display mounting location.

6.15 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.


## 7.0 Digital Signage – Typical Locations

7.1 Typical digital signage locations shall consist of a commercial grade wall mounted flat panel display and digital signage player.

7.2 Typical flat panel displays shall be at minimum 55" diagonal with a minimum resolution of 3,840x2,160 and a minimum brightness of 500 nit.

7.3 Front lobby flat panel displays shall be commercial grade 65" diagonal with a minimum resolution of 3,840x2,160 and a minimum brightness of 500 nit.

7.4 Acceptable manufacturers for flat panel display shall be **Samsung, LG** or FBISD Design Manager approved equal.


- 7.5  Digital signage players will be Owner Furnished Contractor Installed (OFCI)
- 7.6 Flat Panel Display Mounts
- 7.6.1 The flat panel display mount shall be a low profile tilting mount that is rated for the size and weight of the display. The mount shall also feature an articulating arm feature. Acceptable manufacturers for flat panel display mount shall be Chief, Peerless or FBISD Design Manager approved equal.
- 7.7 Typical Placement of Digital Signage Monitors
- 7.7.1 The flat panel displays shall be mounted at locations designated by FBISD.
- 7.7.2 A flat panel display will be located in the administration waiting area.
- 7.7.3 The flat panel display mounting height will generally be 68-inches above finished floor to the center of the screen. Exact location and height shall be coordinated with FBISD Design Manager and FBISD IT.
- 7.7.4 Flat panel display mounting locations at gypsum walls will receive  $\frac{3}{4}$ " plywood in-wall blocking. Blocking will extend 24" vertically and laterally from the center of the mounting point.
- 7.8 Power and AV Pathway Requirements
- 7.8.1 All Audiovisual power requirements shall be coordinated with "Division 26".
- 7.8.2 Each flat panel display location will receive a 14.25" x 14.25" x 3.9" (HxWxD) in-wall storage box. The storage box will be used to house power, data, and AV connections and infrastructure as well as the digital signage player.
- 7.8.3 The in-wall storage box will be mounted generally be 68-inches above finished floor to the center of the screen. Exact location and height shall be coordinated with FBISD Design Manager and FBISD IT. Coordinate display mount with recessed storage box so viewer does not see recessed storage box. The flat panel display mounting height will
- 7.8.4 The flat panel display will receive one 110VAC duplex outlets at the back box location. The receptacle will be located within the recessed storage box
- 7.8.5 The flat panel display will receive two 1.25-inch EMT conduits providing a pathway from the in-wall storage box to the above accessible ceiling space.
- 7.8.6 All conduit shall be 1.25" EMT
- 7.9 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

## **8.0 Digital Signage - Serving Line/Menu Board Locations**

- 8.1 Serving line/menu board digital signage locations shall consist of a wall mounted or ceiling mounted flat panel display and digital signage player.



Location of display shall be coordinated with FBISD Design Manager, FBISD IT, and FBISD Child Nutrition departments. The displays should be visible from queuing lines

- 8.2 Typical flat panel displays shall be at minimum 49" diagonal, with a minimum resolution of 3,840x2,160 and a minimum brightness of 500 nit. The exact size will be coordinated with FBISD D&C Design Manager, FBISD IT, and FBISD Child Nutrition departments
- 8.3 Each display will have a minimum of two HDMI inputs.
- 8.4 Acceptable flat panel display manufacturers shall be **Samsung, LG** or FBISD Design Manager approved equal.
- 8.5  Digital signage players will be Owner Furnished Contractor Installed (OFCI)
- 8.6 Flat Panel Display Mounts
  - 8.6.1 The flat panel display mount shall be a low profile tilting, or pole, mount that is rated for the size and weight of the display. Wall mount displays will require an articulating arm.
  - 8.6.2 Acceptable manufacturers for flat panel display mount shall be **Chief, Peerless** or FBISD Design Manager approved equal.
- 8.7 Typical Placement of Menu Board Flat Panel Displays
- 8.8 Flat panel displays will be mounted above the sneeze guards in the serving line or on the walls. Locations of display shall be coordinated with FBISD D&C Design Manager, FBISD IT, and FBISD Child Nutrition departments.
  - 8.8.1 The displays should be visible from queuing lines
  - 8.8.2 Displays must be visible from the entrance to the serving line.
  - 8.8.3 Each serving line shall receive one display.
- 8.9 Power Requirements
  - 8.9.1 All Audiovisual power requirements shall be coordinated with "Division 26".
  - 8.9.2 Each wall mounted flat panel display location will receive a 14.25" x 14.25" x 3.9" (HxWxD) in-wall storage box. Any ceiling mounted display shall receive an in-ceiling storage box. The storage box will be used to house power, data, and AV connections and infrastructure as well as the digital signage player.
  - 8.9.3 The exact location and height of the in-wall storage box shall be coordinated with FBISD Design Manager and FBISD IT Department. Coordinate display mount with recessed storage box so viewer does not see recessed storage box.
  - 8.9.4 The flat panel display will receive one 110VAC duplex outlets at the back box location. The receptacle will be located within the recessed storage box
  - 8.9.5 The flat panel display will receive two 1.25-inch EMT conduits providing a pathway from the in-wall storage box to the above accessible ceiling space.
  - 8.9.6 All conduits shall be 1.25" EMT

## 8.10 Data Requirements

- 8.10.1 Each ceiling mounted flat panel display will receive an above ceiling data jack at the installation location. Data jack shall be terminated within the ceiling enclosure. If the display is wall mounted the data outlet shall be terminated within the in-wall storage box.

## 9.0 Library Audiovisual Systems

- 9.1 Libraries shall be equipped with ONE (1) Larger Group Instructional Area and ONE (1) Small Group Instructional Area. The Large Group Instructional area shall feature a mounted projector with a motorized screen. The screen will be sized appropriate for the viewing area. The Small Group instructional area shall feature a mobile display. Alternatively, large libraries may be equipped with a large format projector and motorized projection screen and TWO (2) mobile displays

- 9.2 The small group instructional area shall feature an Owner Furnished Owner Installed (OFOI) Interactive Flat Panel Display on a Mobile Height Adjustable Mount. Connection to the display shall be accomplished through a local connection on the display. Control of the display will be through the native remote or through the on-board selection buttons. Sound reinforcement of presentation content shall be handled through the built-in speakers on the display or through an external sound bar.

### 9.3 Audiovisual Sources

- 9.3.1 The Small Group Instructional Audiovisual systems shall display content from a USB-C direct connection to the display from the teacher's device or utilize the on board PC. A pathway through wall from teacher's location to display for Audiovisual connectivity is NOT needed.

- 9.3.2 USB-C Patch cable for teacher's device is OFOI

### 9.4 Audiovisual Infrastructure

- 9.4.1 Small Group Instructional Area Audiovisual Infrastructure shall consist of OFOI localized cabling between the Audiovisual system components.

### 9.5 Power Requirements

- 9.5.1 All Audiovisual power requirements shall be coordinated with "Division 26".
- 9.5.2 One (1) Quad power is required adjacent to the Instructor/Teacher data outlet. One (1) Quad power on each of the solid walls. All four to five outlets will be on one dedicated 120V 20A Circuit.

### 9.6 Large Group Instructional Video Display System for Libraries

- 9.6.1 A 119 inch or larger (16:10) motorized projection screen will be installed. Approved manufacturer Draper or Da Lite.
- 9.6.2 A 5,500 lumen WUXGA (or better) projector will be installed in the large group area centered on the projection screen. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Epson PowerLite L610W or current equivalent
- 9.6.3 If the projector is not serviceable from a six-foot ladder, the projector

will be mounted using a motorized projector lift that is capable of allowing the projector to be serviced from the floor without a ladder. The lift will also accommodate a projected image with NO GEOMETRIC CORRECTION within the projector lens shift capability. The projector and projector lift will require a shared dedicated 120VAC 20A circuit. Approved manufacturers: **Draper, DaLite**

9.6.4 Coordinate with FBISD Design Manager and FBISD IT if a fixed pole must be used due to structure, mechanical, or architectural feature, Approved manufacturers: **Draper, DaLite**

9.6.5 Coordinate with FBISD Design Manager and FBISD IT if geometric correction of the projected image is necessary

9.6.6 The designer shall design the projection system to the space.

## 9.7 Audiovisual Sources

9.7.1 The library area's Audiovisual systems shall display content from a HDMI wall plate. The wall plate input shall be a HDMI Wall Plate Transmitter.

9.7.2 A 3.5mm analog audio wall plate will be collocated with the HDMI wall plate.

9.7.3 The 3.5mm analog audio plate shall be connected to the amplifier via a "balun" or balanced audio transformer set.

9.7.4 Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Extron DTP HWP 4kD or current equivalent.

## 9.8 Audio Reinforcement

9.8.1 The audio content from the source device will be de-embed from incoming HDMI signals and provide a line level analog audio source that will be amplified for playback over a minimum two (2) in-ceiling loudspeakers. Audio content shall be available for broadcast through the system without the projector being on. An audio sensing relay will be provided to mute the audio during paging/intercom events. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Radio Design Labs (RDL) Paging Controlled Relay TX-PSD1 or current equivalent

9.8.2 The amplifier will be compact, stereo or mono, and capable of producing 25 watts per channel. Amplifier quantity will be determined by space and size requirements. The amplifier will feature terminal connections for analog volume and mute. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Stuart Audio CVA 25 x 1 70v/100v or current equivalent.

9.8.3 Each library will receive a minimum two (2) in-ceiling mounted loudspeakers. Spaces with open ceilings shall receive wall mounted or hanging pendant speakers. Speakers quantity will be determined by space size requirements

9.8.4 Speakers will be two-way, capable of low impedance (8 ohm or 70V) operation with integral back cans and a minimum power handling of 30 Watts Continuous Pink Noise.

9.8.5 Libraries with lay-in acoustic tile ceilings will receive 2'x2' square drop in

loudspeakers. Acceptable manufacturers for loudspeakers shall be **JBL**, **Quam** or FBISD Design Manager approved equal.

9.8.6 Libraries with open ceilings will receive pendant style loudspeakers. Acceptable manufacturers for loudspeakers shall be **JBL**, **Community** or FBISD Design Manager approved equal.

9.8.7 Loudspeakers shall be UL2043 listed.

9.8.8 Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design: Ceiling speakers are **JBL** LCT81 CT, wall speakers are **JBL** CCS1ST or current equivalent.

#### 9.9 Public Address/Intercom Override

9.9.1 The library system's audio system will be configured to mute audio during paging events.

9.9.2 Coordination with PA system contractor will be required.

9.9.3 PA system contractor will be responsible for providing speaker wire to paging control relay.

9.9.4 AV Contractor will be responsible for terminating speaker wire at paging control relay and configuring paging control relay.

9.9.5 Paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.

#### 9.10 Control System

9.10.1 The Projection system shall be controlled by a wall mounted controller that provides the instructor's direct control over power, volume and input sources.

9.10.2 The control functionality shall provide for Projector On/Off, Input 1, Input 2 and Volume Control Up/Down.

9.10.3 Wall mounted controller shall be located at the presenter's input HDMI location . If not possible the location shall be coordinated with FBISD Design Manager and FBISD IT

9.10.4 The controller shall be mounted at 48" above finished floor (AFF) to its vertical center.

9.10.5 The wall mounted controller shall be a push button style system.

9.10.6 The controller will communicate via RS-232 between controller and projector

9.10.7 Acceptable manufacturers for controller shall be **Extron** or FBISD Design Manager approved equal.

9.10.8 Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is **Extron** MLC 64 RS VC D or current equal.

#### 9.11 Equipment Storage

9.11.1 The Large group areas with ceilings lower than 12'-0 shall receive a 1'x2' in-ceiling plenum storage enclosure. The enclosure will include two (2) A/V component shelves and an active cooling fan.

- 9.11.2 The Large group areas with ceilings 12'-0" or higher shall receive a lockable recessed in-wall storage enclosure. The enclosure will include two (2) A/V component shelves or mounting plates and an active cooling fan
- 9.12 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.
- 9.13 Audiovisual Infrastructure
  - 9.13.1 Audiovisual Infrastructure shall consist of localized specific cabling between the Audiovisual system's components.
  - 9.13.2 Category cabling used for video transmission shall be shielded Cat6A premade patch cables with boots. Acceptable manufacturers for cable shall be **Liberty, Middle Atlantic** or FBISD Design Manager approved equal.
  - 9.13.3 All cabling shall be plenum rated.
  - 9.13.4 Each library area shall receive (1) 10' HDMI Male to Male, high retention gold plated, high quality cable. Cable shall be rated at least 18Gbps (gigabits per second). Acceptable manufacturers for cable shall be **Middle Atlantic, Comprehensive** or FBISD Design Manager approved equal.
  - 9.13.5 Each Library system shall receive (1) 6' 3.5mm audio Male to Male, cable. Acceptable manufacturers for cable shall be **Middle Atlantic, Comprehensive** or FBISD Design Manager approved equal.
  - 9.13.6 All patch cables should be turned over to FBISD IT department at time of system commissioning.
- 9.14 Power Requirements
  - 9.14.1 One quad power outlet is required on wall adjacent to HDMI input plate.
  - 9.14.2 One quad power outlet is required at the projector mounting location and terminated within the ceiling storage box for ceilings 12'-0" or lower or in in-wall recessed storage box.

## 10.0 Gymnasium Sound Systems

- 10.1 Provide rack elevation as part of Construction Document design package
- 10.2 Loudspeakers and Amplification
  - 10.2.1 Elementary School Gymnasiums shall receive a centrally hung loudspeaker with a 360x180 degree (HxV) coverage pattern and a 15-inch bass driver. Acceptable manufacturer for loudspeaker shall be **Octasound** or FBISD approved equal.
  - 10.2.2 Middle School Auxiliary Gymnasiums shall receive four directional speakers in a center hung cluster aimed toward the perimeter of the gym. Acceptable manufacturer for loudspeaker shall be **JBL, Electrovoice, Community** or FBISD approved equal.
  - 10.2.3 High School Auxiliary Gymnasium shall receive four directional speakers

in a center hung cluster aimed toward the perimeter of the gym. Acceptable manufacturer for loudspeaker shall be **JBL, Electrovoice, Community** or FBISD approved equal.

- 10.2.4 Middle School and High School Competition Gymnasiums shall receive four directional speakers in clusters of two per bleacher side for crown. Each speaker cluster of two shall occupy one channel of a speaker amp. The center cluster will consist of 6 total speakers centrally located with three speakers directed at the audience on each side of the gym. Two of the three speaker array will handle the mid and high frequency range audio, the central speaker shall be the sub-woofer handling the low frequency audio range. **JBL, Electrovoice, Community** or FBISD approved equal.

### 10.3 Public Address/Intercom Override

- 10.3.1 The Gymnasium system's audio system will be configured to mute audio during paging events.
- 10.3.2 Coordination with PA system contractor will be required.
- 10.3.3 PA system contractor will be responsible for providing speaker wire to paging control relay.
- 10.3.4 AV Contractor will be responsible for terminating speaker wire at paging control relay and configuring paging control relay.
- 10.3.5 Paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.

### 10.4 Source Devices

- 10.4.1 Gymnasiums will receive a single gang Bluetooth wall plate receiver.
- 10.4.2 The Bluetooth wall plate shall have an integrated 3.5mm stereo audio input located on the visible side of the wall plate.
- 10.4.3 Acceptable manufacturers for Bluetooth wall plate receiver shall be **AtteroTech by QSC** or FBISD Design Manager approved equal.
- 10.4.4 Middle School and Elementary School Gymnasiums will receive three wireless microphone systems.
- 10.4.5 High School Gymnasiums will receive four wireless microphone systems.
- 10.4.6 Each wireless receiver will be furnished with:
- One (1) wireless handheld dynamic microphone
  - One (1) bodypack type transmitter with a lavalier microphone and low profile ear set microphone.
- 10.4.7 Two wall mounted antennas will be installed outside the equipment storage closet.
- 10.4.8 Acceptable manufacturers for wireless microphone equipment shall be **Shure** or FBISD Design Manager approved equal.
- 10.4.9 When applicable, the Gymnasium shall receive an audio feed from the Cafetorium that will allow it to be used as an overflow seating area.

## 10.5 Audio Control System

- 10.5.1 Each gymnasium shall receive a rack mounted DSP for mixing of all sources.
- 10.5.2 Rack mounted DSP shall be controlled by a wall mounted single gang control keypad installed in the gymnasium.
- 10.5.3 Wall mounted control keypad and Bluetooth wall plate shall be installed within the same electrical box and shall have a locking cover installed over them.
- 10.5.4 Locking cover shall be made of steel and feature a plastic window to see the current status of the control keypad.
- 10.5.5 Acceptable manufacturers for rack mounted DSP and wall mounted single gang control panel shall be **Extron** or FBISD Design Manager approved equal.

## 10.6 Equipment Storage

- 10.6.1 The amplifier and source devices will be stored in a wall mounted 19-inch equipment rack.
- 10.6.2 The rack location will require one dedicated 120VAC 20A circuit with one wall mounted quad receptacle.
- 10.6.3 The equipment rack will typically be located in the gym storage room. Exact placement will vary by project.

- 10.7 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

## 11.0 Cafetorium/Commons Area Systems

- 11.1 Provide rack elevation as part of Construction Design Package.

### 11.2 Loudspeakers and Amplification

- 11.2.1 Cafetorium shall receive one loudspeaker (two total) on either side of the stage's proscenium. In cafeteria's with ceilings 15'-0" and lower, the loudspeaker shall be 2-way with 15 inch bass drivers. Cafeterias with 15'-0" or taller or large Cafeteria spaces where it is more suitable for a distributed speaker system provide in-ceiling type speakers.
- 11.2.2 Acceptable manufacturers for loudspeakers shall be **JBL, Community, RCF** or FBISD Design Manager approved equal.
- 11.2.3 Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design as follows:
  - 11.2.3..1 Ceiling Speakers (selection is dependent on ceiling height): JBL Control 18 C/T, JBL Control 226 C/T
  - 11.2.3..2 Wall Speakers- JBL AC599
- 11.2.4 The wall mounted loudspeakers in the cafeteria space will be powered by two channel amplifier that is rated for 900 watts per channel. @ 8ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.



- 11.2.5 When in-ceiling speakers are used, amp shall be sized to provide double the continuous power rating for the speaker load on a channel.
  - 11.2.6 Acceptable manufacturers for amplifier shall be **Crown, QSC** or FBISD Design Manager approved equal.
  - 11.2.7 Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Crown CDI DriveCore 2-1200
  - 11.2.8 Consultant to calculate sound pressure level and recommend sound reinforcement as needed
  - 11.2.9 When the school design has an operable wall between the Gym and Cafeteria. The system shall be designed as a divisible space. Each system will function independently from one another and be able to handle separate content and sources in the divided condition. In the combined state the cafeteria system will be the main content source and the speakers in the gym area will follow the audio from the cafeteria.
- 11.3 Audio Source Devices
- 11.3.1 Audio sources will be combined with a mic/line mixer sized appropriately to accommodate the quantity of inputs. The mixer will additionally control the master audio level. A Digital Signal Process will NOT be used. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is **Ashley** MX508 used in tandem with a **Shure** SCM800. Provide lockable cover for Ashley Mixer. Install once system in programmed and balanced. Turn over cover keys to FBISD IT and FBISD Low Voltage Maintenance department
  - 11.3.2 Provide audio and mixing board I/O plate shall be located at the rear of the Cafetorium space in a location designated by the FBISD Design Manager, FBISD Theater Arts Director and the AV systems designer. This outlet shall support Theatrical and Production control and input for source content.
  - 11.3.3 A balanced line level output will be fed from the projector to the audio mixer for playback of audio from video sources.
  - 11.3.4 Cafetorium will receive a combination USB/SD/CD player and a Bluetooth receiver. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is **Denon** Media Player DN700CB
  - 11.3.5 The Bluetooth receiver will have a long range antenna that will provide consistent signal coverage for the entire Cafetorium.
  - 11.3.6 Three wired microphone input plates will be installed in the Cafetorium. One in the middle of the stage steps and one on either side of the stage on the proscenium walls.
  - 11.3.7 Each system will receive a rack mounted wireless microphone systems, with remote mounted antenna. The antenna location will be at the front of the proscenium wall facing out into the dining area. Elementary Schools will receive two (2) wireless microphone systems. Middle and High Schools will receive twelve (12) wireless microphone systems.
  - 11.3.8 Elementary and Middle school campuses shall receive ceiling suspended choir microphones on the stage. The quantity and locations

of microphones shall be selected, based on the stage dimensions, to provide the most even audio coverage possible. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Sure MX200

11.3.8..1 Provide service loop for choir mic below ceiling but out of view of sightlines

11.3.9 Acceptable manufacturers for choir microphone equipment shall be **Shure** or FBISD Design Manager approved equal.

11.3.10 Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is

11.3.10..1 Antenna Distribution System\_ UA844 SWB

11.3.10..2 Handheld Wireless System\_ SLX-D/ SLX24-

11.3.10..2.1 Wireless Receivers\_ SLXD4

11.3.10..2.2 Wireless Microphone\_ SLXD2-SM86 .

11.3.10..2.3 At Elementary School level, provide one Lavalier Microphone and one hand held microphone per receiver

11.3.10..2.4 At Middle and High School levels, provide 4 hand held and 12 lavalier microphones

11.4 **Public** Address/Intercom Override

11.4.1 The cafeteria system's audio system will be configured to mute audio during paging events.

11.4.2 Coordination with PA system contractor will be required.

11.4.3 PA system contractor will be responsible for providing speaker wire to paging control relay.

11.4.4 AV Contractor will be responsible for terminating speaker wire at paging control relay and configuring paging control relay.

11.4.5 Paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.

11.5 Assistive Listening System

11.5.1 An assistive listening system will be installed. The system will consist of a rack mounted transmitter, a wall or ceiling mounted RF antenna, and a set of battery powered receiver units. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Listen L5-055-I72

11.5.2 The quantity of the receiver units will be determined by the occupant capacity of the space.

11.5.3 Provide shelf within rack to store ALS receivers and charging apparatus. Shelf will be labeled to indicate this is the space to store ALS equipment

11.6 Video Display Devices

- 11.6.1 A (16:10) motorized projection screen will be installed above the center of the stage behind the proscenium opening, but in front of the curtain. Screen size will be determined by the space served. The screen shall be sized appropriately for BASIC VIEWING / View ratio of 1:6 of the furthest viewing participant from the display surface. Minimum anticipated size is 216" diagonal, If a smaller screen is deemed necessary due to stage restrictions consultant shall coordinate size with FBISD Design Manager and FBISD IT. Approved manufacturers are Draper and DaLite.
- 11.6.2 A 12,000 lumen WUXGA (or better) laser projector will be installed in the dining area centered on the projection screen. Image at screen shall be a minimum of 7:1 Contrast Ratio per AVIXIA PISCR / ISCR. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Epson Pro L1500UHN
  - 11.6.2..1 Provide appropriate lens for mounting application
- 11.6.3 The projector will be mounted using a motorized projector lift that is capable of allowing the projector to be serviced from the floor without a ladder. The lift will also accommodate a projected image with NO GEOMETRIC CORRECTION within the projector lens shift capability The projector and projector lift will require a shared dedicated 120VAC 20A circuit.
- 11.6.4 Coordinate with FBISD Design Manager and FBISD IT if a fixed pole must be used due to structure, mechanical, or architectural feature, Approved manufacturers: Draper, DaLite
  - 11.6.4..1 Coordinate placement of projector with ANY theatrical lighting in the cafeteria
- 11.6.5 Coordinate with FBISD Design Manager and FBISD IT if geometric correction of the projected image is necessary
- 11.6.6 The designer shall design the projection system to the space.
- 11.6.7 A 75" Flat panel display will be wall mounted on either side of the proscenium opening. Each display will require one 120VAC receptacle at the mounting location
  - 11.6.7..1 Additional Displays may be necessary when the viewing area is large than the projection screen can adequately serve or if viewing area does not have a direct line of site to the projection screen.
    - 11.6.7..1.1 Supplemental display size and height will be coordinated and determined during design with Architect, FBISD D&C Design Manager and FBISD IT
- 11.6.8 Each flat panel display location will receive a 14.25" x 14.25" x 3.9" (HxWxD) in-wall storage box. The storage box will be used to house power, data, and AV connections and infrastructure as well as any associated AV equipment

## 11.7 Flat Panel Display Mounts

- 11.7.1 The flat panel display mount shall be a low profile tilting, or pole, mount that is rated for the size and weight of the display. Wall mount displays

will require an articulating arm. Acceptable manufacturers for flat panel display mount shall be **Chief, Peerless** or FBISD Design Manager approved equal.

## 11.8 Video Sources

11.8.1 The Audiovisual system shall display content from three HDMI input plates located on either side of the stage on the proscenium wall, and at center stage.

11.8.2 An additional HDMI input plate shall be located in the rear of the Cafetorium space in a location designated by the FBISD Design Manager, FBISD Theater Arts Director and the AV systems designer. This outlet shall support Theatrical and Production control and input for source content

11.8.2..1 Renovations – if viable conduit and backbox is NOT available for use with center HDMI input, and the renovation scope is NOT adding these in as part of the Work, then it can be omitted from the system design

11.8.3 The multi-media input plate shall be an HDMI type which transmits video via HDBaseT protocol. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Extron HDMI Plate\_ DTP T HWP 4K D Series

## 11.9 Video Switching Devices

11.9.1 A HDMI matrix switcher will be installed in the rack to allow for independent source switching to from all inputs to all outputs. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is **Extron** Switcher\_ IN1808 Series.

11.9.1..1 Renovations – If there are NOT existing ancillary displays in the cafeteria other than menu boards and the renovation scope is NOT adding these in as part of the Work, matrix switcher can be omitted from the system design

## 11.10 Equipment Storage

11.10.1 The amplifier and source devices will be stored in a wall mounted, floor-standing 26 space 19-inch equipment rack. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Middle Atlantic Rack\_ CWR-26R

11.10.1..1 Provide Shelf for Owner Provided Owner Installed Micro PC

11.10.1..2 Provide Shelf for ADA assisted listening receivers and charging station

11.10.1..3 Provide 3RU rack drawer

11.10.1..4 Provide in rack power strip

11.10.1..5 Provide low noise / quiet in rack fans

11.10.1..6 Provide with minimum of 15 spare keys.

11.10.2 The equipment rack will be located on the stage-right wall behind the proscenium.

11.10.3 The rack location will require two wall mounted duplex receptacles, each powered by its own dedicated 120VAC 20A circuit.

#### 11.11 Audiovisual Control System

11.11.1 The control system will simplify the operator interaction with the Cafetorium Audiovisual system.

11.11.2 The control system will provide basic power up and power down control of the system and control the projector, projection screen and flat panel displays (including digital signage display NOT used with menu board system).

11.11.3 The control system will provide source selection options and audio controls to include microphone level, volume up, down and volume mute.

11.11.4 The control system shall consist of two components, a rack mounted control processor and wall mounted touch screen control panel.

11.11.5 The control panel shall be located on the wall and beside the AV equipment rack on the stage-right wall.

11.11.6 The control panel shall be mounted at 44" above finished floor (AFF) to its vertical center.

11.11.7 Acceptable manufacturers for control system components shall be **Extron**, or FBISD Design Manager approved equal. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is Extron Control Panels EBP 111D

11.11.8 A lockable cover shall be provided and installed over the control panel. Coordinate current preferred equipment selection with FBISD Design Manager and FBISD IT. Current basis of design is FSR WB-PSXG

11.11.8..1 Provide a minimum on 5 spare keys with cover

11.12 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

### 12.0 Band Hall, Orchestra, and Choir Classroom Systems

12.1 The Band Hall, Orchestra, and Choir projector shall be a wall mounted laser type with a long throw lens. The projector characteristics shall be greater than 7,500 lumen output, a 16:10 native aspect ratio, WXGA or better resolution and be controllable using RS-232. Image at screen shall be a **minimum** of 7:1 Contrast Ratio per AVIXIA PISCR / ISCR

12.2 Acceptable manufacturer for projectors shall be **Epson** or FBISD Design Manager approved equal.

12.3 The projector shall be wall mounted using an arm style mount that allows the projector adequate ventilation on all sides.

12.3.1 Projectors should be mounted at roughly 12' AFF. Coordinate location and light path with risers and FF&E for height. Tallest expected participant standing on riser to be 7'-0" tall.

- 12.4 Design documents shall contain details for lens calculations and relevant sections and elevations showing projector mounting location, light path travel extents, and projection surfaces along with related rough ins for inputs and output devices.
- 12.5 Source Interfaces
  - 12.5.1 The projector shall have a minimum of one (2) HDMI inputs and one (1) line level analog audio output. The audio output must de-embed the audio from the selected HDMI input.
- 12.6 Typical Placement of Projector in Classrooms.
  - 12.6.1 The projector shall be mounted to the wall opposite the common teaching wall.
  - 12.6.2 The projector shall be mounted perpendicular to the center of the projection screen.
  - 12.6.3 The projector shall be mounted at a height that allows the projected image to fill the screen without the use of keystone adjustment.
  - 12.6.4 Projector mounting locations at gypsum walls will receive 3/4" plywood in-wall blocking. Blocking will extend 24" vertically and laterally from the center of the mounting point.
  - 12.6.5 Projectors should be mounted at roughly 12' AFF. Coordinate location and light path with risers and FF&E for height. Tallest expected participant standing on riser to be 7'-0" tall.
- 12.7 Power and AV Pathway Requirements
  - 12.7.1 The projector shall require a single 120VAC quad outlet at the projector mount location.
  - 12.7.2 The projector shall require a single wall box at the projector mount location. This box and associated conduit will be used for routing of AV and network cabling from the accessible ceiling space to the projector.
  - 12.7.3 An in wall storage box will be placed adjacent to the projector. This storage box will house the paging override relay
- 12.8 Projection Screen
  - 12.8.1 The projection screen shall be a fixed frame type, with high contrast projection material and a black, light absorbing trim bordering the image area.
  - 12.8.2 The screen size shall be 69 x 110" (130" Diagonal) minimum screen size.
  - 12.8.3 An ambient light rejecting screen is preferred.
  - 12.8.4 The screen shall be mounted directly above the center of the teaching wall marker boards so that the edges of the board and screen touch.
- 12.9 Audiovisual Sources
  - 12.9.1 The classroom Audiovisual systems shall display content from Two user work stations. Each user workstation shall receive the following(1) one. wall plate located at the teaching station. The wall plate shall

feature:

12.9.1..1.1 (1) one HDMI connection

12.9.1..1.2 (1) one Stereo Mini-Jack (3.5mm)

12.9.2 Provide a second input faceplate, custom built audio I/O with (5) Five XLR male and (1) one XLR female connection.

12.9.3 User / Teacher workstation location shall be coordinated with FBISD D&C design manager and FBISD IT

12.9.4 Each classroom shall receive (1) 10' HDMI Male to Male, gold plated, high retention cable. Cable shall be rated at least 18Gbps (gigabits per second). Acceptable manufacturers for cable shall be **Middle Atlantic, Comprehensive** or FBISD Design Manager approved equal.

## 12.10 Audiovisual Control System

12.10.1 The classroom projection system shall be controlled by a wall mounted controller that provides the instructor direct control over power, volume and input sources.

12.10.2 The control functionality shall provide for Projector On/Off, Input 1 (Teacher Wall plate), **Input** 2 (HDMI 2) and Volume Control Up/Down.

12.10.3 Wall mounted controller shall be located on teaching wall above the multimedia input plate.

12.10.4 The controller shall be mounted at 48" above finished floor (AFF) to its vertical center.

12.10.5 The controller will fit a two-gang plaster ring and feature push buttons for source selection and a rotary volume knob for audio level adjustment.

12.10.6 The controller shall communicate via RS-232 between controller and projector.

12.10.7 **Acceptable** manufacturers for controller shall be **Extron** or FBISD Design Manager approved equal.

## 12.11 Audio Reinforcement

12.11.1 Band Hall, Orchestra, and Choir Classrooms shall receive one loudspeaker (two total) on either side of the teaching wall and a floor mounted sub-woofer.

12.11.2 The speaker system shall have an on axis frequency response of **20hz-20khz +/-6db**.

12.11.3 The speaker system shall have a maximum SPL rating of 135db.

12.11.4 Loudspeakers shall be wall mounted, using mounts that allow precise aiming.

12.11.5 Acceptable manufacturer for loudspeakers shall be **QSC, JBL, Renkus Heinz** or FBISD Design Manager approved equal.

12.11.6 The loudspeakers will be powered by a four channel amplifier that is rated for at least 1000 watts per channel. @ 8ohms. The amplifier shall



feature internal digital signal processing for frequency equalization and dynamic limiting.

12.11.7 Acceptable manufacturer for amplifier shall be **QSC, Crown** or FBISD Design Manager approved equal.

#### 12.12 Public Address/Intercom Override

12.12.1 The classroom system's audio system will be configured to mute audio during paging events.

12.12.2 Coordination with PA system contractor will be required.

12.12.3 PA system contractor will be responsible for providing speaker wire to paging control relay.

12.12.4 AV Contractor will be responsible for terminating speaker wire at paging control relay and configuring paging control relay.

12.12.5 Paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.

#### 12.13 Audio System Storage

12.13.1 Band Hall, Orchestra, and Choir Classrooms shall receive a rolling equipment rack

12.13.2 The equipment rack will have 12RU on the sides and a 10RU "pop-up" mixer rack on the top.

12.13.3 The rack shall house the mixer, amplifier, playback/recording devices and other audio equipment.

12.13.4 Acceptable manufacturers for rack shall be **Gator, SKB** or FBISD Design Manager approved equal.

#### 12.14 Audio Mixer

12.14.1 Audio sources will be combined with a sixteen input/channel mic/line mixer. The mixer will additionally control the master audio level and provide for signal routing to/from the playback and record decks.

12.14.1..1 **Mixer** channels shall be machine labeled.

12.14.2 Acceptable manufacturers for audio mixer shall be **SoundCraft, Allen & Heath**, or FBISD Design Manager approved equal.

#### 12.15 Audio Source Devices

12.15.1 A balanced line level output will be fed from the projector to the audio mixer for playback of audio from video sources.

12.15.2 Band Hall and Choir Classrooms shall receive a combination USB/SD/CD/Bluetooth player and media recorder.

#### 12.16 Wired Microphones

12.16.1 Each classroom will receive 4 ceiling mounted "choir type" hanging microphones.

12.16.1..1 Ensure microphones are installed and coordinated with owner provided risers

12.16.1..2 Ensure microphones are installed as to NOT obstruct the projector light path.

12.16.1..3 Provide service loop for choir mic below ceiling but out of view of sightlines

12.16.2 Acceptable manufacturers for microphones shall be **Shure** or FBISD Design Manager approved equal.

#### 12.17 Wireless Microphones

12.17.1 Choir Classrooms shall receive four wireless microphone systems.

12.17.2 Each wireless receiver shall be furnished with One (1) wireless handheld dynamic microphone

12.17.3 Antennas shall be mounted in the equipment rack;

12.17.4 Acceptable manufacturers for wireless microphone equipment shall be **Shure**, or FBISD Design Manager approved equal.

#### 12.18 Audio Connector Plate

12.18.1 Each classroom will receive a 3 gang custom connector plate that will connect the audio rack to various components around the room.

12.18.2 The plate will be black anodized aluminum with white engraved labels for each connector.

12.18.3 Connectors will include:

- One (1) Neutrik NL4 connector for the loudspeaker connection.
- One (1) Neutrik NL2 connector for the paging relay connection.
- Two (2) Neutrik XLR male connectors for projector audio.
- Four (4) Neutrik XLR male connectors for microphones.

12.19 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

### 13.0 Theater Classroom Systems

#### 13.1 Video Display System

13.1.1 The video portion of the Theater Classrooms shall utilize the same basis of design as typical classroom projection systems. Reference previous section **27 41 00 | 1.0 Classroom Audiovisual Systems Paragraphs: 1.0 – 1.6.4**

#### 13.2 Audiovisual Control System

13.2.1 The classroom audio system shall be controlled by a wall mounted controller that provides the instructor direct control over power, volume and input sources.

13.2.2 The control functionality shall provide for Audio system ON/OFF and Volume Control Up/Down.

- 13.2.3 Wall mounted controller shall be located on teaching wall above the multimedia input plate.
- 13.2.4 The controller shall be mounted at 48" above finished floor (AFF) to its vertical center.
- 13.2.5 The controller will fit a two-gang plaster ring and feature push buttons for source selection and a rotary volume knob for audio level adjustment.
- 13.2.6 The controller shall communicate via RS-232 between controller and projector.
- 13.2.7 Acceptable manufacturers for controller shall be **Extron** or FBISD Design Manager approved equal.

### 13.3 Audio Reinforcement

- 13.3.1 Theater Classrooms shall receive one loudspeaker (two total) on either side of the teaching wall. The loudspeakers shall be 2-way with 12 inch bass drivers.
- 13.3.2 Loudspeakers shall be wall mounted, using mounts that allow precise aiming.
- 13.3.3 Acceptable manufacturers for loudspeakers shall be is **QSC, JBL, Renkus Heinz** or FBISD Design Manager approved equal.
- 13.3.4 The loudspeaker will be powered by two channel amplifier that is rated for 500 watts per channel. @ 8ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.
- 13.3.5 Acceptable manufacturer for amplifier shall be **QSC, Crown** or FBISD Design Manager approved equal.

### 13.4 Public Address/Intercom Override

- 13.4.1 The classroom system's audio system will be configured to mute audio during paging events.
- 13.4.2 Coordination with PA system contractor will be required.
- 13.4.3 PA system contractor will be responsible for providing speaker wire to paging control relay.
- 13.4.4 AV Contractor will be responsible for terminating speaker wire at paging control relay and configuring paging control relay.
- 13.4.5 Paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.

### 13.5 Audio System Storage

- 13.5.1 Theater classrooms shall receive a rolling equipment rack
- 13.5.2 The equipment rack will have 12RU on the sides and a 10RU "pop-up" mixer rack on the top.
- 13.5.3 The rack shall house the mixer, amplifier, playback/recording devices and other audio equipment.

13.5.4 Acceptable manufacturers for rack shall be **Gator, SKB** or FBISD Design Manager approved equal.

#### 13.6 Audio Mixer

13.6.1 Audio sources will be combined with a sixteen input/channel mic/line mixer. The mixer will additionally control the master audio level and provide for signal routing to/from the playback and record decks.

13.6.2 Acceptable manufacturers for audio mixer shall be **Allen & Heath, SoundCraft** or FBISD Design Manager approved equal.

#### 13.7 Audio Source Devices

13.7.1 A balanced line level output will be fed from the projector to the audio mixer for playback of audio from video sources.

13.7.2 Band Hall and Choir Classrooms will receive a combination USB/SD/CD/Bluetooth player.

#### 13.8 Audio Connector Plate

13.8.1 Each classroom will receive a 4 gang custom connector plate that will connect the audio rack to various components around the room.

13.8.2 The plate will be black anodized aluminum with white engraved labels for each connector.

13.8.3 Connectors will include:

13.8.3..1 One (1) Neutrik NL4 connector for the loudspeaker connection.

13.8.3..2 One (1) Neutrik NL2 connector for the paging relay connection.

13.8.3..3 Two (2) Neutrik XLR male connectors for display audio.

13.9 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT

### 14.0 Dance Classroom Systems

#### 14.1 Video Display System

14.1.1 The video portion of the Dance Classrooms shall utilize the same basis of design as typical classroom projection systems. Reference previous section **27 41 00 | 1.0 Classroom Audiovisual Systems Paragraphs: 1.0 – 1.6.4**

#### 14.2 Audiovisual Control System

14.2.1 The dance classroom audio system shall be controlled by a wall mounted controller that provides the instructor direct control over power, volume and input sources.

14.2.2 The control functionality shall provide for audio system On/Off and Volume Control Up/Down.

14.2.3 Wall mounted controller shall be located on teaching wall above the multimedia input plate.

14.2.4 The controller shall be mounted at 48" above finished floor (AFF) to its

vertical center.

14.2.5 The controller will fit a two-gang plaster ring and feature push buttons for source selection and a rotary volume knob for audio level adjustment.

14.2.6 The controller shall communicate via RS-232 between controller and projector.

14.2.7 Acceptable manufacturers for controller shall be **Extron**, or FBISD Design Manager approved equal.

#### 14.3 Audio Reinforcement

14.3.1 Dance Classrooms shall receive one loudspeaker (four total) in each corner of the room. The loudspeakers shall be 2-way with 12 inch bass drivers.

14.3.2 Loudspeakers shall be wall mounted, using mounts that allow precise aiming.

14.3.3 Acceptable manufacturers for amplifier shall be **QSC**, **Crown** or FBISD Design Manager approved equal.

14.3.3.1 Alternate acceptable design are powered speaker

14.3.4 The loudspeaker will be powered by four channel amplifier that is rated for 500 watts per channel. @ 8ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.

14.3.5 Acceptable manufacturer for loudspeaker shall be **QSC**, **JBL**, **Renkus Heinz** or FBISD Design Manager approved equal.

#### 14.4 Public Address/Intercom Override

14.4.1 The classroom system's audio system will be configured to mute audio during paging events.

14.4.2 Coordination with PA system contractor will be required.

14.4.3 PA system contractor will be responsible for providing speaker wire to paging control relay.

14.4.4 AV Contractor will be responsible for terminating speaker wire at paging control relay and configuring paging control relay.

14.4.5 Paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.

#### 14.5 Audio System Storage

14.5.1 Dance classrooms shall receive a rolling equipment rack

14.5.2 Acceptable manufacturers for rack shall be **Gator**, **SKB** or FBISD Design Manager approved equal.

#### 14.6 Audio Source Devices

14.6.1 A balanced line level output will be fed from the projector to the audio mixer for playback of audio from video sources.

#### 14.6.2 Bluetooth Audio input from anywhere in the room

### 14.7 Audio Connector Plate

14.7.1 The plate will be black anodized aluminum with white engraved labels for each connector.

14.7.2 Connectors will include:  
14.7.2.1 One 3.5 audio

14.8 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

## 15.0 Black Box Theater Systems

### 15.1 Video Display System

15.1.1 The video portion of the Black Box Classrooms shall utilize the same basis of design as typical classroom projection systems. Reference previous section **27 41 00 | 1.0 Classroom Audiovisual Systems Paragraphs: 1.0 – 1.6.4**

### 15.2 Video Sources

15.2.1 The Audiovisual system shall extract audio content from four HDMI, 3.5 audio and input plates. One will be located on each wall.

15.2.2 Audio source content can also be distributed through Bluetooth connection to the user device anywhere in the room.

15.2.3 Acceptable manufacturers for multimedia input plate shall be, **Extron** or FBISD Design Manager approved equal.

15.2.4 Additional audio content will be played on an Owner provided Mac Mini Computer. This computer will be housed in the equipment rack.

### 15.3 Loudspeakers and Amplification

15.3.1 The Black Box Theater shall receive four loudspeakers in each corner of the lighting grid facing into the center of the room. The loudspeakers shall be 2-way with 12 or 15 inch bass drivers.

15.3.2 The speaker system shall have an on axis frequency response of 20hz-20khz +/-6db.

15.3.3 Acceptable manufacturers for loudspeakers shall be **JBL, Community, Renkus Heinz** or FBISD Design Manager approved equal.

15.3.4 The loudspeaker will be powered by four channel amplifier that is rated for 900 watts per channel. @ 8ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.

15.3.5 Acceptable manufacturers for amplifier shall be **Crown, QSC** or FBISD Design Manager approved equal.

15.3.6 Each speaker cable from the amplifier/rack location will be terminated into Neutrik NL4 connector that is mounted to a plate/box that is attached to the lighting grid. A premade eight foot jacketed NL4 speaker cable will connect the connector plate to the loudspeaker.

## 15.4 Audiovisual Control System

### 15.4.1 MISSING INFORMATION

## 15.5 Audio Mixer

15.5.1 Audio sources will be combined with a digital, sixteen input/channel mixing board. The mixer will additionally control the master audio level and provide for signal routing to/from the playback deck and assistive listening system.

15.5.2 The mixer will be mounted into the top rack on the rolling rack.

15.5.3 Acceptable manufacturer for audio mixer shall be **Soundcraft** or FBISD Design Manager approved equal.

## 15.6 Audio Source Devices

15.6.1 The Black Box Theater will receive a combination USB/SD/CD/Bluetooth player.

## 15.7 Microphone Inputs

15.7.1 Four (4) suspended choir microphones are to be centered in the performance space. Provide service loop below ceiling but close to lighting structure

15.7.2 The plate will be black anodized aluminum with white engraved labels for each connector.

## 15.8 Wireless Microphones

15.8.1 The Black Box Theater will share a rack mounted wireless microphone system that will reside within a mobile rolling rack. The wireless microphone system will be shared between the Auditorium / stage and the black box classroom

15.8.2 Each wireless receiver will be furnished with:

15.8.2..1 One (1) wireless handheld dynamic microphone

15.8.2..2 One (1) bodypack type transmitter with a lavalier microphone and low profile earset microphone.

15.8.3 Two wall mounted paddle type antennas will be wall mounted at 120" AFF on either side of the theater.

15.8.4 Acceptable manufacturers for wireless microphone equipment shall be **Shure**, or FBISD Design Manager approved equal.

## 15.9 Assistive Listening System

15.9.1 An assistive listening system will be installed. The system will consist of a rack mounted transmitter, a wall or ceiling mounted RF antenna, and a set of battery powered receiver units.

15.9.2 The quantity of the receiver units will be determined by the occupant capacity of the space.

15.9.3 Provide shelf within rack to store ALS receivers and charging apparatus. Shelf will be labeled to indicate this is the space to store ALS equipment



15.9.4 Acceptable manufacturer for assistive listening system shall be **Listen Technologies** or FBISD Design Manager approved equal.

#### 15.10 Main Audio Connector Plates

15.10.1 A 2 gang custom connector plate will connect the audio rack to the loudspeakers in the space.

15.10.2 The plate will be black anodized aluminum with white engraved labels for each connector.

15.10.3 Connectors will include:

15.10.3..1 Two (1) Neutrik NL4 connector for the loudspeaker connection.

15.10.4 A 4 gang custom connector plate will connect the audio rack to the microphone connections in the space.

15.10.5 The plate will be black anodized aluminum with white engraved labels for each connector.

15.10.6 A 2 gang custom connector plate will connect the audio rack to the RF antennas in the space.

15.10.7 The plate will be black anodized aluminum with white engraved labels for each connector.

15.10.8 Connectors will include:

15.10.8..1 Two (2) Neutrik 50 Ohm BNC coupling connections for the wireless microphone antennas.

15.10.8..2 One (1) Neutrik 50 Ohm BNC coupling connection for the assistive listening system antenna.

#### 15.10.8..3 MISSING INFORMATION?

#### 15.11 Public Address/Intercom Override

15.11.1 The Black Box Theater's audio system will be configured to mute audio during paging events.

15.11.2 Coordination with PA system contractor will be required.

15.11.3 PA system contractor will be responsible for providing speaker wire to paging control relay.

15.11.4 AV Contractor will be responsible for terminating speaker wire at paging control relay and configuring paging control relay.

15.11.5 Paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.

15.11.6 PA speaker level will be controlled by a wall mounted volume control knob so that the PA may be muted during performances. Reference PA system standards.

#### 15.12 Equipment Storage

15.12.1 The Black Box Theater will receive a rolling equipment rack.

15.12.2 The equipment rack will have 12RU on the sides and a 10RU "pop-up" mixer rack on the top.

15.12.3 The rack shall house the mixer, amplifier, wireless microphone system, playback devices and other audio equipment.

15.12.4 Acceptable manufacturers for equipment rack shall be Gator, SKB or FBISD Design Manager approved equal.

#### 15.13 Performance / Backstage Intercom System

15.13.1 Provide a wireless performance intercom system to be shared between the black box and Auditorium

15.13.1..1 The system will have 10 user packs.

15.13.1..2 A rolling rack shall be provided to house the equipment.

15.13.1..3 Approved manufacturer is Clear Comm or FBISD approved equal.

#### 15.14 Shared Wireless Microphone System

15.14.1..1 MS system shall have 12 wireless microphones

15.14.1..1.1 Coordinate quantity of lapel and handheld units with FBISD D&C Design Manager, FBISD Theater Arts, and FBISD IT departments

15.14.1..2 HS system shall have 16 wireless microphones

15.14.1..2.1 Coordinate quantity of lapel and handheld units with FBISD D&C Design manager, FBISD Theater Arts, and FBISD IT departments

15.15 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

### 16.0 High School Auditorium Systems

#### 16.1 Main Projection System

16.1.1 A 283 inch diagonal (16:10) motorized projection screen will be mounted behind the front edge of the proscenium, in front of the main curtain.

16.1.1..1 Coordinate location of projection screen with stage and theatrical lighting. Stage and Theatrical lighting take precedence over AV display. Display location will adjust around lighting.

16.1.1..2 In Renovations, attempt to meet new building design. Screen location will adjust around lighting

16.1.2 The screen shall be furnished with enough additional black material so that it can be lowered to the stage floor.

16.1.3 Acceptable manufacturers for projection screen shall be **DaLite**, **Draper** or FBISD Design Manager approved equal.

16.1.4 A 16,000 lumen (or better) WUXGA laser projector will be mounted centered laterally on the projection screen in an area that is accessible from the catwalk.

- 16.1.5 Image at screen shall be a **minimum** of 7:1 Contrast Ratio per AVIXIA PISCR / ISCR
- 16.1.6 Acceptable manufacturer for video projector shall be **Epson** or FBISD Design Manager approved equal.
- 16.2 Video Switching
- 16.2.1 A modular 16x16 (input x output) video switcher will be installed in the stage rack. It will allow for switching and scaling between multiple input sources. Additionally it will de-embed analog audio from video signals for playback through the sound system.
- 16.2.2 Acceptable manufacturers for video switcher shall be **Extron** or FBISD Design Manager approved equal.
- 16.3 Video Sources
- 16.3.1 The Audiovisual system shall display content from six (6) HDMI input plates.
- One (1) plate (two total) shall be located on the rear side the proscenium walls on both sides of the proscenium opening.
  - One (1) plate shall be located in the front/center stage pocket.
  - One (1) plate shall be located at the on-stage equipment rack location.
  - Two (2) plates shall be located at the control booth location.
  - HDMI patch cables shall be provided for each input plate. Reference paragraph 1.17.15 for cable requirements.
- 16.3.2 The multi-media input plates shall be an HDMI type which transmits video via HDBaseT protocol.
- 16.3.3 Acceptable manufacturers for multimedia input plate shall be **Extron** or FBISD Design Manager approved equal.
- 16.3.4 Video content shall be played on an Owner provided Computer. This computer will be housed in the control booth.
- 16.3.5 Video input source faceplates, lighting control, av control shall be provided at both "house" booth and sound booth locations
- 16.4 Auxiliary Projector
- 16.4.1 One (1) 8,000 lumen laser (or better) WUXGA projector shall be turned over to the Owner at system commissioning. This projector will be used to project onto the cyclorama and for other theatrical effects. The projector shall be equipped with an ultra-short throw lens.
- 16.4.1..1 Shall have at least one HDMI input
- 16.4.1..2 Optional USB-C
- 16.4.2 Acceptable manufacturer for video projector shall be **Epson** or FBISD Design Manager.
- 16.5 Main Loudspeakers and Amplification
- 16.5.1 An acoustic engineer shall design the audio system and acoustic features of the space.

- 16.5.2 Lighting take precedence in terms of location. Adjust speaker array and location as needed.
- 16.5.3 The Auditorium shall receive a hanging line array speaker clusters arranged/wired in an LCR (left, center, right) configuration. Center Cluster is optional and desired if it does not affect lighting. Line array clusters shall be located to the left and right of the proscenium opening with a smaller cluster located above the lateral center of the proscenium opening.
- 16.5.4 In addition to the main full range line array cabinets, the left and right clusters shall feature a subwoofer cabinet.
- 16.5.4.1 Speakers shall be arranged to provide a full spectrum of evenly distributed sound from 20Hz to 20KHz. Provide supplemental speakers as needed evenly broadcast sound
- 16.5.4.2 Stage and Theatrical Lighting take precedence over speaker location. Adjust speaker design to accommodate lighting.
- 16.5.5 All rigging/structural design and calculations must be signed off by a licensed structural engineer. All rigging work must be carried out by a licensed rigging contractor.
- 16.5.6 Acceptable manufacturer for loudspeakers shall be **JBL, Danley Sound Labs, RCF, Renkus Heinz**, or FBISD Design Manager approved equal.
- 16.5.7 The loudspeaker system shall be amplified in a way to meet the following requirements:
- All full-range cabinets shall be bi-amplified
  - The discreet LCR characteristic of the sound system shall be preserved. Amplifier channels shall not be split across clusters.
  - Each subwoofer shall receive a discreet amplifier channel.
  - The power rating of each amplifier channel shall be rated at twice the combined RMS rating of all connected loads.
- 16.5.8 Acceptable manufacturer for amplifier shall be **Crown** or FBISD Design Manager approved equal.
- 16.5.9 Amplifiers shall be located in the on-stage rack.
- 16.6 Stage Monitor Loudspeakers
- 16.6.1 Six (6) self-amplified monitor speakers shall be provided for audio monitoring on stage. The loudspeakers shall be 2-way with 12 inch bass drivers. Internal amplifier power shall be rated at no less than 1000 Watts.
- 16.6.2 Three of the six speakers are to be rear facing at proscenium. Location shall be coordinated and determined by lighting layout.
- 16.6.3 The three remaining speakers shall be mobile and will plug into the floor boxes
- 16.6.3.1 Renovations. If floor boxes are not available provide faceplate for connection at stage right and left. Downstage. Coordinate location with FBISD D&C Design Manager, FBISD Theater, and FBISD IT departments.
- 16.6.4 Acceptable manufacturers for loudspeaker shall be **JBL, QSC** or FBISD Design Manager approved equal.
- 16.6.5 The monitors shall receive audio signals from the digital snake head

through XLR connectors located in the recessed stage pocket boxes. Reference section below.

#### 16.7 Digital Audio Console and Stage-Box

- 16.7.1 Audio sources will be combined and routed with a digital audio console. The console will provide for signal routing level control to the LCR main speakers and stage monitors,
- 16.7.2 The digital audio console shall have 32 on board microphone inputs and be capable of 80 mix channels, with the addition of the digital stage box.
- 16.7.3 The Digital Audio Console shall be located in the control booth.
- 16.7.4 A 32 channel digital audio stage box shall be located in the on stage rack. Machine label each channel
- 16.7.5 Acceptable manufacturer for Digital Audio Console and Stage-Box shall be **Yamaha** or FBISD Design Manager approved equal.

#### 16.8 Audio Source Devices

- 16.8.1 The Auditorium control booth will receive a combination USB/SD/CD/Bluetooth player.

#### 16.9 Wireless Microphones

- 16.9.1 Sixteen (16) wireless microphone receivers shall be located in the MOBILE equipment rack to be shared with Black Box Classrooms.
- 16.9.2 Each wireless receiver shall be furnished with:
  - 16.9.2..1 One (1) wireless handheld dynamic microphone
  - 16.9.2..2 One (1) bodypack type transmitter with both a lavelier microphone and low profile earset microphone.
- 16.9.3 MS system shall have 12 wireless microphones
  - 16.9.3..1 Coordinate quantity of lapel and handheld units with FBISD D&C Design manager, FBISD Theater Arts, and FBISD IT departments
- 16.9.4 HS system shall have 16 wireless microphones
  - 16.9.4..1 Coordinate quantity of lapel and handheld units with FBISD D&C Design manager, FBISD Theater Arts, and FBISD IT departments
- 16.9.5 Two wall mounted paddle type antennas will be wall mounted at 120" AFF on either side of the stage.
- 16.9.6 Acceptable manufacturers for wireless microphone equipment shall be **Shure** or FBISD Design Manager approved equal.

#### 16.10 Wired Microphones and Accessories

- 16.10.1 The following microphones shall be turned over to the Owner at system commissioning.
  - Four (4) hanging mini-condenser cardioid microphones

- Four (4) handheld cardioid dynamic vocal microphones
- Two (2) super-cardioid dynamic instrument microphones
- One (1) dynamic kick drum microphone
- Four (4) Small-diaphragm Mini Cardioid Condenser Microphone with 84" Carbon Fiber Boom Arm

16.10.2 Acceptable manufacturer for microphones shall be **Shure**, **Audix** or FBISD Design Manager approved equal.

16.10.3 25-foot black microphone cables with Neutrik connectors shall be provided with each microphone. An additional twenty (20) cables shall be turned over for future expansion.

16.10.4 The following microphone stands shall be turned over to the Owner at system commissioning.

- Eight (8) black, round base, full height microphone stands.
- Four (4) tripod/boom adjustable height 36"-64" microphone stands.
- Five (5) black 9 inch-12 inch round base microphone stands.

16.10.5 Acceptable manufacturers for microphone stands shall be **Atlas**, **K&M** or FBISD Design Manager approved equal.

#### 16.11 Suspended Microphone Inputs

16.11.1 To facilitate the use of hanging microphones, four (4) XLR input boxes shall be installed, evenly spaced above the center of the stage.

16.11.2 A microphone input connector plate will be located on each of the four walls of the Auditorium. A 2 gang box and plate will be mounted at 18" AFF centered on each wall. Each plate will contain three panel mount Neutrik XLR female connectors.

16.11.3 The plate will be black anodized aluminum with white engraved labels for each connector.

#### 16.12 Assistive Listening System

16.12.1 An assistive listening system will be installed. The system will consist of a rack mounted transmitter, a wall or ceiling mounted RF antenna, and a set of battery powered receiver units.

16.12.2 The quantity of the receiver units will be determined by the occupant capacity of the space.

16.12.3 Acceptable manufacturer for assistive listening system shall be **Listen Technologies** or FBISD Design Manager approved equal.

#### 16.13 Audiovisual Control System

16.13.1 The control system will simplify the operator interaction with the Auditorium Audiovisual system.

16.13.2 The control system will provide basic power up and power down control of the system and control the projector, projection screen and flat panel


displays.

16.13.3 The control system will provide source selection options and audio controls to include microphone level, volume up, down and volume mute.

16.13.4 The control system shall consist of three components, a rack mounted control processor and two (2) wall mounted touch screen control panels.

16.13.5 The control panels shall be located at the on stage rack and in the control booth.

16.13.6 The control panel shall be mounted at 44" above finished floor (AFF) to its vertical center.

16.13.7 Acceptable manufacturers for control system components shall be  Extron or FBISD Design Manager approved equal.

#### 16.14 Equipment Racks

16.14.1 Equipment racks shall be located in the AV/Lighting Control Booth and on stage.

16.14.2 Provide a dedicated drawer for storing Mic and Mic Accessories

16.14.3 Provide shelf for ALS system

16.14.4 Equipment racks shall be floor-standing, and feature active ventilation systems, power sequencing and locking front security doors.

16.14.5 The on-stage rack(s) shall be located on the right side of the stage (audience perspective).

16.14.6 The stage rack location shall receive a minimum of 4 dedicated x 120VAC 20 Amp circuits.

16.14.7 The AV/Lighting Control Booth rack shall receive a minimum 2 dedicated x 120VAC 20 Amp circuits.


#### 16.15 Stage Floor Box Connections

16.15.1 Renovations: If there are NOT existing floor boxes or if viable conduit and backboxes are NOT available for use with a floor box, and the renovation scope is NOT adding these in as part of the Work, then it can be omitted from the system design

16.15.2 Six (6) recessed stage boxes shall be installed in the stage. The boxes will be arranged in a two lines with three upstage and three downstage.

16.15.3 The plate shall be black anodized aluminum with white engraved labels for each connector.

16.15.4 Each floor box shall be equipped with the following connectors:

16.15.4..1  (4) Neutrik XLR Female connectors for microphones and other audio.

16.15.4..2 One (1) Neutrik XLR Male connector for monitor loudspeakers.

16.15.4..3 One (1) Neutrik Ethercon Connector for a HDBaseT video.

16.15.4..3.1 Contrctor shall turn over HDBT TX and RX equipment to FBISD IT





16.15.4..4 One (1) Ethernet network connection. Reference division 27 10 10 standards.

16.15.4..5 One (1) duplex 120VAC power receptacle on a dedicated 20A circuit

16.15.5 Acceptable manufacturer for stage floor pocket shall be **Ace Backstage** or FBISD Design Manager approved equal.

16.16 Lobby Video Feed

16.16.1 The Auditorium Lobby shall receive audio and video feeds from the auditorium so that the lobby can be used as an overflow viewing area.

16.16.2 A 65 inch flat panel display shall be mounted, centered on the wall closest to the auditorium. The display shall receive a HDBaseT feed from the video switcher. Additionally, the display will be capable of being utilized as a digital signage display.

16.16.3 Acceptable manufacturers for flat panel displays shall be **Samsung, LG** or FBISD Design Manager approved equal.

16.16.4 Digital signage players shall be Owner Furnished Owner Installed (OFOI)

16.16.5 A fixed video camera shall be installed at the control booth location so that the stage performance can be captured for viewing in the lobby.

16.16.6 A fixed video camera shall be placed at the ceiling backstage to provide a bird's eye view of the stage, camera shall have infrared capabilities.

16.16.7 Acceptable manufacturers for video camera shall be **Sony, Panasonic,** or FBISD Design Manager approved equal.

16.17 Dressing Room Feed

16.17.1 Audio and video program from the auditorium shall be made available in dressing rooms.

16.17.1..1 Display in this space are controlled locally

16.18 Performance / Backstage Intercom System

16.18.1 Provide a wireless performance intercom system to be shared between the black box and Auditorium

16.18.1..1 The system will have 10 user packs.

16.18.1..2 A rolling rack shall be provided to house the equipment.

16.18.1..3 Approved manufacturer is **Clear Comm** or FBISD approved equal.

16.19 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

**17.0 Weight Room Sound Systems**

17.1 Provide rack elevation as part of Construction Document design package.

17.2 Loudspeakers and Amplification

- 17.2.1 Weight Rooms shall receive six (6) in-ceiling loudspeakers with a 1-inch compression driver and a 6.5-inch bass driver. Loudspeakers shall have an integrated 70/100-volt transformer and be rated for a minimum of 150-watts. Acceptable manufacturer for loudspeaker shall be **JBL** or FBISD approved equal.
- 17.2.2 The loudspeaker will be powered by two channel amplifier that is rated for 300 watts per channel. @ 8ohms. The amplifier shall feature internal digital signal processing for frequency equalization and dynamic limiting.
- 17.2.3 Acceptable manufacturers for amplifier shall be **Crown, QSC** or FBISD Design Manager approved equal.
- 17.3 Public Address/Intercom Override
  - 17.3.1 The Gymnasium system's audio system will be configured to mute audio during paging events.
  - 17.3.2 Coordination with PA system contractor will be required.
  - 17.3.3 PA system contractor will be responsible for providing speaker wire to paging control relay.
  - 17.3.4 AV Contractor will be responsible for terminating speaker wire at paging control relay and configuring paging control relay.
  - 17.3.5 Paging control relay will be set to mute program audio for five (5) seconds after the paging event is over.
- 17.4 Source Devices
  - 17.4.1 Weight Rooms will receive a single gang Bluetooth wall plate receiver.
  - 17.4.2 The Bluetooth wall plate shall have an integrated 3.5mm stereo audio input located on the visible side of the wall plate.
  - 17.4.3 Acceptable manufacturers for Bluetooth wall plate receiver shall be **Atterotech by QSC** or FBISD Design Manager approved equal.
- 17.5 Audio Control System
  - 17.5.1 Each Weight Room shall receive a rack mounted DSP for mixing of all sources.
  - 17.5.2 Rack mounted DSP shall be controlled by a wall mounted single gang control keypad installed in the Weight Room.
  - 17.5.3 Wall mounted control keypad and Bluetooth wall plate shall be installed within the same electrical box.
  - 17.5.4 Acceptable manufacturers for rack mounted DSP and wall mounted single gang control panel shall be **Extron** or FBISD Design Manager approved equal.
- 17.6 Equipment Storage
  - 17.6.1 The amplifier and source devices will be stored in a wall mounted 19-inch equipment rack.
  - 17.6.2 The rack location will require one dedicated 120VAC 20A circuit with



one wall mounted quad receptacle.

17.6.3 The equipment rack will typically be located in an adjacent storage room. Exact placement will vary by project.

17.7 Consulting team shall include control and basic functionality check list for this system. Checklist and control functionality shall be coordinated with FBISD D&C and FBISD IT.

## Division 27

# Communications

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## DIVISION 27 – COMMUNICATIONS

### 27 00 00 – Communications

- 1.0 Refer to the respective architectural, mechanical and electrical divisions for additional requirements relating to structured cabling systems and coordinate all requirements.
- 2.0 Designers shall not deviate from these standards without explicit written approval from the FBISD Design Manager.
- 3.0 Comply with applicable codes, standards, AHJ.
- 4.0 Acceptable manufacturers for structured cabling system is **Panduit Mini-Com** solution utilizing **Panduit, General, Commscope, Belden, or Berk-Tek** cabling or FBISD Design Manager approved equal.

- 5.0 Structured Cabling System Contractor Qualifications:
- 5.1 Minimum 5-year experience
  - 5.2 All structured cabling systems shall be installed by an authorized and registered **Panduit Gold Certified Installer** in good standing.
  - 5.3 Certification will be submitted verifying the Contractor is a manufacturer authorized and certified Contractor.
  - 5.4 Certificates of attendance will be submitted for attendance in manufacturer's installation / maintenance training by the Contractor's directly employed personnel.
  - 5.5 Contractor's Project Manager shall be an RCDD in good standing and a fulltime employee of the company and at all on-site coordination meetings..
  - 5.6 Contractor shall have a minimum of (2) certified BICSI Installers in good standing and a full-time employee of the company and on-site at all times.
  - 5.7 RCDD and BICSI Certified Technicians will be present at the following meeting:
    - Low Voltage Preinstallation Meeting
    - Cabling System Pathway Mockup
    - Owner walks / System inspections
    - Coordination Meetings
    - And Other events as requested by the Owner
- 6.0 All structured cabling systems shall be provided with a 25-year performance warranty.
- 7.0 Full system functionality must be maintained in unaffected areas during additions and renovations.
- 8.0 Contractor shall remove and disconnect abandoned cabling above ceilings and patch wall and floor penetrations.
- 9.0 MDF/IDF room - A minimum one closet per floor to house equipment/cable terminations and associated cross-connect cable located near the center of the area being served but neither next to a restroom nor have, any plumbing in, above, adjacent to, or through the room.
- 9.1 Closets should be stacked where possible
  - 9.2 Minimum room sizes are as follows: MDF to be 150 square feet (10' X 15') and IDF to be 100 square feet (10' X 10") and to have walls lined in 3/4" fire rated plywood.
  - 9.3 No ceiling in the MDF/IDF room.
  - 9.4 Lights to be in front and behind the racks
  - 9.5 MDF/IDF penetrations use an EZ path system. Number and size of EZ Path should be determined by the number of cables going into the room plus 30% growth.
  - 9.6 IDF, no patch panels below middle horizontal wire manager, new relay rack will need to be added. Data cables terminate on third rack. (a two relay rack layout changes to a three-relay rack layout).
  - 9.7 MDF/IDF door shall swing out into corridor not into room.
  - 9.8 Floor mounted HVAC Unit shall be coordinated with MEP, Architect, and FBISD IT
    - 9.8.1 HVAC piping should be 6 inches off the wall. HVAC piping to the outside unit should not go through over or around the network cabling or equipment.
    - 9.8.2 If HVAC Unit is to be located near door it should be blocked by the furr out by the door.
- 10.0 Conduit and pathway mockup are required for Classrooms and other spaces having multiple similar instances i.e., Conference rooms, Collaboration spaces, Offices, PLC etc. Conduit pathway and rough-in installation of the similar spaces shall not commence until mockup rooms have received written approval from Owner's design manager and consultant.
- 11.0 Kronos Clock / Time Clock, coordinate height, data, power and rough-in requirements with FBISD IT.

## 27 05 26 – Grounding and Bonding for Communications Systems

- 1.0 Provide (1) Telecommunications Main Grounding Busbar (TMGB/PBB) in the MDF
- 2.0 Provide (1) Telecommunications Grounding Busbar (TGB/SBB) in each IDF.
- 3.0 Provide a Telecommunications Bonding Backbone (TBB), sized appropriately for the distance, stranded green insulated copper conductor in a star topology between the TMGB/PBB and each TGB/SBB in each building.
  - 3.1 When IDFs are stacked a single TBB can be daisy-chained between TGBs/SBBs back to the TMGB/PBBs.
- 4.0 Provide an Equipment Bonding Conductor (EBC), sized appropriately for the distance, green insulated conductor from the TMGB/PBB or TGB/SBB as applicable to each cable runway system, equipment rack, cabinet, lightning protector, or multi-pair cable with a metallic element.
  - 4.1 Install an appropriately sized stranded green insulated copper conductor from the TMGB/PBB to the main building electrical service ground in each building.
  - 4.2 In a metal frame (structural steel) building, where the steel framework is readily accessible within or external to the room, each TGB/SBB and TMGB/PBB shall be bonded to the vertical steel metal frame using a minimum #6 AWG conductor. The connection to building steel does not eliminate the requirement for the TBB or BC to the service ground.
- 5.0 Provide a Grounding Equalizer Conductor, sized appropriately for the distance, stranded green insulated copper conductor to interconnect multiple TBBs on the top floor and every 3rd floor when required by ANSI J-STD-607-D.
- 6.0 When exceeding 13 feet the conductors shall be sized at 2 kcmil per linear foot of conductor length up to a maximum of 750 KCML.

## 27 05 29 – Hangers and Supports for Communications Systems

- 1.0 Pathways shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill rate.
- 2.0 J-hooks shall be installed every 4-5 feet on center starting at the end of the wire basket cable tray. Installed no higher than 3-feet above ceiling grid.
- 3.0 J-hooks shall be installed utilizing appropriate hardware to support, join and attach j-hooks to structures.
- 4.0 No grid wire shall be utilized for support. J-Hooks shall be mounted to the structure.
- 5.0 Different media types and colors shall be secured and separated within pathways.
  - 5.1 Backbone Fiber.
  - 5.2 Backbone Copper.
  - 5.3 Horizontal Data (Blue).
  - 5.4 Horizontal Wireless (Green).
  - 5.5 Horizontal Security (Orange).

## 27 05 33 – Conduits and Backboxes for Communications Systems

- 1.0 Pathways shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill rate.
- 2.0 Flush Wall Mounted Workstations (Typ.)
  - 2.1 Provide a 4 11/16" by 4 11/16" by 2-1/8" double-gang back box with single-gang mud ring at 18 inches above the finished floor and at appropriate height for wall mounted phones and above-counter and millwork locations.
  - 2.2 Provide a minimum of (1) 1-inch conduit from the double-gang box to above accessible ceiling in the room where double-gang box is located. If ceiling is not accessible, install conduit to nearest accessible ceiling.
  - 2.3 Terminate the conduit above accessible ceiling and install nylon bushing and pull string.
- 3.0 Floor Mounted Workstations
  - 3.1 Provide a floor box or poke-thru specifically designed for the application and environment adequately sized to accommodate the quantity of installed horizontal data cables.
  - 3.2 Provide a minimum of a (2) 1-inch conduits from the floor box to above accessible ceiling.
  - 3.3 When cabling is going below grade, the appropriate OSP rated cable shall be utilized with an industry standard transition to plenum rated cable made overhead at the appropriate location with identification label attached to the ceiling grid.
- 4.0 Modular Furniture Workstations
  - 4.1 Provide a rough-in pathway designed according to the furniture type, quantity of cables, and location as required for each furniture system.
- 5.0 Above Accessible Ceiling
  - 5.1 For ceiling-mounted outlets above accessible ceiling such as Wireless Access Points or IP Cameras, no rough-in is required.
  - 5.2 The data cable will terminate into a surface-mount box secured to the structure above the accessible ceiling. No higher than 3 feet above ceiling grid preferred is 1 foot.
  - 5.3 No outlets shall be provided above an accessible ceiling that is greater than 12-ft above finished floor. If the accessible ceiling is greater than 12-ft above finished floor, the outlet shall be provided on the wall at 12-ft above finished floor, so it remains easily accessible from a standard ladder.
  - 5.4 Consultant/designer to provide detail showing coordination with architect and model.
  - 5.5 Exterior WAP locations should be coordination and provide detail/elevation showing wall and canopies.

## 27 05 36 – Cable Trays for Communications Systems

- 1.0 Pathways and cable trays shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill rate.
  - 1.1 Consultant should calculate fill rate the cable tray to determine the cable tray size.
  - 1.2 Cable tray should not be higher than 12-feet A.F.F.
- 2.0 Main cable pathways shall be wire basket cable tray from the MDF and IDF rooms for a minimum of 20-feet before transitioning to j-hooks.
- 3.0 Cable tray shall be properly grounded and bonded as per industry standards.



- 4.0 Cable tray shall be installed utilizing appropriate manufactures hardware to support, join and attach to structure.
- 4.1 Cable tray shall have a 3-inch minimum clearance from the ceiling tile to the bottom of the cable tray and 8-inch minimum clearance from the top of the cable tray to HVAC units, HVAC duct, heating ducts, and heating equipment, etc.
- 5.0 Different media types and sheath colors shall be secured and separated within pathways.
  - 5.1 Backbone Fiber.
  - 5.2 Backbone Copper.
  - 5.3 Horizontal Data (Blue).
  - 5.4 Horizontal Wireless (Green).
  - 5.5 Horizontal Security (Orange).
  - 5.6 Other systems or trades should not use the same sheath color as listed above.

## **27 05 39 – Surface Raceways for Communications Systems**

- 1.0 Pathways shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill rate.
- 2.0 At locations where the workstation outlets cannot be installed flush in the wall, a Surface Mounted Raceway that is appropriately sized and designed to meet the specific requirements shall be provided.
- 3.0 When power is provided in the surface mounted raceway a dual-channel surface mounted raceway shall be provided to separate the power from the structured cabling.
- 4.0 The use of surface mounted raceway shall only be considered when no option is available to install the workstation outlets flush in the wall and shall be approved by the FBISD Design Manager during the design.

## **27 05 43 – Underground Ducts and Raceways for Communications Systems**

- 1.0 Conduits shall be Schedule 80.
- 2.0 Conduits shall have no more than the equivalent of (2) 90-degree bends between pull boxes.
- 3.0 Conduits shall maintain a minimum bend radius of 6 times the diameter of the conduit for conduits 2-inches or smaller and 10 times the diameter of the conduit for conduits greater than 2-inches.
- 4.0 Conduits shall not exceed 40 percent fill ratio.
- 5.0 Conduits shall be a minimum depth of 36-inches from the top of the conduit to the finished grade with 3-inches of compacted sand above and below the buried conduit and an orange metallic tracer warning tape stenciled "TELECOMMUNICATIONS" 12-inches below grade throughout the entire pathway.
- 6.0 Conduits shall maintain a minimum of 12-inches of well tamped earth or 3-inches of concrete separation between any foreign conduits and/or pipes throughout the entire pathway.
- 7.0 Conduits shall be interrupted by an adequately sized manhole or pull box at least every 600 feet for sections containing up to (1) 90-degree of bend and at least every 350 feet for sections with the equivalent of (2) 90-degree bends.
  - 7.1 Manholes and pull boxes shall be of adequate depth for conduits to enter from the side of the pull box and not be required to sweep up into the bottom of box.
  - 7.2 Manholes shall have a minimum size of 5 feet long x 7 feet wide X 7 feet high with pulling eyes on either side and cable racking no more than 4 feet apart and a sump.



- 7.3 Pull boxes shall be a minimum of 36 inches long X 36 inches wide X 48 inches high.
- 7.4 All accessories such as racking, grounding and bonding, ladders and ancillary equipment shall be provided.
- 7.5 All covers shall be stenciled with **"FBISD COMMUNICATIONS"**.
- 7.6 Manholes and pull boxes shall be designed to ensure proper construction types and load ratings (i.e., traffic bearing) are observed and utilized based on the location of the pull boxes.
- 7.7 All manholes and pull boxes shall be flush with final grade.
- 7.8 Stub up into the MDF and/or IDF at 4-inches above the finished floor, no more than 2-inches from the finished wall, 3-feet minimum clearance of door entry, and installed parallel to the finished wall.
  - 7.8.1 Conduit stub up should be walked by design consultant and FBISD before back fill and before concrete is poured.
- 7.9 Contain a marked pulling tape with 1800 lbs tension strength, be fitted with bushings, and sealed appropriately at both ends.
- 8.0 Service Provider Entrance
  - 8.1 The conduit, manholes and pull box sizing and construction shall be coordinated with FBISD Design Manager and the applicable service provider(s) on a project by project basis.
  - 8.2 Provide a diverse pathway for service entrance conduits. Diverse pathways shall enter into the campus 180 degrees from each other.
  - 8.3 Provide for a minimum of (4) 4-Inch conduits from the MDF Room to the edge of the property Right-of-Way and terminate as required by the service provider(s).
    - 8.3.1 (2) 4-inch conduits shall be provided with 3-cell detectable MaxCell innerduct intended for 4-inch conduits.
    - 8.3.2 Each innerduct shall have a different color identifier.
  - 8.4 Where the service provider termination location is unidentified at the time of design, the conduits shall route from the MDF to an adequately sized manhole or pull box at least 30 feet from the building edge.
- 9.0 Campus Serving Conduits
  - 9.1 The conduit, manholes and pull box sizing and construction shall be coordinated with the FBISD Design Manager on a project by project basis.
  - 9.2 Provide a minimum of (2) 2-inch conduits from MDF to future portable building locations. Additional conduits shall be added as required if fill capacity exceeds 40 percent.
  - 9.3 Provide a minimum of (2) 4-inch conduits from the MDF to the IDF on the first floor of each additional building on the campus. Additional conduits shall be added as required if fill capacity exceeds 40 percent.
    - 9.3.1 (1) 4-inch conduit shall be provided with 3-cell detectable MaxCell innerduct intended for 4-inch conduits.
    - 9.3.2 Each innerduct shall have a different color identifier.
  - 9.4 Where only the first building of a campus is being designed, (2) 4-inch conduits for each additional future building shall route from the MDF to an adequately-sized manhole or pull box at least 30 feet from the building edge.
  - 9.5 Provide a minimum of (2) 2-inch conduit from MDF to digital marquee signage locations. Additional conduits shall be added as required if fill capacity exceeds 40 percent.

## 27 05 53 - Identification and Labeling for Communications Systems

- 1.0 Coordination with and approval by the FBISD Design Manager and FBISD IT Department is required on the specific site labeling schema.
- 2.0 All labels shall be typed (not handwritten)
- 3.0 Verify room numbers and confirm the final room numbering scheme prior to generating labels.
- 4.0 Horizontal Cables shall be labeled within 1 inch from the termination point inside the MDF/IDF.
- 5.0 Horizontal Cables shall be labeled within 3 inches from the termination point at the workstation end.
- 6.0 Backbone Fiber and Copper Cables shall be labeled within 12 inches of the visible end of the jacket.
- 7.0 Fiber Innerduct shall be labeled within 12 inches of the point of entry of the fiber optic enclosure.
- 8.0 Conduits shall be labeled at the point of entry of the conduit into a room, manhole or pull box.
- 9.0 Grounding and Bonding shall be labeled 3 inches from the termination point indicating Busbar and other attachment locations.
- 10.0 Cables shall be labeled identically at both ends.
- 11.0 MDFs and IDFs Room shall be labeled (signage) with the permanent room designations that match the final building signage for cable labeling.
- 12.0 Equipment racks in each MDF or IDF shall be labeled in sequential numeric order. Labels shall be centered on the top front of the equipment rack.
- 13.0 Fiber optic backbone cable labels shall contain the cable origin room number, the cable destination room number, fiber strand numbers, and type (i.e. MDFA150-IDFC126-12MM-001-012).
- 14.0 Fiber optic enclosures shall be labeled alpha-numeric starting with the 1st fiber optic enclosure in the top of the 1st equipment rack. A label for each terminated strand shall be securely placed inside each fiber optic enclosure.
- 15.0 Fiber optic couplers panels in fiber enclosures shall be labeled at each end by strand denoting MDF and/or IDF the cable comes from, and strand number to and from respectively (i.e. IDFC126-12MM-001-012).
- 16.0 Copper backbone cable labels shall contain the cable origin room number, the cable destination room number, and cable pairs (i.e. MDFA150-IDFC126-001-025).
- 17.0 Horizontal cables shall be labeled identically at each end with the destination end and rack number, patch panel number, and port number. (i.e. IDFC126-R1 -B5).
- 18.0 Patch panels in each closet shall be uniquely alphabetically labeled sequentially starting with the first Patch Panel in the top of the first equipment rack (i.e. A, B, C, D, E, etc.). Each MDF or IDF starts with A and shall not repeat a letter.
- 19.0 Workstation Faceplates shall be labeled denoting origin MDF/IDF Room Number, rack number, patch panel, and port number (i.e. IDFC126-R1-B5).
- 20.0 Above ceiling outlets / surface mounted boxes for WAPs, Cameras, etc. shall be labeled denoting origin MDF/IDF Room Number, rack number, patch panel and port number (i.e. IDFC126-R1-B5). An identical label shall also be placed on the ceiling grid where the outlet / surface mounted box is located along with a colored sticker the same color as the cable.



## 27 11 13 – Communications Entrance Protection

- 1.0 Inter-building backbone copper cabling shall be terminated on wall mounted UL-Listed 12-pair 110DC in/out building entrance terminal equipped with UL-Listed Category 5 5-pin solid state quick acting protector modules
- 2.0 The secondary side of the building entrance terminal shall be connected to a rack mounted 24-port patch panel with (2) plenum rated Category 5e or Category 6 24 AWG copper cable.

## 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures

- 1.0 Equipment Racks
  - 1.1 The MDF shall be equipped with a minimum (4) two-post equipment racks with (5) vertical wire managers.
  - 1.2 The IDF shall be equipped with a minimum (2) two-post equipment racks with (3) vertical wire managers.
    - 1.2.1 Rack (1) One: will all ways be on the left when facing the front of rack, will have the fiber enclosure and voice tie(s). in some cases, you will be entering the room and seeing the back side of racks.
    - 1.2.2 Rack (2) Two: will have security camera, wireless access point, and data cables
      - 1.2.2.1 no patch panels below middle horizontal wire manager, new relay rack will need to be added. Security Camera, and Wireless Access Point cables terminate on rack (2) two and Data cables terminate on (3) third rack. (a two relay rack layout changes to a three-relay rack layout).
      - 1.2.2.2 When a (3) Three rack system is required, IDF room size will need to increase in size, 10' X 13'
- 1.3 Racks shall be black aluminum Standard Equipment Racks with EIA 19-inch rails, 84-inches high (45 RMU) and rack mount unit markings on the rails from top to bottom.
- 1.4 Racks shall be bolted to the concrete floor and to the overhead cable runway utilizing manufacturer-recommended hardware and methods.
- 1.5 Racks shall have 4-ft clear in front and back of all racks and on one side of the row of racks.
  - 1.5.1 3 feet minimum from front of rack to first item (equipment panel or Wall). the preferred is 4 feet.
- 1.6 The top half of the equipment racks shall be reserved for cable terminations and the bottom half of the racks shall be reserved for equipment.
- 1.7 MDF/IDFs shall have (1) wall phone directly in front of the racks and (1) camera viewing the entry door.

## 27 11 19 – Communications Termination Blocks and Patch Panels

- 1.0 Acceptable manufacturers for termination blocks and patch panels is **Panduit** or FBISD Design Manager approved equal.
- 2.0 The Category 6 and Category 6A cables shall be terminated on the back on **Panduit** Category 6 and Category 6A angled rack mounted patch panels, which are mounted in the equipment racks.
- 3.0 Category 6 and Category 6A cables shall be terminated with the T568B sequence.
- 4.0 Each "system" shall be provided with a separate patch panel
  - 4.1 Data - Category 6
  - 4.2 Wireless - Category 6A
  - 4.3 Security Camera - Category 6

## 27 11 23 – Communications Cable Management

- 1.0 Vertical Cable Management
  - 1.1 All racks shall be equipped with vertical cable management with a hinged door.
  - 1.2 Vertical cable management shall be 10 inches wide on end of equipment racks and 10 inches wide between equipment racks.
- 2.0 Horizontal Cable Management
  - 2.1 All racks shall be equipped with a minimum of (2) horizontal cable managers with covers.
  - 2.2 One (1) horizontal cable manager shall be placed on the top of the equipment rack and one (1) horizontal cable manger shall be placed in the middle of the equipment rack.
  - 2.3 Horizontal cable management shall be 2U.
- 3.0 Power Distribution Units
  - 3.1 All equipment racks shall be equipped with two (2) Owner Furnished / Owner Installed Power Distribution Units (PDU) to be marked BLUE if connected to UPS or RED if connected to wall outlet.
- 4.0 Overhead Cable Management
  - 4.1 Overhead cable management shall be a Universal Cable Runway made of 3/8" x 1-1/2" x .065" wall rectangular steel tubing with cross members welded at 12-inch intervals.
    - 4.1.1 MDFs shall be provided with a minimum of 18-inch wide Universal Cable Runway. Runway shall be sized per manufacturer fill requirements allowing for 30% growth.
    - 4.1.2 IDFs shall be provided with a minimum of 12-inch wide Universal Cable Runway. Runway shall be sized per manufacturer fill requirements allowing for 30% growth.
    - 4.1.3 The appropriate Radius Drops shall be installed over the racks or cabinets to provide the proper support for the cabling leaving the Universal Cable Runway and entering the rack/cabinet.
    - 4.1.4 The appropriate elevation kits and protective ends shall be installed to properly support the Universal Cable Runways above the equipment racks and protects cables and equipment from damage.
    - 4.1.5 Universal Cable Runway shall be installed utilizing appropriate hardware to support, join, or attach sections to structures, and shall be supported at a minimum of 5 foot intervals.
    - 4.1.6 A vertical section of cable runway shall be attached to the wall board to manage backbone and service provider cables as they transition from the entrance conduits to the overhead cable runway.

## 27 13 13 – Communications Copper Backbone Cabling

- 1.0 Inter-Building
  - 1.1 Inter-building Backbone Copper Cabling shall be (2) OSP rated Category 5e or Category 6 4-pair 24 AWG UTP home run from the MDF to primary IDF in each of the buildings on the campus.
    - 1.1.1 Terminated one pair per port on the panel.
  - 1.2 Provide a 10-foot service loop at both ends of each cable using a U-shaped configuration, not a true loop. Cables shall be secured with hook-and-loop tie-wraps in the MDF or IDF.
  - 1.3 Provide a 10-foot service loop in each manhole or pull box.
- 2.0 Intra-Building
  - 2.1 Intra-building Backbone Copper Cabling shall be (2) Category 5e or Category 6 4-pair plenum rated 24 AWG UTP home run from the MDF to each of the IDFs in the building.
    - 2.1.1 Terminated one pair per port on the panel.
  - 2.2 Provide a 10-foot service loop at both ends of each cable in a U-shaped configuration, not a true loop. Cables shall be secured with Hook-and-loop tie-wraps in the MDF or IDF.



### **27 13 13.13 – Communications Copper Cable Splicing and Termination**

- 1.0 No splicing shall be allowed.
- 2.0 Inter-building Backbone Copper Cabling shall terminate on wall mounted building entrance terminals (that are properly grounded) and extended to rack mounted Category 5e or Category 6 24-Port punch down panels.
- 3.0 Intra-building Backbone Copper Cabling shall terminate on a rack mounted Category 5e or Category 6 24-Port punch down panel.
  - 3.1 All OSP CAT 6 cables should terminate on the wall to surge protection. Then be extended with Plenum cable run to the rack 24 port punch down panel.

### **27 13 23 – Communications Optical Fiber Backbone Cabling**

- 1.0 Inter-Building
  - 1.1 Inter-building Backbone Fiber Optic Cabling shall be OSP rated 12-Strand Armored OM3/OM4 multi-mode home run from the MDF to the primary IDF in each of the buildings on the campus and dressed with fan-out kits as required.
  - 1.2 Provide a 25-foot service loop at both ends of each cable using a U-shaped configuration, not a true loop. Cables shall be secured with Hook-and-loop tie-wraps in the MDF or IDF.
  - 1.3 Provide a 25-foot service loop in each manhole or pull box.
- 2.0 Intra-building
  - 2.1 Intra-building Backbone Fiber Optic Cabling shall be plenum rated 12-Strand Armored OM3/OM4 multi-mode from the MDF to each of the IDFs in the building.
  - 2.2 Provide a 25-foot service loop at both ends of each cable in a U-shaped configuration, not a true loop. Cables shall be secured with Hook-and-loop tie-wraps in the MDF or IDF and in the cable runway.

### **27 13 23.23 – Communications Optical Fiber Splicing and Terminations**

- 1.0 No splicing shall be allowed.
- 2.0 All fiber optic cables shall be fusion spliced to factory provided “pig-tail” LC terminated cables and installed in rack mounted enclosures.

### **27 15 00 – Communications Horizontal Cabling**

- 1.0 Acceptable manufacturers for horizontal cabling shall be a manufacturer certified and authorized to offer the required **Panduit** 25-year warranty or FBISD IT approved equal.
- 2.0 All cabling for wireless access points will be Category 6A, all cabling for all other system will be Category 6.
- 3.0 Horizontal Data Cabling shall be Category 6/6A plenum rated UTP installed from the patch panel in the MDF or IDF to the workstation location not to exceed 295 feet for the permanent link.
- 4.0 When horizontal cables are required to be installed in an outside environment or below grade, an OSP rated Category 6 cable shall be utilized with an appropriately located industry standard consolidation point. For outside environments or wet areas, the OSP cable shall be terminated with a Category 6 industrial jack rated for the environment.
  - 4.1 OSP cabling shall not terminate directly on patch panel on rack. A wall mounted transition point will be utilized. Plenum cable will

- 5.0 Provide a 10' service loop in the MDF or IDF and 10-foot of slack at the conduit stub-up above the outlet. Slack at the outlet location shall be in a U-shaped configuration, not a true loop.
- 6.0 Cable bundles shall be secured with Hook-and-loop tie-wraps.
- 7.0 For wireless access point quantities and locations, Consultant shall provide a heat map indicating the exact quantity and location of all wireless access points. This shall be coordinated through the FBISD Design Manager.
  - 7.1 Design Consultant shall coordinate with architect to insure the WAPs locations are taken into account for the graphics packages, sound dampening panels like in the band rooms and other architectural objects.
  - 7.2 Design Consultant shall coordinate with architect on WAP location at the canopies
  - 7.3 Mechanical room wireless access point shall be wall mounted
  - 7.4 GYM to have a minimum of (4) WAPs.
- 8.0 Each "system," shall be provided with a separate color Category cable:
  - 8.1 Data: CAT6 = Blue.
  - 8.2 Wireless: CAT6A = Green.
  - 8.3 IP Security Camera: CAT6 = Orange.

#### **27 15 43 – Communications Faceplates and Connectors**

- 1.0 Acceptable manufacturers for faceplates and connectors shall be **Panduit** or FBISD Design Manager approved equal.
- 2.0 At the workstation, each Category 6/6A cable shall be terminated in a **Panduit** Category 6/6A Mini-Com jack insert and snapped into a single or double-gang, faceplate. Faceplates shall be equipped with designation windows for labeling and blank inserts in unused ports.
- 3.0 Each "system" shall be provided with a separate color modular jack:
  - 3.1 Data: CAT6 = Blue.
  - 3.2 Wireless: CAT6A = Green.
  - 3.3 IP Security Camera: CAT6 = Orange.
- 4.0 Provide patch panels and/or available ports to support 30% growth for Each "system."
- 5.0 Wall phone workstations shall be equipped with a studded wall phone faceplate capable of accepting a modular jack insert.
- 6.0 All faceplate colors shall be coordinated with FBISD Design Manager and the Architect during the design.
- 7.0 When a data outlet is installed above the accessible ceiling (i.e., IP camera, WAP, etc.) the modular jack shall be inserted in surface mounted box and secured to the building structure. No higher than 3 feet above ceiling grid preferred is 1 foot.

#### **27 15 53 – Communications Fiber and Copper Cable Plant Testing**

- 1.0 All test results and As-Built shall be submitted to the owner along with all other final documentation. Test results shall be submitted in both PDF format and the Native Tester format along with the software needed to read the Native Tester Format.
- 2.0 Terminated fiber optic strands shall be tested bi-directionally end to end be and certified in accordance with applicable industry standards and manufacturer certifications requirements with an OTDR field and Light Meter tester that is within their calibration period.





- 3.0 Terminated backbone copper cable links shall be tested in accordance with applicable industry standards and manufacturer certification requirements for attenuation, continuity, and pin-mapping with approved field tester(s) that are within their calibration period.
- 4.0 Terminated Category 6/6A UTP cable links shall be tested in accordance with applicable industry standards and manufacturer certification requirements for Category 6/6A compliance with approved field tester(s) that are within their calibration period.

## **27 16 19 – Communications Patch Cords and Station Cords**

- 1.0 MDF and IDF Rooms
  - 1.1 Fiber Patch Cables – Duplex
    - 1.1.1 In the MDF and IDF Rooms furnish at the time of network installation (1) 10-foot 10GBE LC to LC fiber optic patch cable plus 25 percent spare for each terminated strand.
    - 1.1.2 Patch cable length is determined as needed per MDF and IDF Room layout and shall be coordinated with FBISD Technology Department.
  - 1.2 Copper Patch Cables (Snagless)
    - 1.2.1 In the MDF and IDF Rooms furnish at the time of network installation (1) Category 6/6A modular patch cable plus 25 percent spare for each terminated cable
      - 1.2.1.1 20% 3-foot for each of the system colors.
      - 1.2.1.2 40% 5-foot for each of the system colors.
      - 1.2.1.3 40% 7-foot for each of the system colors.
    - 1.2.2 Patch cable length is determined as needed per MDF and IDF Room layout and shall be coordinated with FBISD Technology Department.
      - 1.2.2.1 Category 6/6A patch cables for each data end user workstation outlet terminated shall be blue.
      - 1.2.2.2 Category 6/6A patch cable for each wireless access outlet terminated shall be green.
      - 1.2.2.3 Category 6/6A patch cable for each IP security camera outlet terminated shall be orange.
- 2.0 Workstations (Snagless)
  - 2.1 Furnish at the time of final substantial completion (1) Category 6/6A modular patch cable plus 25 percent spare for each terminated cable.
    - 2.1.1 Category 6 patch cables for each data end user workstation outlet terminated shall be 10-feet and blue.
    - 2.1.2 Category 6A patch cable for each wireless access outlet terminated shall be 10-feet and green.
    - 2.1.3 Category 6 patch cable for each IP camera outlet terminated shall be 10-feet and orange.
    - 2.1.4 Any device that is supposed to be installed externally (outside) should be an OSP rated patch cable

## **27 17 00 – Communications As-Built Documentation**

- 1.0 Provide drawings depicting the condition of the Structured Cabling System as installed produced in AutoCAD 2013 or higher and provided in hardcopy, electronically in .DWG and .PDF format. Drawings shall be sealed by a current BICSI certified RCDD and shall include but not be limited to the following:
  - 1.1 Region lines identifying exactly which data drops are served from which MDF / IDF
  - 1.2 Exact locations of MDF and IDF Rooms
  - 1.3 MDF and IDF Room layouts with exact dimensions
  - 1.4 MDF and IDF Room wall elevations
  - 1.5 MDF and IDF Room equipment rack elevations
  - 1.6 Cable pathways, including cable runways, cable tray, sleeves, backbone and horizontal cable pathways
  - 1.7 Data drop locations for all data drops (data, voice, wireless, security, etc.)

- 1.8 Correct room numbers identified
- 1.9 Correct labeling scheme with all data drops labeled.
- 2.0 A laminated half-size hard copy of the as-built drawings for the applicable region served by the MDF and/or IDFs shall be provided in MDF and each IDF for reference.
- 3.0 Provide cable records for the Structured Cabling System as installed to include a list of all horizontal and backbone cables produced in an Excel format and provided in hardcopy and electronic format indicating cable number, unique cable label, cable type, origin and destination, length, termination method, and pass/fail result.
- 4.0 Provide (3) hard copies of all test results for each cable, to include technician's name and date stamp, a list of tested cables, and the individual results for each cable tested. Test results shall be furnished on CD ROM to include native file format and .PDF format.
- 5.0 At the time of network installation install, complete Communication As-Built Documentation to be provide to FBISD.

#### **END OF DIVISION 27 - COMMUNICATIONS**

## Division 27

# Public Address System Wireless Clock System

General Requirements for Public Address System / Wireless Clock System	27 51 00
Operations and Maintenance for Public Address System / Wireless Clock System	27 01 00
Common Work Results for Public Address System / Wireless Clock System	27 05 00
Commissioning of Public Address System / Wireless Clock System	27 08 00
Public Address System	27 51 23
Wireless Clock System	27 53 15

### **DIVISION 27 – PUBLIC ADDRESS SYSTEM / WIRELESS CLOCK SYSTEM**

#### **27 51 00 – General Requirements for Public Address System / Wireless Clock System**

- 1.0 Designers shall not deviate from these standards without explicit written approval from the FBISD Design Manager.
- 2.0 Comply with applicable codes, standards, AHJ.
- 3.0 Designer shall coordinate all systems with the respective divisions (architectural, mechanical, electrical, communications, etc.)
- 4.0 All software, configurations, programming, passwords, etc. required for FBISD to make routine changes to the system for bell schedules, zoning, etc must be provided.
  - 4.1 Provide a dedicated computer with the PA software installed. This computer would stay onsite so that administrators could add/delete schedules as required.
  - 4.2 Coordinate with FBISD IT for the PC requirements.
- 5.0 Full system functionality must be maintained in unaffected areas during additions and renovations.
- 6.0 Prior to commencing any work in an existing building, the Contractor will be required to perform a system test to demonstrate the current state of the system. At substantial completion or when the system is ready to be tested, a demonstration is required by the Contractor to verify that the system is in the same condition prior to construction. If the system is not 100% functional, the Contractor shall make all necessary repairs to

the system.

- 7.0 Contractor shall disconnect and remove any abandoned PA equipment in renovation projects.
- 8.0 Contractor shall remove any abandoned PA cabling above ceilings and patch all wall and floor penetrations.
- 9.0 All removed headend equipment shall be returned to FBISD unless otherwise directed by FBISD Project Manager.
- 10.0 Public Address System and Wireless Clock System Contractor's Qualifications:
  - 10.1 Minimum of 5 years experience.
  - 10.2 Certification will be submitted verifying the Contractor is the manufacturer's authorized Contractor.
  - 10.3 Certificates of attendance will be submitted for attendance in manufacturer's installation / maintenance training by the Contractor's directly employed personnel.
  - 10.4 Provide 24 hour support, 7 days a week within 2 hours during normal business day and 4 hours during non-business hours.

## **27 01 00 – Operation and Maintenance of Public Address System / Wireless Clock System**

- 1.0 Provide for (4) hours of training for two (2) persons on each system.
- 2.0 Training shall be conducted on-site with a manufacturer's representative.
- 3.0 Training / demonstration shall provide for a "user's manual" written specifically for the school personnel onsite, for daily routine operations of the system.
- 4.0 Provide a test report showing the system has been 100% tested and is 100% operational prior to training / demonstration.
- 5.0 Electronic pdf as-built drawings in 11" X 17" format will be required for final closeout of the project. Close out drawings must include details indicating the actual wiring layout and installed locations of all devices such as speakers, handsets, etc. Close out drawings must also include model numbers and serial numbers of all equipment installed. Laminated PDF copies of the as-built drawings shall be mounted next to the panels in the MDF / IDF Rooms.

## **27 05 00 – Common Work Results for Public Address System / Wireless Clock System**

- 1.0 All public address system cabling shall be **white** in color.
- 2.0 All public address system cabling shall be plenum rated.
- 3.0 All public address system cabling shall be installed following the same pathway and requirements as the Division 27 Communications.
- 4.0 All pathways shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill rate.
- 5.0 All cabling shall be properly supported from the structure using j-hooks.
- 6.0 J-hooks shall be installed every 4-5 feet on center starting at the end of the wire basket cable tray.
- 7.0 J-hooks shall be installed utilizing appropriate hardware to support, join and attach j-hooks to structures.



- 8.0 No grid wire shall be utilized for support. J-Hooks shall be mounted to the structure.
- 9.0 Provide spare conduits at bulk heads, furr downs and at hard ceiling areas separating sections of buildings. Intent is to provide a future cabling pathway through inaccessible areas.
- 10.0 All labels for public address system cabling shall be typed (not handwritten).

## **27 08 00 – Commissioning of Public Address System / Wireless Clock System**

- 1.0 All public address and wireless clock systems shall be commissioned ensuring 100% system functionality and operation.

## **27 51 23 – Public Address System**

- 1.0 Acceptable manufacturers shall be **Carehawk, Rauland, Bogan and TeleCor**.
- 2.0 Provide a programmable and addressable system to every occupied space and to the exterior of the building.
- 3.0 Provide for 2-way communications to every interior occupied space. Exterior spaces do not require 2-way communication.
- 4.0 Provide activation of security monitoring functions on a per room basis and per zone basis. Amplified two-way voice communications shall be available from any dial phone in the system, through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is open and a supervisory tone shall sound at regular intervals when speaker monitoring is active.
- 5.0 The public address system shall provide for bell changes and shall be capable of storing events, schedules, programmable holidays, bells silenced, etc.
- 6.0 Provide for integration with the synchronized wireless clock system.
- 7.0 Provide for integration with the audio | visual systems allowing for “Priority Page Override” capability.
- 8.0 Provide for data network cables as required for network connectivity.
- 9.0 The public address system shall be provided with a UPS with a (60) minute capacity.
- 10.0 The public address system shall be connected to the emergency generator, when available.
- 11.0 The public address system **must** integrate with the FBISD Cisco VoIP phone system.
  - 11.1 An FXO interface will not be accepted.
  - 11.2 A SIP interface the public address system manufacturer certifies will work with the Cisco Call Manager 12.0 is preferred. If a SIP interface is not available, provide a Viking RAD-1A, a Cisco ATA190 and an analog phone for testing.
    - 11.2.1 FBISD will configure the ATA190 on the Cisco Call Manager.
    - 11.2.2 The Contractor will configure the Viking RAD-1A and make the interconnection between the network switch, Cisco ATA190, Viking RAD-1A and Public Address System.

- 12.0 Provide for the increase of stations by 25 percent above those required for the initial design without adding any internal or external components.
- 13.0 The public address system shall not be located within the MDF room or IDF room. Design Consultant to coordinate with architect and MEP to find wall space for the pa system and any cross termination required . All wall mounted equipment shall be mounted on fire rated plywood with dedicated electrical receptacles located next to the panels on the fire rated plywood.
- 14.0 Provide the following program sources installed in a remote desk intercom cabinet installed at the reception area.
  - 14.1 AM / FM Receiver/CD with Mixer/Preamp and Monitor Loudspeaker
  - 14.2 CD/MP3-iPod Player
  - 14.3 8-input stereo mic/line mixer
- 15.0 Zoning shall be coordinated with FBISD Design Manager during the design phase for each project. At a minimum, sixteen (16) separate paging zones shall be provided and each location shall be programmed in software to belong to any combination of software zones. Initially zones shall be provided for the following:
  - 15.1 One zone for inside classroom speakers [GRADE K] through [GRADE 1]
  - 15.2 One zone for inside classroom speakers [GRADE 2] through [GRADE 3]
  - 15.3 One zone for inside classroom speakers [GRADE 4] through [GRADE 5]
  - 15.4 One Zone for inside classroom Speakers [GRADE 6]
  - 15.5 One Zone for inside classroom Speakers [GRADE 7] through [GRADE 8]
  - 15.6 One Zone for inside classroom Speakers [GRADE 9]
  - 15.7 One Zone for inside classroom Speakers [GRADE 10]
  - 15.8 One Zone for inside classroom Speakers [GRADE 11]
  - 15.9 One Zone for inside classroom Speakers [GRADE 12]
  - 15.10 One zone for gymnasium speakers
  - 15.11 One zone for cafeteria speakers
  - 15.12 One zone for common area speakers
  - 15.13 One zone for administration areas
  - 15.14 One zone for teacher's lounge and workrooms
  - 15.15 One zone for outside speakers
- 16.0 Speakers
  - 16.1 Acceptable manufacturers shall be **Atlas Sound, Lowell Manufacturing Company, Quam-Nichols.**
  - 16.2 Provide 2 ft x 2 ft recessed lay-in speakers tile assembly in interior spaces.
  - 16.3 Provide 8 inch full range recessed wall mounted speakers with dual 25/70 volt transformer at 9-feet above finished floor in high volume areas.
  - 16.4 Provide speakers in the following locations:
    - 16.4.1 Classrooms
    - 16.4.2 Offices
    - 16.4.3 Conference Rooms
    - 16.4.4 Administrative Areas
    - 16.4.5 Corridors
    - 16.4.6 Gymnasiums
    - 16.4.7 Cafeteria
    - 16.4.8 Restrooms
    - 16.4.9 Common Areas

#### 16.4.10 Exterior Perimeter of Entire Facility

16.4.10.1 Exterior speakers shall be provided with surge protection

16.4.10.2 Exterior speakers shall be weatherproof / program speakers. Speakers shall be UL listed for flush mounted waterproof type paging speakers for voice and tones with matching transformer.

17.0 Provide administrative handsets with 12-digit keypad to transmit calls to other stations and initiate commands for programming and operation at the following locations:

17.1 Front Desk

17.2 Principal's Office

17.3 Assistant Principal's Office

17.4 Nurse's Office

17.5 Attendant's Office

17.6 Each dialing administrative telephone in the system shall be programmable for the following options:

17.6.1 Allow zone paging

17.6.2 Allow All-Page announcements

17.6.3 Allow Executive Override

17.6.4 Allow Emergency Paging

17.6.5 All activation of Time Zone tones

17.6.6 Set the priority level and target display or "normal" calls

17.6.7 Set the priority level and target display of "emergency" calls

17.6.8 Assignment of architectural number

17.6.9 Class of service

17.6.10 Assignment of associated speaker to paging zone

17.6.11 Automatic Call-Back Busy

17.6.12 Call Forward-No Answer

17.6.13 Call Forward-Busy

18.0 Provide microphone with desk stand and integral-locking, press-to-talk switch at the following locations:

18.1 Front Desk

19.0 Provide volume control in the following locations:

19.1 Offices

19.2 Conference Rooms

19.3 Administrative Areas

19.4 Large Teaching Areas

19.5 Special Education Classrooms

19.6 Auditoriums

19.7 Band

19.8 Orchestra

19.9 Choir

19.10 Cafeteria



## 27 53 15 – Wireless Clock System

- 1.0 Acceptable manufacturers shall be **American Time and Signal, Sapling and Bogan**
- 2.0 The master clock shall provide but not be limited to the following functions:
  - 2.1 Up to (16) programmable schedules.
  - 2.2 Selection of any of (16) schedules to allow flexibility due to seasonal changes or special events.
  - 2.3 Bells to be silenced or special schedules to be implemented for special events.
  - 2.4 Non-volatile memory capacity for storing up to 500 events and up to 100 calendar dates for schedule changes
  - 2.5 Ability to review, edit and delete events via Windows PC running the configuration program
  - 2.6 Events shall be programmable to any or all zone circuits.
  - 2.7 User programmable Automatic Daylight Saving Time Change
  - 2.8 Separate bell tone selection and separate bell duration for each event
- 3.0 The wireless clock system shall maintain synchronized time and transmit over wireless radio frequency from a master clock transceiver to secondary clocks.
- 4.0 The wireless clock system shall integrate into the public address system and bell schedule to provide for storing events, schedules, programmable holidays, bells silenced, etc.
- 5.0 The wireless clock system shall function autonomously, meaning it does not rely on Wi-Fi or Bluetooth technology.
- 6.0 It is preferred the wireless clock system does not require an FCC license. If an FCC license is required, it shall be provided by the manufacturer / integrator of the wireless clock system.
- 7.0 The wireless clock system **must** be integrated with the Public Address System
- 8.0 The wireless clock system shall provide full coverage of the entire facility.
- 9.0 Analog Clocks
  - 9.1 Analog clocks shall be provided with a sweep second hand.
  - 9.2 Analog clocks shall be battery operated.
  - 9.3 Provide 12-inch double face analog clocks at the following locations:
    - 9.3.1 Elementary Schools
      - 9.3.1.1 Corridors
  - 9.4 Provide 15-inch single face analog clocks at the following locations:
    - 9.4.1 Elementary Schools
      - 9.4.1.1 Gymnasium (Provide Wire Guard)
      - 9.4.1.2 Cafeteria
      - 9.4.1.3 Dining Area
      - 9.4.1.4 Library
      - 9.4.1.5 Rooms over 2,500 sq. ft.
- 10.0 Digital Clocks
  - 10.1 All digital clocks shall provide a (4) digit display with 4-inch digits.
  - 10.2 Provide single face digital clocks at the following locations:



10.2.1.1 Gymnasium (Provide Wire Guard)

10.2.1.2 Cafeteria

10.2.1.3 Dining Area

10.2.1.4 Library

10.2.1.5 Rooms over 2,500 sq. ft.

10.3 Provide dual face digital clocks at the following locations:

10.3.1 Secondary Schools

10.3.1.1 Corridors

**END OF DIVISION 27 – PA/CLOCK SYSTEMS**

## Division 28

# Security and Life Safety

General Requirements for Security	28 00 00
Operations and Maintenance for Electronic Safety and	28 01 00
Common Work Results for Electronic Safety and Security	28 05 00
Access Control	28 13 00
Intrusion Detection	28 16 00
Video Surveillance	28 23 00
General Requirements for Fire Detection and Alarm	28 31 00
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Sequence of Operation for Fire Alarm Detection	28 31 20
Fire Alarm – Devices and Installation Requirements	28 31 30
Distributed Antenna System (DAS)	28 50 00

### DIVISION 28 – SECURITY AND LIFE SAFETY

#### 28 00 00 – General Requirements for Security

- 1.0 Designers shall not deviate from these standards without explicit written approval from the FBISD Design Manger.
- 2.0 FBISD Police Department / Life Safety Department shall be consulted on every project.
- 3.0 Comply with applicable codes, standards, AHJ.
- 4.0 Designer shall coordinate all systems with the respective divisions (architectural, mechanical, electrical, communications, door hardware, etc.)
- 5.0 Full system functionality must be maintained in unaffected areas during additions and renovations.
- 6.0 Prior to commencing any work in an existing building, the Contractor will be required to perform a system test to demonstrate the current state of the system. At substantial completion or when the system is ready to be tested, a demonstration is required by the Contractor to verify that the system is in the same condition prior to construction. If the system is not 100% functional, the Contractor shall make all necessary repairs to the system.

- 7.0 Contractor shall remove and disconnect abandoned access control, intrusion detection and video surveillance equipment in renovation projects.
- 8.0 Contractor shall remove any abandoned cabling above ceilings and patch wall and floor penetrations in renovation projects.
- 9.0 All removed equipment shall be returned to FBISD Police Department / Life Safety Department.
- 10.0 Security and Life Safety Systems Contractor's Qualifications:
  - 10.1 Minimum of 5 years experience in security industry.
  - 10.2 Certified by manufacturer for sales and service of equipment.
  - 10.3 Provide 24 hour support, 7 days a week within 2 hours during normal business day and 4 hours during non-business hours.
  - 10.4 Licensed in the State of Texas
  - 10.5 Contractor shall pay for all applicable permits.
  - 10.6 Submitting Contractor must be certified to install products and services for systems they are proposing. No subcontract of services will be allowed for any security scope of work. Contractor must submit to the Owner prior to starting any work the factory training certifications for all personnel that will be working on the system.
- 11.0 All cabling shall be installed in accordance with Div. 27 installation standards,
  - 11.1 Reference FBISD structured cabling standards for additional details
  - 11.2 An RCDD will review and approve ALL Div. 28 cabling installation. The installing contractor shall be responsible for contracting with and RCDD if the installing company does NOT have and RCDD on staff.
- 12.0 All cabling installed in exposed areas shall be in conduit,
- 13.0 All cabling shall be rated for the space that is installed in

## **28 01 00 – Operation and Maintenance for Security and Life Safety**

- 1.0 Provide for (4) hours of training for two (2) persons on each system.
- 2.0 Training shall be conducted on-site with a manufacturer's representative.
  - 2.1 After training and FBISD review of the system, Contractor may be required to readjust camera angles which will be included in the base costs.
- 3.0 Training / demonstration shall provide for a "user's manual" written specifically for the school personnel onsite, for daily routine operations of the systems.
- 4.0 Provide a test report showing the system has been 100% tested and in 100% operational prior to training / demonstration.
- 5.0 Prior to substantial completion, the security camera contractor shall submit a detailed spreadsheet showing camera numbers, room area of viewing and IP addresses to district for their use.
- 6.0 As built drawings for the security systems must include model number, serial number and installed location for each security device (i.e., camera, card reader, motion detector, etc.)
  - 6.1 As-built drawings shall clearly identify all separate arming zones.
    - 6.1.1 Example: Each detection device shall be home run to a dedicated zone. Each zone shall be on a floor plan with zone number, device type, device location. Keypad, main panel, zone expanders shall also be identified on the map. This will assist in troubleshooting faults or alarm.

- 6.1.2 Contractor shall provide (2) 11" x 17" laminated drawings of Intrusion System Zone map. Contractor shall turn over to FBISD Life safety Manager.
- 6.1.3 Contractor shall provide (1) 30" x 42" laminated drawings of Intrusion System Panel wiring diagram for each panel. Contractor shall turn over to FBISD Life Safety Manager.
- 7.0 Electronic pdf as-built drawings will be required for final closeout. Close out drawings must include final installed locations, model numbers and serial numbers of all installed equipment. Include this requirement for all Division 28 systems.

## **28 05 00 – Common Work Results for Security and Life Safety**

- 1.0 All security system cabling shall be orange in color.
- 2.0 All security system cabling shall be plenum rated, unless installed in a wet or exterior environment. Cable shall be rated for the environment in which it is installed in.
- 3.0 All security system cabling shall be installed following the same pathway and support requirements as the Division 27 Communications.
- 4.0 Pathways shall be sized according to the manufacturer specifications and provide for 30% growth without exceeding the 40% fill rate.
- 5.0 All cabling shall be properly supported from the structure using j-hooks, includes solid support.
- 6.0 J-hooks shall be installed every 4-5 feet on center starting at the end of the wire basket cable tray.
  - 6.1 If a wire basket tray is not present, then J-hooks shall be provided throughout the entire pathways.
- 7.0 J-hooks shall be installed utilizing manufacturer recommended and approved hardware and methods to support, join and attach j-hooks to structures.
- 8.0 No grid wire shall be utilized for support. J-Hooks shall be mounted to the structure.
- 9.0 Provide spare conduits at bulk heads, furr downs and at hard ceiling areas separating sections of buildings. Intent is to provide a future cabling pathway through inaccessible areas.
- 10.0 All labels for security cabling shall be typed (not handwritten). Label individual access control cabling with door number and termination point location similar to IT cabling standards.

## **28 13 00 – Access Control**

- 1.0 Acceptable manufacturers for access control system is **Win DSX** or FBISD Design Manager approved equal.
- 2.0 The access control server is Owner Furnished / Owner Installed (OFOI).
- 3.0 The Contractor will be provided access to the OFOI server for "general" programming. The Contractor shall provide for the following "general" programming of the access control system. FBISD will then complete the detailed programming.
  - 3.1 Naming of all doors
  - 3.2 General access level at all doors
  - 3.3 General access level is all doors are locked 24/7/365

- 4.0 The Basis of Design for the access control system shall be:
  - 4.1 Intelligent 2 Door Package NV (Nonvolatile Memory) Processor DSX-1042PKG NV
  - 4.2 Intelligent 8 Door Package DSX-1048PKG
  - 4.3 Intelligent 2 Door Controller Package DSX-1042PKG
  - 4.4 Two Door Controller DSX-1042
    - 4.4.1 Power Distribution Panel DSX-1040PDP
    - 4.4.2 24V Lock Power Supply SP320-27
  - 4.5 ThinLine II Low Profile Proximity Card Reader DSXID-TL5395
  - 4.6 Latching Hold-up Switch HUSK20
  - 4.7 Hold-up Button Momentary Panic HUB-2SA
  - 4.8 Door position sensor shall monitor door status Amseco AMS-25B-G
- 5.0 For new construction projects, all access control controller panels and associated power supplies shall reside in Mechanical Rooms, coordinate with MEP for locations. For renovation projects, controller panels will be handled in a case by case scenario. If an existing controller panel and power supply has already been established in MDF/IDF's, then it shall remain.
  - 5.1 Controller panels and power supplies shall be provided with dedicated 30AMP electrical receptacles located next to the panels on the fire rated plywood. Dedicated electrical receptacle(s) shall be connected to the Building's Emergency Electricity Backup System.
  - 5.2 Controller panels and associated power supplies shall be equipped with (12VDC / 24VDC) battery backup as required. Batteries shall be installed with a printed labels indicating the date of installation.
- 6.0 Provide a data network connection for the control panels.
- 7.0 Provide emergency power for the control panels.
- 8.0 Provide electric panic devices (quiet electric latch retraction) on all exterior doors with a card reader so loss of power will not leave doors unsecured.
- 9.0 Locks on interior security vestibule doors shall fail open in the event of a loss of power or in the event of a fire alarm.
- 10.0 Provide a "secondary" student access point at all secondary schools.
  - 10.1: Provide a video intercom or FBISD Design Manager approved equivalent) connected to the reception area and the ELP reception area with a remote door hardware release. - (Per REVISION No.01) Door station part number – AIPhone Flush Mount Door Station (IX-DV).
    - 10.1.1: Door stations shall be located at main entrance, closest entrance into main building from the field house, entrances from courtyards, closest entrance into main building from temporary classroom buildings. Designer shall verify if any vehicle / pedestrian gates will require video intercom stations. Non-campus buildings / Ag barns may require coordination for master and door station locations.
  - 10.2: Confirm with FBISD Police during design development if a video intercom is required at the nearest entrance from any potential temporary classroom buildings location. - (Per REVISION No.01)
  - 10.3: Master intercom station AIPhone (IX-MV) shall be installed at the **Reception desk and ELP desk.**
- 11.0 Provide a hard-wired under desk momentary door release button for the secure vestibule doors at the **Reception desk, and Extended Learning Program Reception desk.** This button shall be located in a separate location than the panic button in order to avoid false alarms.

- 12.0 Provide a hard-wired lock down button (blue mushroom button) with cover located by the fire alarm panel inside the **administration area**. Each campus will be handled on a case by case scenario.
- 12.1.1 For panic button reference Div. 28 16 00.
- 13.0 All doors at the main entrance shall be provided with electrified hardware to allow for doors to be placed on schedule for locking / unlocking of the doors.
- 14.0 Provide card readers at the following locations, final locations to be reviewed with FBISD Life Safety and Police Department and FBISD Design Manager:
- 14.1 Elementary Schools:
- 14.1.1 Exterior Kitchen Entrance
  - 14.1.2 Front Entrance to Building
  - 14.1.3 Security Vestibule Doors
  - 14.1.4 Nearest entrance to Staff Parking Lot
  - 14.1.5 Nearest Entrance to Bus Loading Area
  - 14.1.6 MDF and IDF Rooms
  - 14.1.7 All Exterior Doors
  - 14.1.8 At Administration Area – On Main Door Leading to Main Corridor and Lobby
  - 14.1.9 Records Room
  - 14.1.10 Testing Materials Room
  - 14.1.11 Satellite buildings doors shall be coordinated with the Owner during the design process to verify which doors, if any, will require access control.
  - 14.1.12 Pedestrian / Vehicle gates shall be coordinated with the Owner during the design process to verify which gates, if any, will require access control.
- 14.2 Middle Schools
- 14.2.1 Exterior Kitchen Entrance
  - 14.2.2 Front Entrance to Building
  - 14.2.3 Security Vestibule Doors
  - 14.2.4 Nearest entrance to Staff Parking Lot
  - 14.2.5 Nearest Entrance to Bus Loading Area
  - 14.2.6 Nearest Entrance to Athletic Fields
  - 14.2.7 MDF and IDF Rooms
  - 14.2.8 Vault Rooms
  - 14.2.9 All Exterior Doors
  - 14.2.10 At Administration Area – On Main Door Leading to Main Corridor and Lobby
  - 14.2.11 Records Room
  - 14.2.12 Testing Materials Room
  - 14.2.13 Satellite buildings doors shall be coordinated with the Owner during the design process to verify which doors, if any, will require access control.
  - 14.2.14 Pedestrian / Vehicle gates shall be coordinated with the Owner during the design process to verify which gates, if any, will require access control.
- 14.3 High Schools
- 14.3.1 Exterior Kitchen Entrance
  - 14.3.2 Custodial Entrance, if Different from Kitchen Entrance
  - 14.3.3 Front Entrance to Building
  - 14.3.4 Security Vestibule Doors
  - 14.3.5 Nearest entrance to Staff Parking Lot
  - 14.3.6 Nearest Entrance to Bus Loading Area
  - 14.3.7 Nearest Entrance to Athletic Fields
  - 14.3.8 Nearest Entrance to Fine Arts
  - 14.3.9 Main Entrance to Field House
  - 14.3.10 MDF and IDF Rooms
  - 14.3.11 Chemical Storage Room
  - 14.3.12 Vault Rooms



## 14.3.13 All Exterior Doors

14.3.14 At Administration Area – On Main Door Leading to Main Corridor and Lobby

## 14.3.15 Records Room

## 14.3.16 Testing Materials Room

## 14.3.17 Field House

14.3.18 Satellite buildings doors shall be coordinated with the Owner during the design process to verify which doors, if any, will require access control.

14.3.19 Pedestrian / Vehicle gates shall be coordinated with the Owner during the design process to verify which gates, if any, will require access control.

15.0 Provide door position sensors on all doors with card readers.

16.0 Provide for one hundred (100) access control cards per facility. Coordination with FBISD Design Manager is required for the exact type for each facility. **Only for new construction projects.****28 16 00 – Intrusion Detection**1.0 Acceptable manufacturers for intrusion detection system is **Ademco** or FBISD Design Manager approved equal.

2.0 The Basis of Design for the intrusion detection system shall be:

2.1 Main intrusion control panel, Honeywell (Resideo) VISTA-250BPT

2.2 Alpha Display Keypad, **VISTA 6160**2.3 Eight input alarm module, **VISTA 4208U**2.4 Panoramic 360 Ceiling 60' motion, **DS938Z**2.5 Panoramic 360 Ceiling 25' motion, **DS936**2.6 TriTech 60x60 PIR Microwave Detector, **DS860**2.7 Long Range TriTech PIR Detector, **DS720**2.8 3/4 recessed gray door contact, **Amseco AMS-25B-G**2.9 Overhead door contacts **Amseco ODC-59A**2.10 Self Contained, dual tone surface mount indoor siren, **SS-2**2.11 Relay Module - Interlock with Lighting Controls System, **ADEMCO 4204**

3.0 The intrusion detection system shall be a single zone at all schools.

3.1 Interlock with security system to turn off all contactor controlled fixtures upon arming of system.

3.2 Interlock with security system to turn on all contactor controlled fixtures upon intruder activation.

3.3 Interlock with security system to enable partial lighting when system is first disarmed via contactor schedule.

3.4 Intent is to have three inputs from security system: armed, disarmed and activated.

4.0 The only "delays" allowed for the intrusion detection system shall be where keypads are located.

5.0 For new construction projects, all intrusion control panels and associated power supplies shall reside in Mechanical Rooms, coordinate with MEP for locations. For renovation projects, control panels will be handled in a case by case scenario. If an existing control panel and power supply has already been established in MDF/IDF's, then it shall remain. Control panels and power supplies shall be provided with dedicated 30AMP electrical receptacles located next to the panels on the fire rated plywood. Dedicated electrical receptacle(s) shall be connected to the Building's Emergency Electricity Backup System. The master control panel shall not be plugged into a UPS. Control panels and associated power supplies shall be equipped with (12VDC / 24VDC) battery backup as required. Batteries shall be installed with a printed labels indicating the date of installation.

- 6.0 Dial out method shall be coordinated with FBISD Design Manager, FBISD IT, and FBISD security. Current method is IP based for primary call, back up is cellular. Coordinate with FBISD IT for cellular dialer information
- 7.0 Provide a hard-wired under desk latching panic button at the **Reception area, Principal's office, and Principal's secretary's office** that will alert the FBISD Police Department via Intrusion system dialer. Contractor shall test with FBISD Life Safety Manager to verify signal.
- 8.0 Provide emergency power for the control panels.
- 9.0 Provide keypads at the following locations:
  - 9.1 Elementary Schools:
    - 9.1.1 Exterior Kitchen Entrance
    - 9.1.2 Front Entrance to Building
  - 9.2 Middle Schools
    - 9.2.1 Exterior Kitchen Entrance
    - 9.2.2 Front Entrance to Building
    - 9.2.3 Nearest Entrance to Athletic Fields
  - 9.3 High Schools
    - 9.3.1 Exterior Kitchen Entrance
    - 9.3.2 Custodial Entrance, if Different from Kitchen Entrance
    - 9.3.3 Front Entrance to Building
    - 9.3.4 Nearest Entrance to Athletic Fields
    - 9.3.5 Nearest Entrance to Fine Arts
    - 9.3.6 Main Entrance to Field House
- 10.0 Provide motion detectors at the following locations:
  - 10.1 All Entrances
  - 10.2 All Computer Rooms
  - 10.3 All First Floor Rooms with Windows
  - 10.4 All Second Floor Rooms that are Accessible from the Roof, Wall, Fences, etc.
  - 10.5 Stairwell lobbies at 2nd Floor
- 11.0 Provide door position sensors at the following locations:
  - 11.1 All Roof hatches.
  - 11.2 All Exterior Mechanical Rooms, fire riser, and exterior storage rooms.

## 28 23 00 – Video Surveillance

- 1.0 Acceptable manufacturers for video surveillance system is **Video Insight** or FBISD Design Manager approved equal.
- 2.0 The video surveillance server shall be Owner Furnished / Owner Installed (OFOI).
- 3.0 All programming and configuration of the video surveillance systems shall be accomplished by FBISD.
- 4.0 Provide for all required software / licenses required per facility.
- 5.0 Provide for going back to adjust the camera angles and views one (1) time per camera.
- 6.0 Provide a data network connection for the server.
  - 6.1 Provide a data network connection to each IP camera.

- 6.2 All cameras within 295 feet (total cable length) from the associated PoE switch, shall receive power via owner provided PoE switch.
- 6.3 All exterior pole mounted cameras shall receive power via powered fiber solution.
- 7.0 Typical camera counts per facility are as follows but will be reviewed with FBISD Design Manager and FBISD Police Department during 50% CD.
  - 7.1 Elementary Schools: 50 – 75
  - 7.2 Middle Schools: 100 - 150
  - 7.3 High School: 125 – 200
- 8.0 All cameras shall be fixed, unless otherwise directed by FBISD Police Department.
- 9.0 The Basis of Design for camera types shall be:
- 10.0 New Cameras as of 10/26/2021
  - 10.1 Outdoor Stadiums / Stadium Parking Lots / HS, MS Campus Parking Lots- 4x4K (33MP) H. 265 Multi Sensor
    - 10.1.1 **Panasonic WV-X8571N**
  - 10.2 Outdoor Building Perimeter - 8MP Multi Sensor H.265
    - 10.2.1 **Panasonic WV-S8531N**
  - 10.3 Outdoor - 5MP Outdoor Camera
    - 10.3.1 **Panasonic WV-S2552L**
  - 10.4 Indoor Common Areas / Indoor Hallways/ Sped - 5MP Indoor Camera
    - 10.4.1 **Panasonic WV-S2252L**
  - 10.5 Stairwells - 360 5MP Camera
    - 10.5.1 **Panasonic WV-S4151**
- 11.0 Provide cameras at the following locations final locations to be reviewed with FBISD Life Safety and Police Department and FBSD Design Manager:
  - 11.1 Elementary School
    - 11.1.1 All Entrances / Exits
    - 11.1.2 Front Office / Administration Area / Secure Vestibule
    - 11.1.3 Main Corridors
    - 11.1.4 Second Floor Corridors (Open to the First Floor)
    - 11.1.5 Stairwell Landings
    - 11.1.6 Common Areas (Interior and Exterior)
    - 11.1.7 Kitchen Serving Lines
    - 11.1.8 Restroom Entrances & Water Fountains
    - 11.1.9 Isolated Areas
    - 11.1.10 Bus Loading / Unloading Areas
    - 11.1.11 Parent Drop Off / Pick-Up Area
    - 11.1.12 Playground
    - 11.1.13 Staff Parking Area
    - 11.1.14 Kitchen Delivery Areas
    - 11.1.15 Loading / Unloading Areas (Band, Athletics, etc.)
    - 11.1.16 Portable Buildings
    - 11.1.17 School Perimeter
    - 11.1.18 MDF/IDF Rooms
  - 11.2 Middle Schools
    - 11.2.1 All Entrances / Exits
    - 11.2.2 Secondary Student Entrance
    - 11.2.3 Front Office / Administration Area / Secure Vestibule
    - 11.2.4 Main Corridors
    - 11.2.5 Second Floor Corridors (Open to the First Floor)
    - 11.2.6 Stairwell Landings
    - 11.2.7 Common Areas (Interior and Exterior)
    - 11.2.8 Kitchen Serving Lines
    - 11.2.9 Restroom Entrances & Water Fountains

- 11.2.10 Isolated Areas
- 11.2.11 Bus Loading / Unloading Areas
- 11.2.12 Parent Drop Off / Pick-Up Area
- 11.2.13 Staff Parking Area
- 11.2.14 Kitchen Delivery Areas
- 11.2.15 Loading / Unloading Areas (Band, Athletics, etc.)
- 11.2.16 Portable Buildings
- 11.2.17 School Perimeter
- 11.2.18 MDF/IDF Rooms
- 11.3 High Schools
  - 11.3.1 All Entrances / Exits
  - 11.3.2 Secondary Student Entrance
  - 11.3.3 Front Office / Administration Area / Secure Vestibule
  - 11.3.4 Main Corridors
  - 11.3.5 Second Floor Corridors (Open to the First Floor)
  - 11.3.6 Stairwell Landings
  - 11.3.7 Common Areas (Interior and Exterior)
  - 11.3.8 Kitchen Serving Lines
  - 11.3.9 Restroom Entrances & Water Fountains
  - 11.3.10 Isolated Areas
  - 11.3.11 Bus Loading / Unloading Areas
  - 11.3.12 Parent Drop Off / Pick-Up Area
  - 11.3.13 Student Parking Area
  - 11.3.14 Staff Parking Area
  - 11.3.15 Kitchen Delivery Areas
  - 11.3.16 Loading / Unloading Areas (Band, Ag, Athletics, etc.)
  - 11.3.17 Portable Buildings
  - 11.3.18 School Perimeter
  - 11.3.19 MDF/IDF Rooms

## 28 31 10 – General Requirements for Fire Detection and Alarm

- 1.0 General Requirements for Fire Alarm:
  - 1.1 Designers shall not deviate from these standards without explicit written approval from the FBISD Design Manager.
  - 1.2 FBISD Police Department / Life Safety Department shall be consulted on every project.
  - 1.3 Comply with applicable codes, standards and Authority Having Jurisdiction (AHJ).
  - 1.4 Designer shall coordinate all systems with the respective divisions (architectural, mechanical, electrical, communications, door hardware, etc.)
  - 1.5 It is the Contractor's responsibility to submit for approval the engineered system configuration and layout showing all devices, wiring, conduit and locations along with other required information as specified to provide a complete operational system as specified.
  - 1.6 Approved manufacturers are **Silent Knight (SK Series), Fahrenheit (IDP protocol series), Notifier** or FBISD Design Manager approved equal to include a minimum of two expander modules; no substitutions.
  - 1.7 Provide STI alarm covers on all pull stations.
  - 1.8 Provide STI protective covers on all signaling devices in public areas and play areas including corridors and gyms.

- 1.9 Full system functionality must be maintained in unaffected areas during additions and renovations.
  - 1.10 Prior to commencing any work in an existing building, the Contractor will be required to perform a system test to demonstrate the current state of the system. At substantial completion or when the system is ready to be tested, a demonstration is required by the Contractor to verify that the system is in the same condition prior to construction. If the system is not 100% functional, the Contractor shall make all necessary repairs to the system.
  - 1.11 Contractor shall remove and disconnect abandoned fire alarm equipment and support panels in renovation projects.
  - 1.12 Contractor shall remove any abandoned cabling above ceilings and patch wall and floor penetrations in renovation projects.
  - 1.13 All removed equipment shall be returned to FBISD Police Department / Life Safety Department.
  - 1.14 Only basic equipment devices have been shown on the contract drawings. Specific wiring between equipment / devices may not be shown. It is the Contractor's responsibility to submit for approval the engineered system configuration and layout showing all devices, wiring, conduit and locations along with other required information as specified to provide a complete operational system as specified.
- 2.0 System shall comply with:
- 2.1 National Fire Protection Association Standards: NFPA 70, NFPA 72, NFPA 90A, and NFPA 101
  - 2.2 Local and State Building Codes
  - 2.3 Requirements of Local Authorities having Jurisdiction.
  - 2.4 Underwriters Laboratory Requirements and Listings for use in Fire Protective Signaling Systems.
  - 2.5 Americans with Disabilities Act (ADA).
- 3.0 Fire Alarm Contractor's Qualifications:
- 3.1 Minimum of 5 years' experience in fire alarm industry.
  - 3.2 The equipment supplier shall be an authorized and designated representative of the Fire Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment.
  - 3.3 The equipment supplier and installing contractor shall be licensed by the State Fire Marshal to sell, install, and service fire alarm systems as required by Article 5.43-2 of the Texas Insurance Code.
  - 3.4 The installing contractor and/or equipment supplier shall have on his staff a minimum of three (3) installation superintendents who are licensed by the State Fire Marshal's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the Texas Insurance Code.

- 3.5 The installing contractor or equipment supplier shall have on staff a minimum of one (1) certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place.
- 3.6 The installing contractor shall provide 24 hour support, 7 days a week within 2 hours during normal business day and 4 hours during non-business hours with qualified and state licensed service technicians.
- 3.7 The installing contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems for at least ten (10) years.

## **28 31 20 - Operation and Maintenance for Fire Alarm**

- 1.0 Training shall be conducted on-site with a manufacturer's representative.
- 2.0 Training / demonstration shall provide for a "user's manual" written specifically for the school personnel onsite, for daily routine operations of the systems.
- 3.0 Provide a test report showing the system has been 100% tested and in 100% operational prior to training / demonstration.
- 4.0 Provide a laminated, framed list of operating instructions for school personnel located adjacent to annunciator panel.
- 5.0 Provide laminated and framed 11"x17" floor plan with room numbers (used on building signage) that identifies device type and location.
- 6.0 Furnish four (4) hours of instruction to be conducted at the project site with manufacturer's representative. The installing Contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction.
- 7.0 The installing Contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
- 8.0 Control panel wiring and interconnection schematics
- 9.0 Complete point to point wiring diagrams
- 10.0 Complete floor plan drawings locating all system devices
- 11.0 Factory data sheets on each piece of equipment proposed
- 12.0 Detailed system operational description
- 13.0 Complete bill of material
- 14.0 All submittal data will be in bound form with contractor's name, supplier's name, project name and state fire alarm license number adequately identified.

## 28 31 30 - Sequence of Operations – Fire Alarm Detection

- 1.0 Alarm Detection - When a fire alarm condition is detected by any of the system alarm initiating devices, the following functions shall occur:
  - 1.1 The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledgement or silencing the alarm condition shall silence the alarm signals and cause flashing alarm LEDs to illuminate steady.
  - 1.2 A 160 character back-lit LCD display shall indicate all applicable information associated with the alarm condition including: zone, device type, divide location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
  - 1.3 Any remote or local annunciator LEDs associated with the alarm zone shall be illuminated as herein specified.
  - 1.4 A three channel digital alarm communicator shall be integrally provided and transmit trouble and alarm signals to an approved remote station (remote station connection and service provided by FBISD).
    - 1.4.1 Engineer shall specify a communicator that will operate off of an IP based signal as the primary means of notification to the owner's monitoring facility. The secondary means of notification will be over cellular services.
    - 1.4.2 Coordinate with FBISD for their preferred means and/or equipment during design to ensure the communicator is properly specified in the construction documents.
  - 1.5 All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated. As each indicating circuit or control relay is activated, its associated "ON" LED shall be illuminated.
  - 1.6 Activate all audible/visual alarm devices.
  - 1.7 De-activate HVAC systems over 2000 CFM.
  - 1.8 Display system status changes on the remote annunciator(s).
  - 1.9 Release all smoke doors, fire doors, fire coiling doors, fire smoke dampers and fire shutters.
- 2.0 System Trouble Detection Sequence
  - 2.1 When a trouble condition is detected by the CPU, one of the system initiating, alarm or SLC circuits, the following functions shall immediately occur:
    - a. The system trouble LED on the CPU module shall flash and the internal audible trouble device shall sound. Acknowledgement of the trouble condition shall silence the audible trouble device and cause all trouble LEDs to illuminate steady.
    - b. The 160 character alphanumeric LCD annunciator shall display all applicable information via the alphanumeric display associated with the respective trouble condition and its location.
- 3.0 Auxiliary Control Sequence:
  - 3.1 All designated "non-silenceable" auxiliary control functions shall remain in operation (even upon silencing of audible alarms) until such time as the control panel is cleared and reset manually (i.e. fan control outputs, central station interface, elevator recall interface, etc.).
  - 3.2 Activation of duct smoke detectors associated fans shall shutdown their respective units immediately in addition to identifying the condition as herein specified.
- 4.0 System Supervisory Detection Sequence
  - 4.1 When a supervisory condition is detected by the fire alarm control panel, the following functions shall occur:
    - a. The fire alarm control panel supervisory indicator shall flash and the internal audible device shall sound. Acknowledgment of the supervisory condition shall silence the audible device and cause the supervisory indicator to illuminate steady.
    - b. The 160 character liquid crystal display shall display all applicable information associated with the respective supervisory condition.



- c. Activate a supervisory contact closure to interface with the owner provided central station monitoring service.
  - d. Display the system status change on the remote annunciator(s).
- 5.0 Fire Drill Control Sequence
- 5.1 Provide a fire drill switch located on the Fire Alarm Control Panel. When activated, this switch will activate all horn/strobes and speakers for a fire drill. It shall not release fire shutter, shut down air handling equipment or recall elevators. If a fire alarm condition is detected, the system shall operate as defined in part 1.0 of this section.

## 28 31 30 – Fire Alarm – Devices and Installation Requirements

- 1.0 All fire alarm cabling shall be red in color and shall be installed following the same pathway and support requirements as the Divisions 27 Communications.
- 2.0 All conduits shall enter the top of the panel(s).
- 3.0 All panels are to be labeled with the circuit number and electrical panel location.
- 4.0 All power supplies shall have integral surge protection.
- 5.0 The system shall be wired as a style B and style 4 supervised system for all circuits.
- 6.0 All cabling shall be properly supported from the structure using j-hooks.
- 7.0 J-hooks shall be installed every 4-5 feet for the entirety of cabling run.
- 8.0 J-hooks shall be installed utilizing manufacturer recommended and approved hardware and methods to support, join and attach j-hooks to structures.
- 9.0 No grid wire shall be utilized for support. J-Hooks shall be mounted to the structure.
- 10.0 Provide spare conduits at bulk heads, furr downs and at hard ceiling areas separating sections of buildings. Intent is to provide a future cabling pathway through inaccessible areas.
- 11.0 Provide line isolator modules (SK-150) to isolate circuits. Provide at following locations at a minimum:
  - 11.1 Main panel
  - 11.2 At line to temporary buildings
  - 11.3 At line to out buildings
  - 11.4 (1) spare
- 12.0 Provide automatic recall for elevator interlocked with fire alarm system.
- 13.0 Provide relays for all kitchen hood interlocks to Ansul fire suppression system.
- 14.0 Field Devices
  - 15.1 Multi Sensor Detector (smoke and heat)
    - 15.1.1 Acceptable manufacturer, as the basis of design, shall be **Honeywell Silent Knight, SK-ACCLIMATE** multi sensor smoke detectors or FBISD Design Manager Approved Equal. Hochiki detectors are not acceptable. The Multi sensor smoke detector shall be rated for ceiling installation at minimum of 30 ft. (9.1m) centers and suitable for wall mount applications. The Multi sensor shall be suitable for direct insertion into air ducts up to 3 ft. (0.91m) high and 3 ft. (0.91m) wide and air velocities up to 500 ft/min. (0-2.54m/sec) without requiring specific duct detector housings or supply tubes.

## 15.2 Manual Fire Alarm Stations

15.2.1 Acceptable manufacturers, as the basis of design, shall be **Honeywell Silent Knight, SK-PULL-SA or SK-PULL-DA**, to provide manual fire alarm stations that are non-coded, break glass, single or double action type, with a key operated test-reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal except by use of a key.

## 15.3 Remote Power Supplies

15.3.1 Acceptable manufacturers, as the basis of design, shall be **Honeywell Silent Knight Model RPS-1000 or 5496** or FBISD Design Manager approved equal, for the remote power supplies for notification appliances. The Model RPS-1000 intelligent power supply shall wire on the main SBUS and be programmed through the IFP-2000ECS. It will support 6 amps of 24 volt DC power with 6 Flexput™ circuits, rated at 3 amps each. Two additional 5815XL SLC loop expanders shall be capable of be install in the cabinet. The power supply will also regenerate the SBUS for an additional 6000 feet of SBUS capability. The Silent Knight 5496 intelligent power supply shall wire on the main SBUS and be programmed through the IFP-2000ECS. It will support 6 amps of 24 volt DC power with 4 notification circuits, rated at 3 amps each. The remote power supply model 5499 or 5495 may also be used on the system. These power supplies are activated by a notification circuit or an IDP-Control module and support 6amps of 24VDC power, with 4 notification circuits, rated at 3amps each.

## 15.4 Notification Devices

15.4.1 Acceptable manufacturers, as the basis of design, shall be **System Sensor Series** or FBISD Design Manager approved equal for the visible and audible/visible signal type and be listed by Underwriters Laboratories Inc. per UL 1971 and/or 1638 and UL 464. The notification appliance (combination audible/visible units only) shall produce a peak sound output of 90dba or greater as measured in an anechoic chamber. The signaling appliance shall also have the capability to silence the audible signal while leaving the visible signal energized with the use of a single par of wires. Additionally, the user shall be able to select either continuous or temporal tone output with the temporal signal having the ability to be synchronized.

## 15.5 Smoke Detectors

15.5.1 Acceptable manufacturers, as the basis of design, shall be **Honeywell, Silent Knight Model IDP-PHOTO** or FBISD Design Manager approved equal. Devices shall be ceiling mounted, analog/addressable photoelectric smoke detectors. The combination detector head and twist lock base shall be U.L. listed

## 15.6 Heat Detectors

15.6.1 Acceptable manufacturers, as the basis of design, shall be **Honeywell Silent Knight Model IDP-HEAT** or FBISD Design Manager approved equal. Devices shall be analog/addressable heat detectors. The combination heat detector and twist lock base shall be U.L. listed

## 15.7 Duct Detectors

15.7.1 Acceptable manufacturers, as the basis of design, for the duct detector shall be **Silent Knight Model DNR Duct Detector Housing** or FBISD Design Manager Approved Equal. A separate IDP-Photo or IDP-PhotoR is required. The duct detector housing shall be capable of housing the IDP-Relay module for optional output devices.

## 15.8 Speakers (Wet or Damp Locations)

15.8.1 Acceptable manufacturers, as the basis of design, for the speakers shall be **System Sensor SPK Series** or FBISD Design Manager approved equal,

listed under U.L. Standard 1480, meet all specifications of the Life Safety Code, and be capable of reproducing both tone alerts and voice communication instructions. Speakers shall have built in matching transformer, field selectable multiple power taps and circuitry for speaker/line supervision. Speakers shall be provided with screw terminal connection points. Speakers shall be 4" square with textured white decorative metal grill. Speakers shall be tapped to produce a minimum sound-pressure level of 87 dBA at 10 feet. Speakers shall be wall mounted. Speakers and back boxes shall be weatherproof.

#### 16.0 Voice Evacuation Devices

- 16.1 Provide quantities as needed for complete and functional system.
- 16.2 VIP 50 – 50 watt amplifier
- 16.3 VIP 125 – 125 watt amplifier
- 16.4 VIP RM – Remote Microphone – Provide minimum (1) per building
- 16.5 VIP-SW16 – 16 switch expander
- 16.6 VIP-VCM – Voice Control Module
- 16.7 7780 – Downloading of all required messaging.

#### 17.0 Sprinkler Valves

- 17.1 Contractor shall connect all tamper switches and post indicator valves to the supervisory circuit.
- 17.2 Connect all water flow switches to the alarm circuit.

### 28 50 00 – Distributed Antenna System (DAS)

- 1.0 Where required by Authority Having Jurisdiction, provide complete design for distributed antenna system capable of supporting public safety networks. System shall contain head-end equipment, backbone cabling and cabinets as well as remote antennas and horizontal cabling.
- 2.0 DAS specifications shall be a performance specification listing manufacturers of headend equipment, backbone cabling, antenna cabling and remote antenna products and/or requirements but final design and device layouts shall be performed by licensed contractor holding FCC license to design and install DAS systems.
- 3.0 System shall be designed to provide extended coverage for all life safety and law enforcement agencies utilizing bands 700 thru 900 Mhz. Coordinate exact frequencies with AHJ for law enforcement and life safety agencies serving project site.
- 4.0 DAS system shall be designed in two parts:
  - 4.1 Original construction document design shall contain all main distribution panels and backbone interconnection cabling between main headend and remote panels.
  - 4.2 Design shall also include a project allowance where the amount will cover the overall testing of the building to determine where remote passive antennas are required to extend coverage throughout select areas of the building. Testing shall occur once the majority of the building structure and interior walls have been constructed to properly reflect the final building layout and materials installed.
  - 4.3 The allowance amount shall also provide enough funding to cover the installation of passive antennas and horizontal wiring based on findings of building coverage test where coverage needs to be extended.
- 5.0 DAS products shall comply with latest edition of NFPA-72 and capable of being upgraded should any local agency frequency changes occur in order to maintain system coverage.

- 6.0 DAS headend panel shall be located in main mechanical room and remote panels shall be located in satellite mechanical/electrical rooms. All panels shall be served from dedicated receptacles connected to the building generator system and mounted on fire treated plywood.
- 7.0 Provide emergency power for all DAS equipment. Coordinate with Division 26 for exact locations where power is required.
- 8.0 Refer to local building and fire codes for room wall rating requirements where DAS equipment is installed.
- 9.0 Submittals shall contain the following:
  - 9.1 Headend equipment and remote units.
  - 9.2 Backbone and antenna cabling
  - 9.3 Antenna, mounting and grounding information.
  - 9.4 Drawing showing headend panel locations and route of backbone cabling between panels.
  - 9.5 RF propagation modeling
  - 9.6 Signal to noise interference ratio (SNIR) map.
  - 9.7 Passive antenna products and mounting information.
  - 9.8 Bill of materials.
- 10.0 Close out documents shall contain the following:
  - 10.1 Detailed cutsheets of products installed.
  - 10.2 Final building test results showing coverage map
  - 10.3 All operations and maintenance manuals for equipment and devices installed.
  - 10.4 Test results of all cabling installed.
- 11.0 Products
  - 11.1 Acceptable manufacturers for all cabling shall be **Commscope, Belden or Superior Essex**.
  - 11.2 Acceptable manufacturers for headend equipment shall be designed around products from **Motorola or ADRF** or FBISD Design Manager approved equal.
  - 11.3 All headend cabinets shall be NEMA 4 rated and waterproof.
  - 11.4 Coaxial backbone cabling shall be 0.5" hardline meeting all fire ratings and routed in raceway as required by AHJ.
- 12.0 Final Testing Procedures
  - 12.1 PSN Acceptance Testing shall comply with the following:
  - 12.2 The Acceptance Test shall ensure that two-way coverage on each floor of the building meets the minimum coverage requirements required by AHJ.
  - 12.3 Tests shall be made using the frequencies required by local agencies serving project site location.
  - 12.4 Testing shall be coordinated with the Customer and AHJ to ensure no undue interference to any public safety operations.
  - 12.5 All testing shall be done on frequencies authorized by the FCC.
  - 12.6 Test procedure:
    - 12.6.1 The test plan shall ensure testing throughout the building. Testing shall be performed on a grid system. A spot located approximately in the center of a grid area will be selected for the test. Once the spot has been selected, prospecting for a better spot within the grid area will not be permitted. A grid is overlaid onto a floor area to provide 20 grid cells. Grid cells are provided with definite minimum and maximum dimensions. For most buildings, using a minimum grid dimension of 20 ft and a maximum grid dimension of 80 ft will suffice to encompass the entire floor area. A maximum of one area will be allowed to fail the test (95% coverage). Where a floor exceeds 128,000 sq ft, which is the floor area that can be covered by the maximum grid dimension of 80 ft, the floor shall be subdivided into 40 equal sectors, with each sector being tested individually. A maximum of two nonadjacent areas will be allowed to fail the test (95% coverage). In addition to the above requirement,

all critical areas, which include; the emergency command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage.

- 12.6.2 Measurements shall be recorded using a calibrated spectrum analyzer or a calibrated automatic signal-level measurement recording system measuring RSSI in each band with a dipole antenna positioned approximately 4' above the surface.
- 12.6.3 If P25 Phase II TDMA signals are being measured, the system BER will be measured on a known P25 Phase II TDMA signal. The signal source for measuring the system BER will be provided by the AHJ. The downlink signal level will be measured and the BER will be determined. The DAS coverage will be considered acceptable if the measured BER is five percent (5%) or less.
- 12.6.4 In addition, the AHJ may conduct portable radio test to show true system performance for P25 Phase I and Phase II TDMA and FDMA services being used on the DAS. These tests shall be conducted using the DAQ scale. A successful test shall include any score measuring DAQ 3.4 or greater.
- 12.6.5 Measurements will be recorded for the test pattern as described above.
- 12.6.6 The System uplink noise floor will be measured by connecting a spectrum analyzer to the uplink output of the donor BDA to verify that it agrees with levels predicted by the design link budgets detailed in the Contractor's TF link budget submittals.
- 12.6.7 System acceptance is achieved when 95% of the averaged data points meet or exceed the requirements.

#### **END OF DIVISION 28**


## Division 31

# Earthwork

General Requirements for Earthwork		31 00 00
Common Work Results for Earthwork		31 05 00
Site Clearing		31 10 00
Earth Moving		31 20 00
Earth Methods		31 30 00

### DIVISION 31 - EARTHWORK

#### 31 00 00 - General Requirements for Earthwork

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2  Leadership in Energy and Environmental Design (LEED)
    - 1.2.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.2.2 Related Credits (as applicable)
      - 1.2.2.1 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations.
      - 1.2.2.2 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials.
      - 1.2.2.3 MRc4: Building Product Disclosure and Optimization – Material Ingredients.
- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

### 3.0 Requirements

- 3.1 The earthwork will be by performance specification that will include FBISD specific requirements, as noted within these Division 31 sections. A/E team will incorporate the design elements into the documents and include the materials and installation requirements in the specifications.
- 3.2 Earthwork submittals require review by Engineer and Architect. Engineer to review for compliance with performance specification and design documents.

## 31 05 00 – Common Work Results for Earthwork

- 1.0 Consider drought conditions when designing foundations and other earthwork, including coordination with irrigation so that soil immediately adjacent to building structure and other major site elements can be stabilized.

## 31 10 00 – Site Clearing

- 1.0 Clearing and Grubbing
  - 1.1 Remove vegetation, debris and rubbish from topsoil. Clear under growth, brush and dead wood from site without disturbing sub-soil.
  - 1.2 Remove all rocks over 1/2- inch diameter, tree stumps, main root ball and root system to a depth of 24 inches below finished sub-grade elevation. Engineer to confirm.
  - 1.3 Fill excavations per the requirements in the geotechnical report and compact to minimum 92% in grass area and 95% in paved/building areas.
- 2.0 Removal and Trimming
  - 2.1 Protect living trees identified to remain by FBISD Design Manager. Minimize site clearing by retaining all trees over 4-inches in diameter and of acceptable type possible. Provide a minimum of 10-feet around trees for maintenance and mowing. No trees shall be planted within 20 feet of building line.
  - 2.2 Trim bottom (low-hanging) limbs on trees designated to remain, up to 8-feet above proposed final grade. Trim to occur twice, prior to work commencing, and prior to substantial completion. Trimming of trees shall be as directed by FBISD Design Manager.
  - 2.3 Clear all underbrush and protect plants including trees designated by FBISD Design Manager to remain. Trim tree branches on trees to remain as directed by FBISD Design Manager.
- 3.0 Earth Stripping and Stockpiling
  - 3.1 Topsoil shall be stripped and stockpiled in a location approved by FBISD Design Manager and shall be spread over all areas receiving sod and/or hydro-mulch seeding.
  - 3.2 Establish a stand of grass on all areas affected by construction activities and all areas designated to receive sod and/or hydro-mulch seeding before final acceptance by FBISD Design Manager. Imported topsoil is to be accepted by Architect, FBISD Design Manager, and FBISD Grounds Supervisor prior to using.

## 31 20 00 – Earth Moving

- 1.0 Site Grading
  - 1.1 Finished grade including sod, soil, mulch and/or bedding materials shall not cover weep holes. Unpaved areas adjacent to buildings, landscaped or other areas shall sheet flow AWAY from the building at a minimum 2% grade for the first 10 feet with no standing water. Paved areas adjacent to buildings shall sheet flow AWAY from the building at a minimum 2% grade for the first 5 feet with no standing water.
  - 1.2 Grading around buildings including walkways shall be coordinated with the Architect and FBISD prior to installation of landscape materials.



- 1.3 Refer to Div. 32 for mow strip requirements.
  - 1.4 Use of swales for drainage are discouraged.
    - 1.4.1 Grading in grass areas shall be at a minimum grade of 1% grade. Swale ditches shall be graded at a minimum grade of 0.5%.
  - 1.5 Grade playground area prior to installation of playground surfacing and equipment. Coordinate with Division 32 – Exterior Improvements.
- 2.0 Excavation and Fill
- 2.1 Comply with OSHA regulations and State of Texas law concerning excavation, trenching and shoring.
  - 2.2 Provide sheeting, shoring and bracing necessary to protect excavations and existing utilities during all phases of the project.
  - 2.3 All fill shall be per the recommendations of the geotechnical report and tested by the Owner's testing lab per 1000-feet in areas.
  - 2.4 Imported topsoil shall be utilized in all play areas and fields as required. Imported topsoil shall be free of organic material including rocks over 1/2- inch diameter, tree stumps, main root ball and root systems, plastics and other foreign material.
- 3.0 Erosion and Sedimentation Controls
- 3.1 Provide Storm Water Pollution Prevention Plan complying with federal regulations.
  - 3.2 Contractor shall be responsible for documentation and submission of all required state, and federal forms related to Storm Water Pollution Prevention.
  - 3.3 Contractor shall be responsible for construction, implementation, maintenance, inspection and removal of all storm water pollution prevention items, adherence to storm water management and pollution prevention plans, waste collection & disposal, off-site vehicle tracking & other practices.

### **31 30 00 – Earthwork Methods**

- 1.0 Termite Control
  - 1.1 Provide at new schools and additions.
  - 1.2 Manufacturer must certify that Products/Materials comply with U.S. Environmental Protection Agency (EPA) and applicable state and local codes.
  - 1.3 Installer/Applicator shall be licensed and specialize in termite control with minimum of five (5) years documented experience and approved by FBISD Design Manager and manufacturer of approved materials.
    - 1.3.1 Application Areas: Gym, staging areas, foundations, under slab on grade, soils within 10-feet of building perimeter and for a depth of 4' under slabs.
- 2.0 Slope Protection
  - 2.1 Maximum slope shall be 3:1. However 5:1 slope is preferred.
  - 2.2 Consider the use of solid sod (staked) or Flexterra spray on hydromulch on slopes exceeding 5:1.
- 3.0 Riprap
  - 3.1 Provide concreted slope paving erosion protection at storm sewer connections to detention ponds or on-site drainage channels.
  - 3.2 Concrete slope paving shall be a minimum of 5" thick with #3 bars on 12" centers each way.

**END OF DIVISION 31**


## Division 32

# Exterior Improvements

General Requirements for Exterior Improvements		32 00 00
Operation and Maintenance of Exterior Improvements		32 01 00
Common Work Results for Exterior Improvements		32 05 00
Schedules for Exterior Improvements		32 06 00
Bases, Ballasts, and Paving		32 10 00
Site Improvements		32 30 00
Irrigation		32 80 00
Planting		32 90 00

### DIVISION 32 – EXTERIOR IMPROVEMENTS

#### 32 00 00 - General Requirements for Exterior Improvements

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2 Additional standards as indicated with sections below.
  - 1.3  Leadership in Energy and Environmental Design (LEED)
    - 1.3.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
    - 1.3.2 Related Credits (as applicable)
      - 1.3.2.1 SSc2: Site Development – Protect or Restore Habitat.
      - 1.3.2.2 SSc5: Heat Island Reduction.
      - 1.3.2.3 WEp1: Outdoor Water Use Reduction (Prerequisite).
      - 1.3.2.4 WEc1: Outdoor Water Use Reduction.
      - 1.3.2.5 MRc2: Materials and Resources credit: Building Product Disclosure and Optimization - Environmental Product Declarations.
      - 1.3.2.6 MRc3: Materials and Resources credit: Building Product Disclosure and Optimization - Sourcing of Raw Materials.
      - 1.3.2.7 MRc4: Building Product Disclosure and Optimization – Material Ingredients.
- 2.0 Comparable Products
  - 2.1 Approved by Architect and FBISD Design Manager.

- 2.2 Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

### 3.0 Requirements

#### 3.1 Dumpster requirements:

- 3.1.1 ES: (1) recycle bin, (2) trash bins, 6 yards each for both.
- 3.1.2 MS: (2-4) recycle bins (coordinate with FBISD Design Manager), (4) trash bins,
- 3.1.3 HS: (6-8) trash bins, (3-4) recycle bins.
- 3.1.4 To be located on hard surface, adjacent to maintenance and kitchen area, at least 50 feet away from the building, require access to a water hose, provide screen on three sides, consider truck access, locate all bins together, exact location to be coordinated with FBISD Project Manager, no gate required.

### 4.0 Coordination

- 4.1 For additional parking, athletic, and playground information refer to the Education Specifications.
- 4.2 Reference Division 3 - Concrete for additional information.

## **32 01 00 – Operation and Maintenance of Exterior Improvements**

- 1.0 List Special Maintenance Agreements for FBISD in specifications, including providing sample agreement forms and durations. Reference Division 11 – Equipment.

## **32 05 00 - Common Work Results for Exterior Improvements**

- 1.0 Consider potential for objects to become windborne (during hurricanes or other storms) when designing, detailing, and specifying materials within this section.

## **32 06 00 – Schedules for Exterior Improvements**

- 1.0 Refer to Appendix for schedule of exterior elements at Elementary, Middle and High Schools.

## **32 10 00 – Bases, Ballasts, and Paving**

- 1.0 Base Courses: Follow geotechnical report recommendations for limestone (or other rock base) thickness, size (gradation), and type.
- 2.0 Flexible Paving: Follow geotechnical report recommendations for hot-mix asphaltic concrete pavement thickness and type.
- 3.0 Rigid Paving: Follow geotechnical report recommendations for concrete pavement thickness, compressive strength and steel reinforcing. Use minimum 3,500 psi for concrete pavement.
  - 3.1 Concrete Paving: Refer to Division 03 – Concrete.
    - 3.1.1 Parking Areas:
      - 3.1.1.1 Consult with local Authorities Having Jurisdiction (AHJ).
      - 3.1.1.2 Planter islands shall be minimized. Consult with local AHJ.
      - 3.1.1.3 All parking areas shall be reinforced concrete.
      - 3.1.1.4 Paving shall have a medium broom finish.

- 3.1.1.5 Parking areas shall be designed so that the pavement slope is not less than 1% and not more than 5%.
- 3.1.1.6 Driveways shall have a slope of no more than 10% and provide a 5' wide section not exceeding 2% for a crosswalk.
- 3.1.1.7 Parking areas shall be designed such that extreme event ponding shall not exceed 9" at any inlet or other point.
- 3.1.1.8 Comply with geotechnical report recommendations for sidewalk design; however, as a minimum, all reinforcing in pavement shall be:
  - 3.1.1.8.1 5" thick pavement #4 bars at 18" O.C.E.W.
  - 3.1.1.8.2 6" thick pavement #4 bars at 12"-18" O.C.E.W.
  - 3.1.1.8.3 7" and 8" thick pavement #4 bars at 12" O.C.E.W.
  - 3.1.1.8.4 10" and 12" thick pavement #5 bars at 18" O.C.E.W.
  - 3.1.1.8.5 No wire mesh is allowed.
- 3.2 Sidewalks
  - 3.2.1 All sidewalks shall be reinforced concrete.
  - 3.2.2 Sidewalks which connect buildings shall have canopies.
  - 3.2.3 Sidewalks shall have a light broom finish.
  - 3.2.4 All sidewalks shall comply with ADA & TAS requirements and shall have a maximum cross-slope of 2% and maximum running slope of 5% unless otherwise approved by the Owner. Ramps shall not exceed 6 feet in length with 1:12 slope unless a handrail is provided. Ramps with handrails shall not exceed 30 feet in length without a change in direction. All ramps require a minimum 5-foot landing not exceeding 2% slope.
  - 3.2.5 Comply with geotechnical report recommendations for sidewalk design; however, as a minimum all reinforcing in sidewalks shall be #4 bars at 18" O.C.E.W. No wire mesh is allowed.
- 3.3 Mow Strips
  - 3.3.1 Provide 24" mow strip adjacent to buildings. Mow strip shall be sloped 2% away from buildings.
- 4.0 Painted Pavement Markings
  - 4.1 Paint for striping shall be 100% acrylic premium grade traffic paint conforming to the requirements of FS TT-P-1952 Type 1; latest edition.
  - 4.2 White striping shall be utilized to delineate parking stalls.
- 5.0 Curbs, Gutters, Sidewalks, and Driveways
  - 5.1 Provide 6 inch concrete (3,000 psi) curbs at all drives and parking lot areas. Curbs shall have a minimum 5 foot radius to prevent damage by vehicles. Review all curb radius adjacent to public right-of-way with FBISD traffic engineer.
  - 5.2 No extruded curb construction allowed

- 5.3 Continuous 6" concrete curbs not required where drainage swale system vegetated provided.
- 5.4 Curbs in fire lanes shall be painted following local authority requirements exactly. Where none exist, provide red curbs with "No Parking" and "Fire Lane" alternated, 20' spacing. Indicate recommended locations for fire lanes on architectural site plan as well as dimensional site plan.
- 6.0 Athletic and Recreational Surfacing
  - 6.1 Synthetic Grass Surfacing:
    - 6.1.1 District-Wide Athletic Facilities and High School Athletic fields: Provide infilled synthetic turf system that is specifically suited for the type of athletic competition proposed. The system may contain a rubber granule fill or a combination sand-rubber granule fill. The pile fibers may be made of polyethylene, polypropylene, nylon or a combination of these materials. The polyethylene fiber shall be C8 grade, low friction, UV-resistant fiber measuring not less than 2 ½ inches high as measured in the field (unless noted otherwise). The primary backing of the synthetic turf shall resist tearing and heat degradation and the secondary backing shall be coated with polyurethane or latex to lock in the fiber in the primary backing.
    - 6.1.2 The synthetic turf shall be capable of draining rapidly after a heavy rainfall with minimum 40 inch/hour permeability.
    - 6.1.3 The synthetic turf system shall be suitable for inlaid and/or tufted permanent field markings.
    - 6.1.4 Impact attenuation: G-Max requirement. The synthetic turf for a football or soccer field must maintain an ASTM 355 G-Max between 100-160 for the life of the Warranty. The contractor shall pay for a third party G-max testing upon completion of field installation. If at any point during the 8-year warranty period the field is G-Max tested and does not meet the specified requirements, the turf contractor and/or manufacturer shall reimburse the owner for the test cost and shall make the necessary improvements to the field to bring into the specifications.
    - 6.1.5 Warranty: Eight (8) years warranty (third party, non-cancelable, non-prorated insurance policy for the full eight (8) year period.) Policy must be from an A Best Rated company and be paid in full for the 8-year term.
    - 6.1.6 Installation qualifications. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, top dressing or brushing operations. The designated Supervisory personnel on the project must be certified, in writing by the turf Manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.
    - 6.1.7 Approved manufacturers.
      - 6.1.7.1 AstroTurf.
      - 6.1.7.2 FieldTurf USA

- 6.1.7.3 Hellas.
- 6.1.7.4 Shaw Sports.
- 6.1.7.5 Comparable product approved by FBISD Design Manager.

## 6.2 Athletic Surfacing

6.2.1 Baseball/Softball Field Surfacing – Only natural grass fields are at High School practice fields and all middle school athletic fields.

### 6.2.1.1 Approved Suppliers

- 6.2.1.1.1 Athletic Field Specialists
- 6.2.1.1.2 Fielder's Choice, Inc.
- 6.2.1.1.3 Texas Multi-ChemSports Field Solutions.
- 6.2.1.1.4 Comparable product approved by FBISD Design Manager.

6.2.1.2 Provide 6 inch thick red dog cinders 60/40 mix for high school baseball/softball fields warning tracks.

6.2.1.3 Provide 6 inch deep infield topping mix. Provide a 25% mixture of "Red Improved Diamond Pro" infield conditioner in the top 2 inches of the infield topping.

## 6.3 Natural Field Sport Surfacing

6.3.1 Athletic fields shall have a minimum 6 inches of topsoil material and 70% sand soil mixture and minimum 90 days grass grow-in growth, subject to approval of FBISD Design Manager.

6.3.2 Laser-grade fields to elevations shown on drawings prior to seeding or sodding. FBISD Construction Manager to participate in a punch list walk through prior to acceptance of the final grading of topsoil.

6.3.3 Practice athletic fields shall be hydro mulch seeded. Summer and spring seed application shall be Panama Bermuda grass seed; fall and winter seed application shall be Panama Bermuda grass seed with perennial rye grass seed in 50/50 mix.

6.3.4 Athletic fields shall be completed one year prior to Substantial Completion of the new buildings. FBISD Design Manager shall be involved in Substantial Completion acceptance of the athletic fields. Special emphasis will be placed on removal of debris and proper grading for drainage. Maintenance of athletic fields will be turned over to FBISD after completion of punch list items for grounds and fields. A separate Substantial Completion certificate may be issued for the athletic fields prior to acceptance of the remainder of the entire project.

6.3.4.1 Athletic competition fields, to include middle school competition field and high school baseball and softball fields, shall be solid sodded using Common Bermuda big-roll solid sod if schedule prevents fields being completed with less than one year of growth.

6.4 For Synthetic Field Sport Surfacing, refer to Synthetic Grass Surfacing.

## 6.5 Synthetic Running Track

6.5.1 For Middle Schools, provide polyurethane base mat surface with black structural spray coat 13 mm thickness athletic track surfacing.

6.5.2 For District-Wide Facilities and High Schools, provide 10 mm full pour synthetic track surface.

6.5.3 Provide sub-grade soil stabilization following the geotechnical report

recommendations. Ensure separate soil borings are obtained for track areas, do not utilize geotechnical reports from previous projects of adjacent locations on site.

- 6.5.4 Provide full depth curbs around the perimeter of the athletic track with concrete curb abutments at curves.
- 6.5.5 Provide limestone base and asphalt pavement section for the athletic track following the geotechnical report and track design consultant recommendations.
- 6.5.6 Provide field events conforming to UIL requirements. Provide concrete (not asphalt) runways with synthetic track surfacing for long jump/triple jump and pole vault facilities.
- 6.5.7 Warranty: Five (5) years warranty.
- 6.5.8 Approved Manufacturers:
  - 6.5.8.1 Beynon Sports Surfaces
  - 6.5.8.2 Hellas Sports Construction.
  - 6.5.8.3 Paragon Sports Constructors.
  - 6.5.8.4 Conipur SP by Conica.

## 6.6 Recreational Surfacing

- 6.6.1 Unitary, Single Density, Seamless Surfacing:
  - 6.6.1.1 Must comply with ASTM F 2223-04, "Standard Guide for ASTM Standards on Playground Surfacing".
  - 6.6.1.2 Site mixed and applied, single layer material in thickness necessary to comply with fall criteria, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.
  - 6.6.1.3 Approved Manufacturers:
    - 6.6.1.3.1 Child Safe Products, Inc.
    - 6.6.1.3.2 GameTime; a PlayCore, Inc. company.
    - 6.6.1.3.3 Hanover Specialties, Inc.
    - 6.6.1.3.4 No Fault Sport Group, LLC.
    - 6.6.1.3.5 Play Safe Surfacing, Inc.
  - 6.6.1.4 Composition: Blend of recycled SBR and EPDM rubber, particles and binder, forming a wearing and cushioning product.
  - 6.6.1.5 Binder: Weather resistant, UV stabilized, flexible, non-hardening, 100 percent solids polyurethane. Critical Height: 6 feet (1.8 m).
  - 6.6.1.6 Overall Thickness: Not less than required for critical height indicated.
  - 6.6.1.7 Primer/Adhesive: Primer and weather resistant, moisture cured polyurethane adhesive suitable for unit, substrate, and location recommended and warranted by manufacturer.
  - 6.6.1.8 Color(s): Selected by Architect and incorporated into documents prior to bidding.
  - 6.6.1.9 Leveling and Patching Material: Portland cement based grout or epoxy or polyurethane based formulation suitable for exterior use and approved by protective surfacing manufacturer.
- 6.6.2 Weed Control Barrier: Composite fabric geotextile consisting of woven, needle punched polypropylene substrate bonded to a nonwoven polypropylene fabric, weighing not less than 4.8 oz./sq. yd. (160 g/sq. m).
- 6.6.3 Wood fiber playground surfaces not allowed for new installations.



- 6.7 Synthetic Tennis Court Surfacing
  - 6.7.1 Provide even-textured acrylic surface system for post-tensioned concrete tennis courts as manufactured by California Products Corp. or Laykold Recreational Sports Surfacing. Court color shall be dark green with surrounding area to be red. All line markings to be white.
  - 6.7.2 Refer to the next section 32 30 00 for information regarding tennis fence construction.

### **32 30 00 – Site Improvements**

- 1.0 Fence and Gates:
  - 1.1 Gate Operators:
    - 1.1.1 For uses on Auxiliary Facilities such as Transportation, Ag Science, or Safe and Secure (Police) facilities where security and enhanced site access control are required.
    - 1.1.2 Basis of Design: Commercial Grade Gate Operators (swing or sliding) by LiftMaster or comparable product approved by FBISD Design Manager.
    - 1.1.3 At locations where gate is more than 200' from facility or access to power, recommend using solar power operator with battery. Verify needs and security requirements with FBISD Design Manager. Maximum gate length is 20 feet for 12V power sensor for either solar power or plug in.
    - 1.1.4 Use sub surface sensors for Auxiliary Facilities.
  - 1.2 Chain Link Fences and Gates:
    - 1.2.1 Recreational Court Fences and Gates heights based on security and visibility needs.
    - 1.2.2 Tennis Court Fences and Gates:
      - 1.2.2.1 Provide commercial grade galvanized fabric, 9 gauge, 1-3/4" mesh with double knuckle, top and bottom for 12 feet high fence. Corner and line posts shall be a minimum 4 inch, Schedule 40 galvanized steel. Top and middle rail shall be a minimum 1-5/8", Schedule 40 galvanized steel pipe. Provide 9 gauge tension wire at bottom of fence fabric.
    - 1.2.3 Wind Breakers:
      - 1.2.3.1 Provide 9 foot windscreen with wind flaps for 12 foot high fences with open area at bottom (for drainage and to prevent direct contact with ground, deterring premature deterioration).
      - 1.2.3.2 Provide windscreens with wind flaps for baseball and softball the same size as the outfield fences with approximately 6 inches open area at the bottom. Provide windscreen at curve of outfield fence (corner to corner). Lisco or equal.
    - 1.2.4 Chain Link Backstops
      - 1.2.4.1 For use at Elementary and Middle Schools. Verify locations with Educational Specifications.
      - 1.2.4.2 Provide 5.563 inch O.D. galvanized steel end posts and 4.00 inch O.D. galvanized steel line posts, 1-5/8 inch O.D. horizontal rails at 6 feet on centers for 18 foot high backstops include a horizontal rail at the base of the backstop, with

approximately 1-1/2 inch clear between the bottom rail and finish grade.

- 1.2.4.3 Backstop post piers shall be 6 feet deep (+ 3 inches bottom cover minimum), 18 inch diameter and be reinforced with 4-#3 verticals and #3 stirrups at 24 inch on center, Top of concrete shall be 2 inches below finish grade.
- 1.2.4.4 All posts/pipes, including and especially horizontal members, should be arranged to avoid press box windows.
- 1.2.4.5 Size backstops so that no portion of baseball or softball bleachers are in direct site line of batter's box without chain link protection.

#### 1.2.5 Softball/Baseball Backstops at High Schools

- 1.2.5.1 CMU wall, 5 feet high at softball, 4 feet high at baseball. Adjustments may be made for existing bleachers and site-specific sight line conditions.
- 1.2.5.2 Backstop Netting Height – minimum height above field elevation shall be 40 feet at softball and 60 feet at baseball.
- 1.2.5.3 Netting Material: 1-5/8 inch square, #18 knotted multi-strand UHMW polyethylene mesh with 350 LB tensile strength made from Spectra fibers (Honeywell) or Dyneema fibers (DSM), treated for UV protection, in longest practical lengths in order to limit number of splices. Approved Manufacturers: Dyneema or Spectra
- 1.2.5.4 Netting Hardware: Stainless Steel 3/8-inch aircraft cable with 15,000 LB tensile strength. Cable clips, Shackles, eyebolts, turn-buckles, etc. shall be galvanized.
- 1.2.5.5 Netting Support Poles: Hot dipped galvanized steel poles engineered to support net and deflection caused by tensioned cable.
- 1.2.5.6 Backstop netting length to extend to far end of dug outs.

#### 1.2.6 Hitting Cages

- 1.2.6.1 Consider chain link fencing around netting.
- 1.2.6.2 Shall include 5" minimum concrete pad with padded nylon turf glued to the surface.
- 1.2.6.3 Netting shall be #42 Knotted Black Nylon treated for UV protection and secured using stainless steel 3/8-inch aircraft cable with eyebolts at the turf surface and between poles. Each tunnel shall be minimum 14' clear height from the turf to the netting overhead.

#### 1.2.7 Bull Pens

- 1.2.7.1 Baseball: Clay pitcher's mound with 8" concrete curb, 5-inch concrete pad at home plate area with padded nylon synthetic turf glued to top, and natural grass between. Enclose bullpen with 8' chainlink fence and include full height 3" thick backstop pad attached to fence behind each home plate. Pads shall be removable to store during offseason. Include rubber pitchers plates and home plates.
- 1.2.7.2 Softball: 5-inch concrete pads at pitcher's mound and home

plate areas with padded nylon synthetic turf glued to top, and natural grass between. Enclose bullpen with 8' chainlink fence and include full height 3" thick backstop pad attached to fence behind each home plate. Pads shall be removable to store during offseason. Include pitchers plates and home plates.

- 1.2.8 Steel Fencing
  - 1.2.8.1 Steel except where high abuse is expected, durability is needed.
  - 1.2.8.2 9 gauge minimum.

1.3 Manufactured Metal Bollards:

- 1.3.1 Consider for use at Main Entry or areas subject to potential impact, subject to approval by FBISD Design Manager.
- 1.3.2 All other areas, provide concrete filled galvanized steel pipe, removable with 10 foot minimum clearance between where appropriate for maintenance access. Provide welded steel angle cleat for FBISD-provided padlock.
- 1.3.3 Consult with Local AHJ and utility provider.
- 1.3.4 Reference concrete bollards in Division 03 – Concrete.

### 32 80 00 – Irrigation

1.0 General:

- 1.1 Refer to Divisions 31 and 33 for additional requirements for utilities and earthwork pertaining to irrigation.

2.0 Irrigation Pumps:

- 2.1 Provide prefabricated skid mounted irrigation pump system with cycle stop control valve and cycle sensor.
  - 2.1.1 Approved manufacturers
    - 2.1.1.1 W. C. Smith Manufacturing, Inc.
    - 2.1.1.2 Tyco.
    - 2.1.1.3 Dayton Sprinkler Systems.
- 2.2 Provide master valve, tied to Irrigation Controller, to shut off system. On some controllers, this is tied to pump. If pump not required, pump 'on' signal would open master valve (valve fail closed).

3.0 Planting Irrigation:

- 3.1 Drip Irrigation: Provide buried line bubbler irrigation at trees in lieu of sprinkler heads.
- 3.2 Underground Sprinklers:
  - 3.2.1 At Elementary Schools, fields do not require irrigation.
  - 3.2.2 At Middle Schools, provide irrigation for competition football field and practice fields.
  - 3.2.3 At High Schools, provide irrigation for softball and baseball fields and practice fields.
  - 3.2.4 Irrigation system shall be reviewed prior to any cover-up. Architect, Irrigation Consultant (if used), FBISD Project Manager and Grounds/Maintenance Department personnel shall attend.
- 3.2.5 Pop-Up Spray Sprinklers

- 3.2.5.1 Shall be heavy duty plastic pop-up to specified height with appropriate nozzle as indicated on drawings.
- 3.2.5.2 Irrigation head body, stem nozzle, and screen shall be constructed of heavy duty plastic.
- 3.2.5.3 Head shall have wiper seal for cleaning debris as it retracts into case.
- 3.2.5.4 Plastic nozzles shall have matched precipitation rate with an adjusting screw capable of regulating the radius and flow.
- 3.2.5.5 Head shall have stainless steel retroactive spring.
- 3.2.5.6 Head shall have filter spring under nozzle.
- 3.2.5.7 Head shall have side and bottom inlet on racking system for easy alignment of pattern on six (6) inch and 12 inch pop-ups.
- 3.2.5.8 The nozzles on pop-up spray head body shall be as shown on drawings and shall be capable of covering the radius as shown on drawings. Nozzles in same series shall have matched precipitation rates.
- 3.2.5.9 Heads shall be connected to irrigation lateral lines by swing joints as indicated. Flexible PVC will not be accepted as a swing joint.
- 3.2.6 Gear Driven Sprinklers
  - 3.2.6.1 The pop-up rotor sprinklers shall be gear driven sprinkler. The part circle sprinklers shall have an infinitely adjustable arc of coverage from 40 degrees to 360 degrees.
  - 3.2.6.2 The sprinkler case and internal assembly, except for the arm spring, bearing spring, wiper seal and bearing washers, shall be constructed of durable plastic.
  - 3.2.6.3 The sprinkler shall have an adjustable nozzle-retainer/range adjustment screw for distance and distribution control and shall be capable of full or part circle operation as noted on drawings.
  - 3.2.6.4 The sprinkler shall have a four (4) inch pop-up stroke, turbine bypass valve, fine mesh filter screen, and the gear drive shall be sealed in oil.
  - 3.2.6.5 Plastic nozzles shall be color coded and interchangeable for matched precipitation.
- 3.2.7 Irrigation Piping:
  - 3.2.7.1 Shall be Schedule 40 at all supply lines, no 1 ¼" piping allowed.
  - 3.2.7.2 Piping arrangement should be parallel. Stacked piping is not permitted.
  - 3.2.7.3 14 inch minimum depth
  - 3.2.7.4 Irrigation sleeves required under paving conditions spanning 10 feet or more.
- 3.2.8 Irrigation Piping Connections:
  - 3.2.8.1 Christy's Red-Hot Blue Glue or approved equal by FBISD Design Manager. Use a compatible primer recommended by the solvent cement manufacturer.
- 3.2.9 Provide lockable cage/covers for above ground back-flow devices.
- 3.2.10 Provide irrigation controller that is internet-ready, to allow for remote-access control by FBISD Grounds and Maintenance, with


over-ride control and monitoring through Building Automation System (refer to Division 25 for additional information).

### 3.2.11 Controllers:

- 3.2.11.1 All controllers to be indoor/outdoor compatible.
- 3.2.11.2 Controller, valves, and flow sensors to be by same manufacturer.
- 3.2.11.3 Provide Rain Bird ESP-LXME or Hunter with Network Communication Cartridge and integral water-conserving technology, in weather-proof enclosure located in service yard or other area that does not require FBISD Grounds to enter building. Provide data connection so that controller can be monitored/overridden remotely (Rain Bird IQv2 Central Control).
- 3.2.11.4 Rain Bird ESP-MC or Hunter, where installed at existing conditions, will require data connection so that remote control and monitoring is possible (via Rain Bird IVx2 Central Control or Maxicom2).

## 32 90 00 – Planting

### 1.0 General:

- 1.1  Coordinate LEED requirements and recommendations included within this section with Local AHJ and Home Owners Association. Where recommended species do not align, schedule Pre-Development Meeting with AHJ to review alternatives.
- 1.2 Consider pricing an alternate for a maintenance agreement up to one year.

### 2.0 Planting Preparation

- 2.1 Soil Preparation: Hold surface grading down 2" at all areas set to receive sod. Provide 6" of organic material under all areas. This may not be native soils, especially in locations where high clay-content soils are present.

### 3.0 Turfs and Grasses

- 3.1 Hydro-Mulching and Seeding: Refer to Athletic Surfacing-Natural Field Sport Surfacing for hydro-mulching and seeding requirements. All general lawns shall be hydro-mulched.
- 3.2 Sodding: solid rolled sod for the competition athletic fields for middle schools in order to establish ground cover in a shorter period of time. Rolled sod shall be common Bermuda grass field grown, not less than 10 months prior to harvest. Rolls shall be 42 inches wide and 50 feet long and harvested not more than 18 to 24 hours prior to installation. A 24" wide strip of sod shall be provided along paving edge (back of curb or sidewalk) and around all inlets not located in paved areas.
- 3.3 Establish turf in all grass areas, swales, and detention facilities to provide 100% coverage at 75% density with no noticeable erosion.
- 3.4 Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
  - 3.4.1 Seeded Lawns: 90 days from date of planting completion.



- 3.4.2 For areas seeded in fall or if lawn is not fully established, continue maintenance following spring until acceptable lawn is established.
- 3.4.3 Sodded Lawns: 30 days from date of planting completion.

#### 4.0 Plants

##### 4.1 General:

- 4.1.1 Planting beds shall be a minimized. Beds should have a 2 foot concrete mow strip adjacent to lawn areas. Final elevation of planting beds shall be 3 to 6 inches below building weep holes, coordinate with foundation.
- 4.1.2 Provide a 3 feet wide concrete strip in front of all parking spaces which are bordered by shrubs. Plant shrub center 3 feet away from the strip edge to provide enough space for the car to overhang the curb and allow the shrub to be trimmed while a car is parked.
- 4.1.3 Plants sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae, and shall have healthy, well developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving growth.

##### 4.2 Shrubs

- 4.2.1 Coordinate with FBISD Design Manager on required xeriscape planting with Texas native plants and drought tolerant planting. Regardless of drought tolerance any shrub which has berries, is poisonous in any way, or has sharp thorns or leaves is not allowed. No Oleander.

##### 4.3 Trees

- 4.3.1 Trees shall be located 5' more than mature drip line from buildings (Example: Mature Live Oak Tree, 30 years old, has drip line of 30' from center, therefore must be planted 35' from nearest structure)
- 4.3.2 Indicate trees on site plans (architectural, civil, and landscaping) with mature drip lines (not diagrammatic size typically found on landscaping plans), for coordination with utilities and above grade structures.
- 4.3.3 Mature Tree is considered to be 30 years old for most varieties DO NOT consider Bradford Pears. Consider tree species that require less water and are drought resistant.
- 4.3.4 Refer to Texas Forest Service website below for recommended tree species in Fort Bend County. Do not introduce tree species that are not recommended for use in Fort Bend County.
  - 4.3.4.1 <http://texastreeplanting.tamu.edu/>
- 4.3.5 Submit sample of soil to Texas Agricultural Extension Service along with recommended tree species prior to finalizing landscape plans for verification of tree viability.

#### 5.0 Plant Accessories

- 5.1 Utilize where decomposed granite used.

### END OF DIVISION 32


## Division 33

# Utilities

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### DIVISION 33 - UTILITIES


#### 33 00 00 - General Requirements for Utilities

- 1.0 Applicable Standards & References
  - 1.1 ASTM standards as applicable to products used.
  - 1.2  Leadership in Energy and Environmental Design (LEED)
    - 1.2.1 Refer to Sustainability & LEED Guidelines section within this document for additional information.
- 2.0 Comparable Products
  - 2.1 As approved by Architect and FBISD Design Manager.
  - 2.2 Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- 3.0 Requirements
  - 3.1 The Utilities will be by performance specification that will include FBISD specific requirements, as noted within these Division 33 sections. A/E team will incorporate the design elements into the documents and include the materials and installation requirements in the specifications.
  - 3.2 Install clay plugs at all trench entries to building.
  - 3.3 Valves, fittings, and storm covers are to be manufactured within the United States of America.
  - 3.4 Utilities submittals require review by Engineer and Architect. Engineer to review for compliance with performance specification and design documents.
  - 3.5 Size underground domestic water, sanitary and storm drainage to accommodate future additions of approximately 15% additional floor area.
  - 3.6 Connect all downspouts and roof drains to the underground storm sewer system.





### 33 10 00 – Water Utilities

- 1.0 Water Utility Distribution Piping
  - 1.1 Provide polyvinyl chloride (PVC) pipe, DR-18, Class 150, AWWA C900 or C905, for domestic and fire lines 4 inches and larger.
  - 1.2 Provide polyvinyl chloride (PVC) IPS pipe conforming to the requirements of ASTM D2241 for waterlines 2-inches to 3-inches in diameter.
  - 1.3 Provide polyvinyl chloride (PVC) pipe, Schedule 40 with schedule 40 fittings for water lines 2-inches and smaller.
  - 1.4 Provide bedding and backfill for all water lines following appropriate Authorities Having Jurisdiction (AHJ) requirements.
- 2.0 Water Utility Distribution Equipment
  - 2.1 Provide underground fire vault with double check valve assembly unless not allowed by local City or MUD. Provide gravity drainage of vault to prevent holding water in vault.
  - 2.2 Set top of vault minimum 1-inch (1") above surrounding grade and pour a two foot wide mow strip around perimeter for ease of maintenance.
  - 2.3 Provide 2-inches conduit to building (nearest mechanical room) to allow for installation of tamper-flow and/or meter.
  - 2.4 Install an above ground RPZ backflow for domestic service. Fire service can usually be served by a vault structure. An insulated enclosure around above ground RPZ structure is required. Refer to Division 22 – Plumbing.
  - 2.5 Provide separate meters for domestic water service, cooling tower, and irrigation unless not allowed by local authority. Coordinate with other metering requirements, as identified in Division 25.
- 3.0 Disinfecting of Water Utility Distribution
  - 3.1 Provide testing and disinfecting for all water lines per AHJ requirements.
- 4.0 Water Utility Storage Tanks
  - 4.1 If required, A/E shall provide design calculations, documents and coordinate equipment/material selection with FBISD.
  - 4.2  Refer to LEED Section and Division 21 (Plumbing) for design information regarding above and/or underground storage of rainwater for use with non-potable water system (grey water and/or irrigation).

### 33 30 00 – Sanitary Sewerage


- 1.0 Sanitary Utility Sewerage Piping
  - 1.1 Match proposed MEP pipe type and size from connection at building to first manhole structure (typically MEP provides utilities 5' outside building).
  - 1.2 Provide polyvinyl chloride (PVC) pipe, Schedule 40 with rubber gasket joints for sanitary sewers 4-inches and smaller.
  - 1.3 Provide polyvinyl chloride (PVC) pipe, SDR 26 with rubber gasket joints for sanitary sewers 6-inches and larger.
  - 1.4 Provide 12-inch wrap, cement-stabilized sand bed and backfill for all sanitary sewer piping. Confirm AHJ requirements.
  - 1.5 Provide mandrel and air testing of all sanitary sewer lines following City or MUD requirements. All sanitary sewer lines shall be inspected via camera at Closeout. The District shall be notified of testing, 48 hours prior to the test date, and shall be a witness to all sanitary sewer testing.
  - 1.6 If any obstructions are found, they shall be removed and video of removal of blockage showing clearance shall be provided. Provide documentation in Closeout documents (Operations and Maintenance document(s)).
- 2.0 Wastewater Utility Pumping Stations
  - 2.1 If required, the A/E shall provide design calculation, documents and coordinate equipment selection with FBISD. See Section 22 13 00 – Sanitary Waste and Vent Piping.

- 3.0 Sanitary Utility Sewerage Force Mains
  - 3.1 Provide polyvinyl chloride (PVC) pipe DR-18 (Green color), Class 150, AWWA C900 or C905 for sanitary sewer force mains.
- 4.0 Utility Septic Tanks
  - 4.1 Septic tank/drain field sewer systems are not acceptable to FBISD.
- 5.0 Sanitary Utility Sewerage Structures
  - 5.1 Sanitary sewer manholes shall be precast concrete structures with water tight adaptors of a type compatible with pipe materials being used. Sanitary manholes interiors shall be sealed using with Raven Liner 405 or Thane Coat. All sanitary sewer manholes shall be vacuum tested.
  - 5.2 Sanitary cleanouts shall be installed so that they open in the direction of the flow of the waste water. Cleanouts shall have an air tight mechanical plug. All cleanouts shall be located inside of a round cast iron access cover, Josam 58680 or approved equal. Cleanouts located in grassed areas shall have a 6" reinforced, concrete collar poured around the cleanout. Cleanouts shall be set to match finished grades and not cause an obstruction for mowing equipment.

### **33 40 00 – Stormwater Utilities**

- 1.0 Storm Utility Drainage Piping
  - 1.1 Match proposed MEP pipe type and size from connection at building (typically 5' outside building) to first inlet or manhole structure. Fernco couplings are not allowed.
  - 1.2 Provide corrugated high density polyethylene pipe (HDPE) with smooth interior with gasket joints for storm sewers 12 inches and larger for site drainage.
  - 1.3 Provide poly-vinyl chloride (PVC) pipe, SDR 26 with gasket joints for storm sewers 10 inches or less for site drainage.
  - 1.4 Provide reinforced concrete pipe (RCP) meeting ASTM C-76, Class III with bell and spigot rubber gasket joints in public right-of-way and/or connections to public storm sewer systems.
  - 1.5 Provide 12-inch wrap, cement sand bedding and backfill for all storm sewer pipe following AHJ requirements.
  - 1.6 New systems shall be flushed and cleaned 1 month prior to Substantial Completion and after turf establishment per Division 31 - Earthwork.
  - 1.7 All downspouts need to be tied into the storm sewer system.
- 2.0 Culverts
  - 2.1 Provide reinforced concrete pipe for culverts, meeting the same requirements as noted above in 33 40 00.
  - 2.2 Culverts shall have minimum 6:1 safety end treatments (S.E.T.). Culverts shall have safety pipe runners. Steel reinforcing bars cast into safety ends are not acceptable.
  - 2.3 Provide cement sand bedding and backfill for culverts following AHJ requirements.
- 3.0 Storm Utility Water Drains
  - 3.1 Provide two interconnected outfalls from enclosed or semi-enclosed court yards so that area does not pond water. Size pipes in court yards for the 100 year storm event to main storm sewer trunk line.
- 4.0 Storm Utility Drainage Pumps
  - 4.1 Storm pump stations are discouraged by FBISD. If required, the A/E shall provide design calculations, documents and coordinate equipment selection with FBISD.
- 5.0 Subdrainage
  - 5.1 Provide corrugated high density polyethylene (HDPE) double wall perforated sub-drain pipe with perforations at 45 degrees, configuration. Provide aggregate drainage media and geotextile filter fabric encasement per AASHTO, Class II.
  - 5.2 Provide connections to storm sewer for drainage at location of each outdoor playground area as shown on plans. Coordinate with Division 32 – "Exterior Improvements."
  - 5.3 Provide connections to storm sewer for roof drains at canopies located within close proximity to buildings to facilitate drainage away from buildings.

## 6.0 Ponds and Reservoirs

- 6.1 Detention ponds shall be approved by the AHJ requirements.
- 6.2 Side slopes on detention ponds shall not exceed 5:1 slope unless approved by FBISD and shall be protected from erosion with solid sod or hydromulch seeding. Solid sod on side slopes shall be staked until root growth is established.
- 6.3 Consider the use of solid sod or Flexterra® Flexible Growth Medium™ throughout entire pond and four foot outside pond to control erosion
- 6.4  Where detention is required, consider over-sizing capacity so that it is possible to use water available in the permanent pool for use by irrigation system and provide a well for pond makeup water. Refer to LEED Section for additional information.

## 7.0 Storm Drainage Structures

- 7.1 Storm sewer manholes and inlets shall be precast concrete structures. All structures to be grouted inside and outside. Fill inlet bottom with concrete and slope to ensure positive drainage from inlet to storm sewer line.
- 7.2 Brick manholes may be used if approved by FBISD. Brick structures must be mortared inside and out and are to be approved by FBISD and Architect.
- 7.3 Provide slotted type cast iron grates for inlets with openings approximately 1-5/16"x6-5/8" and similar in design to Model V5630 by East Jordon Iron Works or FBISD approved alternate of a USA manufactured product.

### END OF DIVISION 33

## Appendix

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## Diagram 01\_01 (Refer to Divisions 10, 11, 13 & 32) – General – Site Requirements for Elementary, Middle, and High Schools

### Elementary School:

1. Parking – align with Traffic Impact Analysis (TIA) if additional spaces are required by jurisdiction. Quantities listed below are a minimum district standard.
  - a. Visitors 60 spaces (confirm with TIA if additional spaces are required by jurisdiction).
  - b. Staff 110 spaces.
2. Bicycle racks – 11 (align with LEED and local jurisdiction requirements).
3. Provide LED exterior lighting.
4. Service yard.
  - a. Masonry wall around service yard.
  - b. Shall screen all equipment plus 12”.
  - c. Steel bollards to protect all openings wall and at doors from the main building into the service yard.
  - d. Lockable with a full height gate for deliveries (not to exceed 8 feet high).
  - e. Provide a turning radius for delivery trucks (18 wheelers and box trucks).
5. Main Entries.
  - a. Provide decorative bollards at main entries.
6. Student Drop off/Pick-up
  - a. Canopy spaces for 80 linear feet, car queuing minimum 800 feet (coordinate with project TIA)
  - b. Provide inclement weather drop protection at all drop off areas.
7. Bus canopy
  - a. Minimum 100’ of canopy to accommodate minimum of 6 busses.
  - b. Provide inclement weather drop protection at all drop off areas.
8. Dumpsters
  - a. Provide space for 2 dumpster bins.
  - b. Provide space for 1 recycling bin.
9. Flagpole
  - a. 1 Flagpole with capacity for 2 flags.
10. Digital Marquee.
  - a. Provide 1 Digital marquee.
11. Hard surface play court
  - a. Provide 48’x80’ covered concrete court with 6 basketball goals with 42’x74’ elementary size basketball court striping.
12. Playgrounds/Play equipment.
  - a. Provide 2 playgrounds (monkey bars are not permitted) with hard surface shade structure over playgrounds.
  - b. Provide 2 sets of swings that are 8 bays per set. Total of 16 swings.
  - c. Provide site fencing around playground and playfield areas.
13. Playfields.
  - a. Grass area sufficient for kickball and soccer.
  - b. Provide baseball/softball backstop at grass field.
  - c. Provide soccer goals.
14. Outdoor Learning Areas
  - a. Provide 2 outdoor learning areas with seating, planting and group areas.



## Diagram 01\_01 (Refer to Divisions 10, 11, 13 & 32) – General – Site Requirements for Elementary, Middle, and High Schools

### **Middle School:**

1. Parking – align with Traffic Impact Analysis (TIA) if additional spaces are required by jurisdiction. Quantities listed below are a minimum district standard.
  - a. Visitors 88 spaces (confirm with TIA if additional spaces are required by jurisdiction).
  - b. Staff 115 spaces.
  - c. Bus parking Project Manager to confirm bus parking quantities with Transportation department.
2. Bicycle racks – 11 (align with LEED and local jurisdiction requirements).
3. Provide LED exterior lighting.
4. Service yard.
  - a. Masonry wall around service yard.
  - b. Shall screen all equipment plus 12".
  - c. Steel bollards to protect all openings in the service yard wall and at doors from the main building into the service yard.
  - d. Lockable with a full height gate for deliveries (not to exceed 8 feet high).
  - e. Provide a turning radius for delivery trucks (18 wheelers and box trucks).
5. Main Entries.
  - a. Provide decorative bollards at main entries.
6. Student Drop off/Pick-up
  - a. Canopy spaces for 80 linear feet, car queuing minimum 800 feet (coordinate with project TIA).
  - b. Provide inclement weather drop protection at all drop off areas.
7. Bus canopy.
  - a. Minimum 200' of canopy.
  - b. Provide inclement weather drop protection at all drop off areas.
8. Dumpsters
  - a. Provide space for 4 dumpster bins.
  - b. Provide space for 2-4 recycling bins.
9. Flagpole
  - a. 1 Flagpole with capacity for 2 flags.
10. Digital Marquee.
  - a. Provide 1 Digital marquee.
11. Playfields.
  - a. Football field (turf), 4 lane track with lights and bleachers to accommodate 460 seats (no press box).
  - b. Practice field.
  - c. 4 Tennis Courts with windscreens, no lights or bleachers.
  - d. Baseball and softball backstops.
  - e. Cage for discus.
  - f. Portable water at fields and tennis.
  - g. Provide site fencing around competition fields and playfield areas.
12. Outdoor Learning Areas
  - a. Provide 2 outdoor learning areas with seating, planting and group areas.



## Diagram 01\_01 (Refer to Divisions 10, 11, 13 & 32) – General – Site Requirements for Elementary, Middle, and High Schools

### High School:

1. Parking – align with Traffic Impact Analysis (TIA) if additional spaces are required by jurisdiction. Quantities listed below are a minimum district standard.
  - a. Visitors 40 spaces (confirm with TIA if additional spaces are required by jurisdiction).
  - b. Staff 235 spaces (including kitchen staff).
  - c. Student 600 spaces.
  - d. Bus parking Project Manager to confirm bus parking quantities with Transportation department.
2. Bicycle racks – 11 (align with LEED and local jurisdiction requirements).
3. Provide LED exterior lighting.
4. Service yard
  - a. Masonry wall around service yard.
  - b. Shall screen all equipment plus 12".
  - c. Steel bollards to protect all openings in the service yard wall and at doors from the main building into the service yard.
  - d. Lockable with a full height gate for deliveries (not to exceed 8 feet high).
  - e. Provide a turning radius for delivery trucks (18 wheelers and box trucks).
5. Main Entries
  - a. Provide decorative bollards at main entries.
6. Student Drop off/Pick-up
  - a. Canopy spaces for 80 linear feet, car queuing minimum 800 feet (coordinate with project TIA).
  - b. Provide inclement weather drop protection at all drop off areas.
7. Bus canopy
  - a. Minimum 200' of canopy.
  - b. Provide inclement weather drop protection at all drop off areas.
8. Dumpsters
  - a. Provide space for 6-8 dumpster bins.
  - b. Provide space for 3-4 recycling bins.
9. Flagpole
  - a. 2 Flagpoles with capacity for 2 flags.
10. Digital Marquee.
  - a. Provide 1 Digital marquee.
11. Playfields
  - a. Competition football and soccer stadium (turf with football goal posts and soccer goals), 8 lane track with lights, scoreboard, bleachers to accommodate 1,200 seats and press box. Field events to include 2 shot put, 1 pole vault, 2 long jump, triple jump, 2 high jump and s discus areas.
  - b. 2 Practice football fields.
  - c. 1 Practice soccer field.
  - d. 1 Baseball stadium with lights, score board, press box, hitting cages, bull pens and bleacher seating for 750.
  - e. 1 Softball stadium with lights, score board, press box, hitting cages, bull pens and bleacher seating for 500.
  - f. 6 Tennis Courts with windscreens. lights and bleacher seating for 300.
  - g. Baseball and softball backstops.
  - h. Cage for discus.
  - i. Potable water at fields and tennis.



- j. Provide site fencing around competition fields and playfield areas.
- 12. Guard Shack
  - a. 1 Guard shack by entry to student parking.
- 13. Band Practice Field
  - a. Painted practice football field by fine arts area for marching band practice.
  - b. 1 Band director tower at 50-yard line.
- 14. Outdoor Learning Areas
  - a. Provide 2 outdoor learning areas with seating, planting and group areas.

## Diagram 01\_02 – General – CxA Scope and Deliverables

### Schematic Design Phase

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#### 1. Project Kickoff Meeting

Develop and conduct a project kickoff meeting with all commissioning team members. These members include the owner, users, operation and maintenance staff, architect, engineers, and any other involved parties. The purpose of this meeting will be to formally introduce the commissioning process to be utilized for this project, determine the expectations of all team members, and gain a firm understanding of the Owner's project requirements and current process. Work with the design architect to facilitate the process, and answer questions that will lead to the credit for the Integrative process. This will help ensure all team members clearly understand the commissioning process and help ensure a successful implementation of the Commissioning Process.

Deliverable(s): Meeting agenda, attendance record & meeting minutes

#### 2. Owner Project Requirements (OPR) Development

Immediately following the initial kick-off meeting, the district will provide a revised draft of the OPR based upon the District's current design standards and LEED® v4. This will be accomplished through a coordinated effort between the district design and construction team, the design team, the project team, and the building users with reviews/updates at each design milestone. Once finalized the OPR will be used throughout the project to verify the construction and acceptance phases of the project are achieving these original criteria. Verify that any documented OPR goal is verifiable prior to occupancy.

Deliverable(s): Review comments for the owner provided OPR

#### 3. Commissioning Plan & Schedule

Develop an outline for expectations of a commissioning plan for the project. This project work plan will form the core of the commissioning plan and will detail the tasks to be accomplished along with specific personnel and resources to be applied throughout the project. The commissioning plan will be updated periodically throughout the project process, will become the depository for the commissioning documentation, and ultimately will become the basis of the final commissioning report.

Deliverable(s): Outline of Cx plan and schedule

## Design Phase

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### 4. Basis of Design (BoD) Reviews

Immediately following the development of the initial OPR, provide a template to the A/E to be used for the development of the BoD. The BoD will be provided by the A/E team and is to be reviewed at each design review milestone to ensure proper documentation of the design process and compliance with the OPR. Key to the process for LEED® v4 is to ensure the envelope is addressed in both the OPR and BoD documents during the review process.

Deliverable(s): OPR compliance comments, BoD Template

### 5. Design Reviews

Provide a total of three (3) reviews at the DD, 50% and 100% construction document phases to verify compliance with the stated OPR, overall constructability and allowance for commissioning facilitation.

- Verify that the design meets the OPR and clear identification of the measurable criteria for each OPR has been provided
- The design of equipment and systems includes provisions for access and maintenance
- The design provides sufficient access and capabilities for testing, and commissioning of each system/component
- Provide a general design for quality items during the review
- Verify proper coordination and clarity of items and details between trades and specifications
- Detailed design-related items to be verified:
  - Technical review from an engineer in the same field
  - Acceptable practice and standard of care
  - Sheet-to-sheet and trade-to trade coordination
  - Constructability
  - Conformance to client, industry, local, state and federal standards and codes
  - Specific concerns of stakeholders
  - Detail and coordination of controls, life safety, electrical and mechanical systems
  - Overall calculations and assumptions utilized for system and equipment selection

To ensure resolution of the items that are identified during the design review, work with the A/E to ensure each issue has been formally addressed within two (2) weeks, make the Owner aware of any OPR items that may be at risk if comments are not incorporated into the design. Participate in three (3) design review meeting with the design team to discuss the issues identified at each design review and discuss possible methods for resolution.

Deliverable(s): Design review reports (multiple)

### 6. Commissioning Specifications

Develop the commissioning specifications. The commissioning specifications will be incorporated into the construction document package and will be detailed to the extent that contractors will have a clear understanding of the process being implemented and their responsibility for the tasks. Review the specification sections pertaining to commissioned systems and make suggestions for improving the content, to be specific

and customized to the project. This will include provisions within the general conditions for the training program and O&M manual requirements.

Additional systems to be commissioned in LEED v4 include electrical service and distribution, as well as the plumbing systems, including pumps and controls.

Deliverable(s): Update, provide and review specification sections (013310 Submittal Procedures, 017830 Operation and Maintenance, 018130 Cx (Commissioning) Process, 018010 Cx Pre-functional Checklists, 018020 Cx Functional Performance Testing, 018021 Facilities Exterior Enclosure Commissioning, 018113 Sustainable Design Requirements – LEED for Schools)

## **7. Pre-Bid Meeting**

It is important that bidding contractors have a clear and accurate understanding of the commissioning process for this project in order to submit an appropriate bid. Attend and provide a brief review of the commissioning process during the pre-bid meeting and be available for answering questions. This review of the commissioning process will include a discussion of the key project intents for the project, tools and techniques to be utilized on the project (Commissioning Plan), and preliminary discussion of responsibilities.

Deliverable(s): Meeting agenda, attendance record & meeting minutes

## Construction Phase

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### 8. Value Engineering Review

Review the results of the value engineering session from the bid negotiations phase. Review the post bid documents and provide input to the District regarding the potential impact of the recommendations on the OPR of the facility.

Deliverable(s): VE review report

### 9. Pre-Construction Meeting

Conduct one (1) pre construction meeting, where the goals of the project are reviewed (OPR), the Basis of Design presented, and the tools and techniques to be followed detailed (Commissioning Plan). By clearly detailing the OPR during this meeting, all project team members will understand what the Owner expects for a successful project. Presenting the Commissioning Plan then details of how your team will assist to achieve the OPR.

Deliverable(s): Communication plan, meeting agenda, attendance record, meeting minutes

### 10. Submittal Reviews

Concurrently with the A/E's review, review the contractor's submittals to verify they meet the OPR. Provide your comments will to the A/E to aid in the identification and resolution of problems. The main focus of these reviews is to verify the quality of the submittals, the detailed information required for the long-term operation of the equipment is provided, any substitutions meet the OPR and Basis of Design in their entirety, and that the supplied systems and components will meet the needs of the Owner. In addition to the submittals, review all MEP requests for information (RFI) and change orders for their potential impact on the OPR, as well as coordination drawings to verify proper coordination between trades. To ensure resolution of the issues identified during our review, work with the A/E to ensure formal resolution of each issue identified is accomplished and incorporated in the formal response to the Contractor.

Deliverable(s): Submittal review comments (multiple)

### 11. Construction Checklists

Develop:

- Construction Checklist
- Contractor readiness matrix
- Final checklist
- Training Agenda
- Complete construction checklist report

A key effort in integrating the commissioning process activities into the construction documents is to verify construction quality control steps take place. The intent of the construction checklist system is to transfer the requirements of the contract documents and OPR to the various workers in the field for each phase of delivery,



installation, and start-up for the commissioned systems and equipment. The checklist is not intended to replace or repeat project specifications, but rather to serve as reminders of basic items of concern, especially those items the team has observed to be commonly missed on other projects. In addition, these checklists shall be utilized to develop and track the detailed start-up plan and contractor readiness schedule for all commissioned systems and equipment.

The checklist system incorporates a tracking mechanism that allows the CxA team to periodically check the status of each commissioned system and/or equipment, as well as perform periodic verification of checklist completion.

Provide construction checklists for each applicable commissioned system and component. These checklists shall be organized and composed in a method to provide verification of each step of installation for a given system or component, including final start-up and testing. Checklist shall also be used in conjunction with the contractor readiness matrix developed by the CxA team to document progress of the project relative to preparedness for functional testing.

Prior to distribution of the checklist system, the CxA team will provide samples of each checklist proposed for the project within the contract specifications. In addition, at the outset of construction comments will be solicited from the contractors on the specified checklists and incorporated as possible. In addition, the CxA team will conduct a **full-day training** session on site with the construction manager and all contractors for the construction checklist system prior to distribution of the system. Provide the A/E, contractors and the Owner with copies of checklist completion and deficiency reports throughout the project, and will provide a final copy of these reports within our final commissioning report.

Deliverable(s): Draft construction checklists, final construction checklists, training agenda, training record, completed construction checklists, checklist completed construction checklists, checklist completion report & checklist deficiency report

## 12. Site Visits and Commissioning Meetings

A significant effort will be required for periodic site visits to verify the contractors' processes are such that the OPR is being achieved. To assist with early detection, provide a significant presence at the beginning of the installation of the commissioned systems, especially where repetitive work is involved. The benefit of this approach is to communicate the expectations to the contractors early enough to minimize rework. In practice, this usually results in close discussions in the beginning, and a subsequent smoothing of the work and greatly reduced 'punch list' items for the duration of the project. During these site visits the following activities shall be incorporated as required/planned with the Owner and Contractors:

1. Randomly sample the construction checklists as a means to verify that the installation of the systems and equipment meets the Owner's OPR
2. Randomly sample red-line documents to verify proper record documents are being maintained
3. Review the general condition and progress of the facility as a whole
4. Witness pressure testing, flushing, and cleaning of piping and ductwork systems
5. Witness NETA and meager testing of electrical systems
6. Witness initial start-up of major equipment to verify that proper procedures are followed and that the tests are properly documented
7. Attend periodic Cx meetings
8. Attend periodic construction meetings



Deliverable(s): Meeting agenda, site visit report, meeting minutes

### **13. O&M Manual Review**

As part of the submittal review, verify the contractor has provided all the information required to properly install, operate, maintain, and troubleshoot the commissioned system and equipment, including key full- and part-load data as well as detailed instructions for maintenance of the systems/equipment to maintain warranty coverage. Specify that the contractors' O&M manuals be due 60 days after shop drawing acceptance by the A/E. Ensure the O&M documentation is tailored to the systems being installed and is of high quality. Early receipt of the O&M documentation should enable its use during on-going training and in the production of a facility systems concept manual and preventative maintenance program.

Deliverable(s): O&M manual review report

### **14. Functional Performance Test Development**

During the construction phase, work with the contractors and the A/E in the development of the functional performance tests. The intent of the functional performance tests will be to clearly document that the systems and buildings meet the Owner's OPR and are fully functional. The test procedures will be reviewed with the A/E, contractors and the Owner to obtain their concurrence relative to procedure, warranty, and safety issues.

Deliverable(s): Draft FPT & final FPT

### **15. Testing, Adjusting and Balancing (TAB) Verification**

Provide a TAB scope of work for the owners use in soliciting pricing. Randomly sample the TAB report and verify the system performance is properly documented. Work with the TAB contractor to verify acceptance of TAB methods and equipment. The TAB contractor will identify the key technician for the project to the commissioning provider for the purpose of verifying the methods, equipment and TAB report. In addition to verifying results, verify that proper procedures are being used for TAB work by reviewing the procedures utilized during the verification process. For this verification process sample of 10% of the total points reported in the TAB report shall be selected at random. If significant issues are identified during the 10% verification, the TAB contractor will need to completely rebalance those systems, and typical systems.

Deliverable(s): TAB scope of work, TAB plan review report, TAB report review report, TAB verification plan & TAB verification report

### **16. Functional Performance Testing**

Functional performance testing of the building systems occurs once all systems are installed but before the Owner occupies the building. The building systems are tested in all modes of operation, including full heating, full cooling, and any other modes that may be required by the project. As the commissioning provider, witness and direct the tests as the contractors complete them. Work closely with the Owner and the contractors early in the Construction Phase to schedule the tests and key milestones.

Deliverable(s): FPT report

## 17. Training Program Coordination & Review

Review and oversee the coordination and implementation of the training program scheduled and conducted by the contractors to verify it achieves the Owner's intent and provides sufficient, tailored training for the O&M staff. This coordination will include:

- Coordination and communication with the Owner to document training needs
- Review of the training agenda and training materials prepared by the contractors
- Development, coordination and scheduling of all training sessions
- Attendance at select contractor training sessions
- Evaluation of the training sessions attended

Provide the following during the review of the training program:

- Document and distribute a formal training program based upon the Owner's objectives
- Develop and maintain schedule for all training sessions
- Maintain a training record of attendees for each session
- Develop, distribute and collate attendee evaluation forms for all sessions
- Review and comment on all training sessions attended, including recommendations for approval or rejection

Deliverable(s): Training program, training record, training evaluation forms, training summary report

## 18. Re-Commissioning Manual

Using the information obtained from the O&M manuals prepared by the contractors, compile the information from the Owner, A/E, and contractors for the re-commissioning manual. This manual will be electronic and constructed to provide the information necessary to re-commission the various systems within the facility, including the following:

- Copy of Commissioning record including OPR, BOD, functional test procedures, etc.
- Single line drawings
- System narratives (by A/E & CxA)
- Space and Use descriptions (by A/E)
- Control Drawings and sequences (by Contractors)
- Start-up and shutdown procedures by system & equipment (by Contractors)
- Schedules matrix and recommendations for review (by Contractors & CxA)
- Set point table, including implications for adjustment and recommended practice for evaluation
- Descriptions of energy saving features and matrix of operation and maintenance recommendations for each
- Re-commissioning recommendations table by system and equipment type
- Energy use benchmarking guidelines, including recommended trend logs and metrics

Deliverable(s): Re-Cx manual

## 19. Commissioning Record / Final Report

As soon as possible after the Owner takes occupancy of the facilities, submit a report on the results of the commissioning process. The report includes the scope and activities of commissioning for the project, as well as a discussion of problems and difficulties that were avoided, rather than errors that were discovered. A part

of the report provide a detailed listing of each problem encountered, how it was resolved. This listing provides the Owner with substantive documentation of the value of commissioning. In addition, provide all letter templates and back-up documentation required by USGBC for LEED® v4

Deliverable(s): Draft commissioning record, final commissioning record

## WARRANTY/OPERATION PHASE

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### 20. Operations & Maintenance (O&M) Plan

Prior to final completion provide current facility requirements and an operations and maintenance (O&M) Plan. The O&M plan includes things such as systems narrative, sequence of operation, building occupancy schedule, PM plan, ongoing commissioning tasks, and so forth.

Deliverable(s): O&M Plan

### 21. Seasonal Testing

Due to weather conditions, not all systems in the building will be able to be tested at or near full load. To the extent possible, the building automation system (BAS) will be utilized for trending, both to facilitate functional performance testing (FPT) and long term trends to confirm overall HVAC performance throughout the year. If the BAS cannot facilitate the trends listed, then manual testing will be conducted to verify the building's performance during maximum design conditions. The BAS trending will include short term (e.g. coinciding with a particular field test) and long term points to show adequate full load heating and cooling system capacity, and event records, such as rooms chronically out of temperature range, CO2 levels out of range, etc.

Deliverable(s): Seasonal test report

### 22. Warranty Review

At the ten month points of occupancy, perform a thorough review of the operation of all building systems in preparation for the end of the equipment warranty period. Identifying any potential problems prior to the expiration of the warranty, the Owner can save significant resources by having the manufacturer or contractor corrects the problems. In addition, during this site visit work with the Owner's O&M personnel on the identification and resolution of outstanding deficiency issues, operation & maintenance issues, and preliminary re-commissioning of various systems.

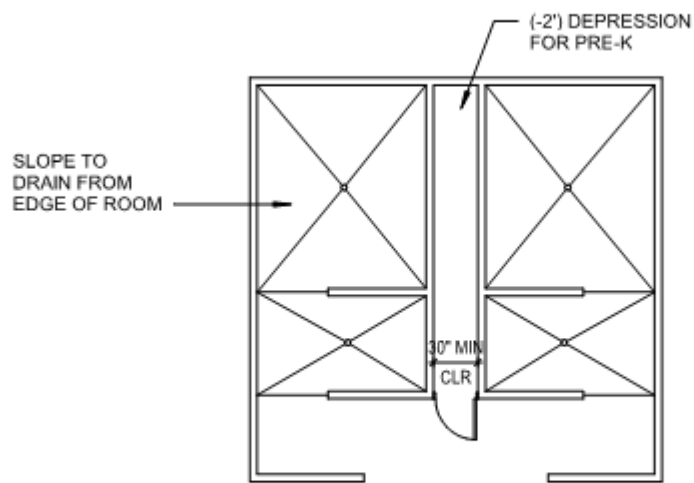
Deliverable(s): Warranty review report

The following tasks have occurrences during each phase of a project and are treated as continuous component of the commissioning process.

### 23. Commissioning Plan and Schedule Updates

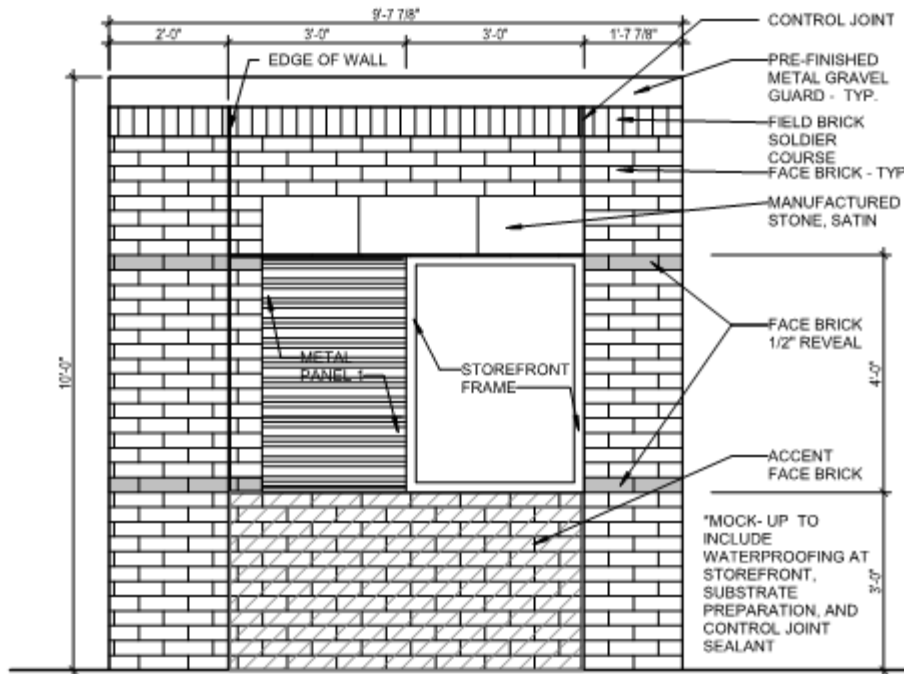
Due to the dynamic nature of the construction process, it is necessary to continuously review and update the plan and schedule for the commissioning process to coordinate with the progress and results of construction. Periodically review and distribute the commissioning plan to reflect the progression and current schedule of the facility construction. This shall also include updates and tracking of a master issues list. Both tasks shall be conducted on a monthly basis during the course of the project.

Deliverable(s): Cx plan update (multiple), issue log (multiple) & issue detail report (multiple)

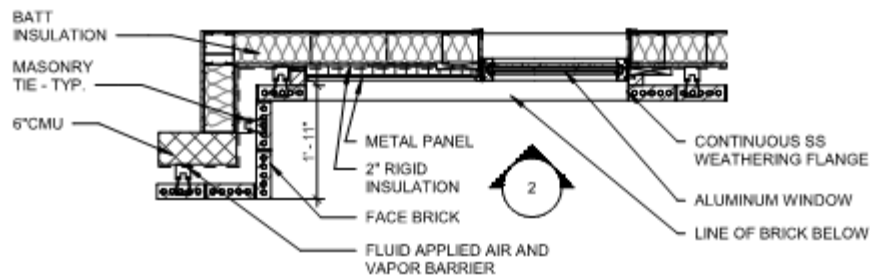


**1** FOUNDATION DETAIL AT TOILET ROOMS  
 1/8" = 1'-0"

**Diagram 03\_01 (Refer to Division 03) – Foundation Detail at Toilet Rooms**

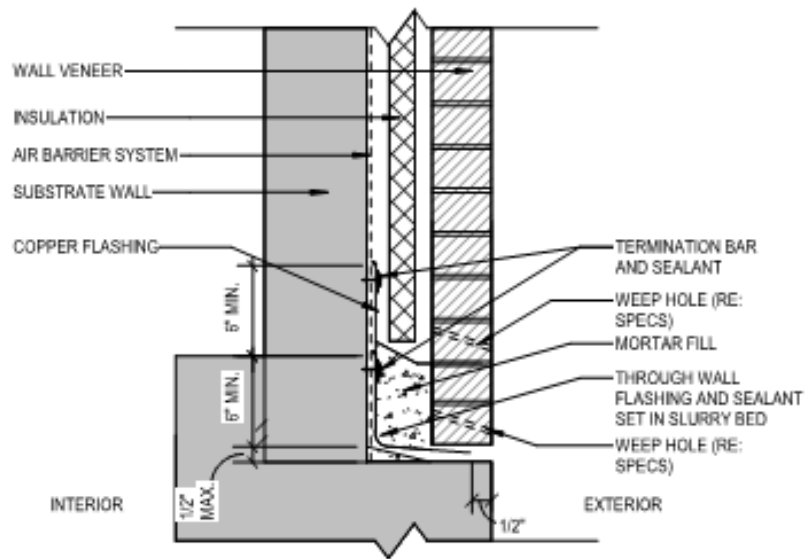


2 MOCK-UP  
1/2" = 1'-0"



1 MOCK UP WALL PLAN DETAIL  
1/2" = 1'-0"

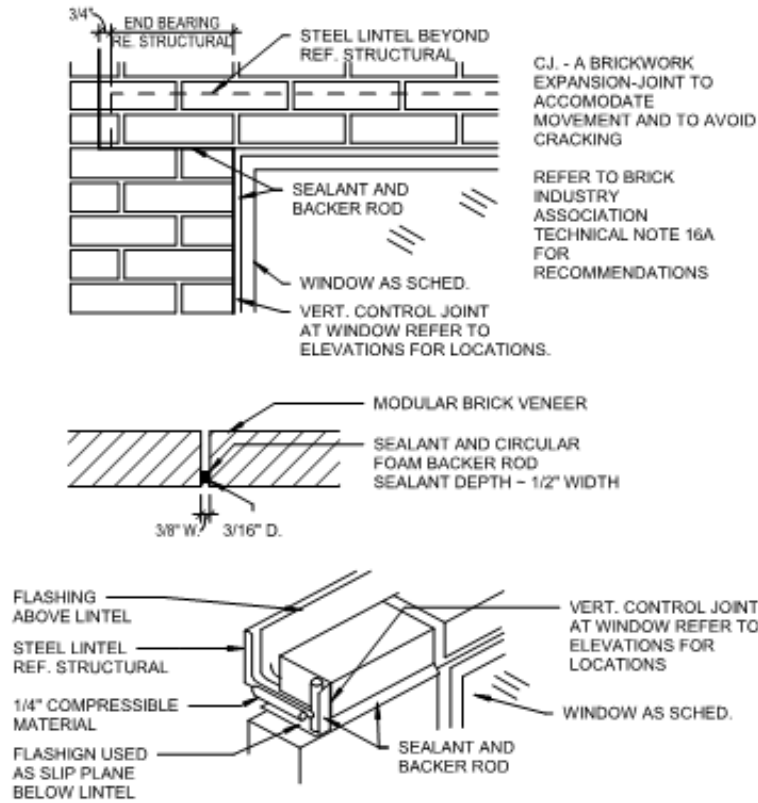
Diagram 04\_01 (Refer to Division 04) – Masonry Wall Mockup Sample



# 1 CAVITY DRAINAGE FLASHING 1 1/2" = 1'-0"

Diagram 04\_02 (Refer to Division 04) – Cavity Drainage - Flashing





# 1 MASONRY CONTROL JOINT DETAIL

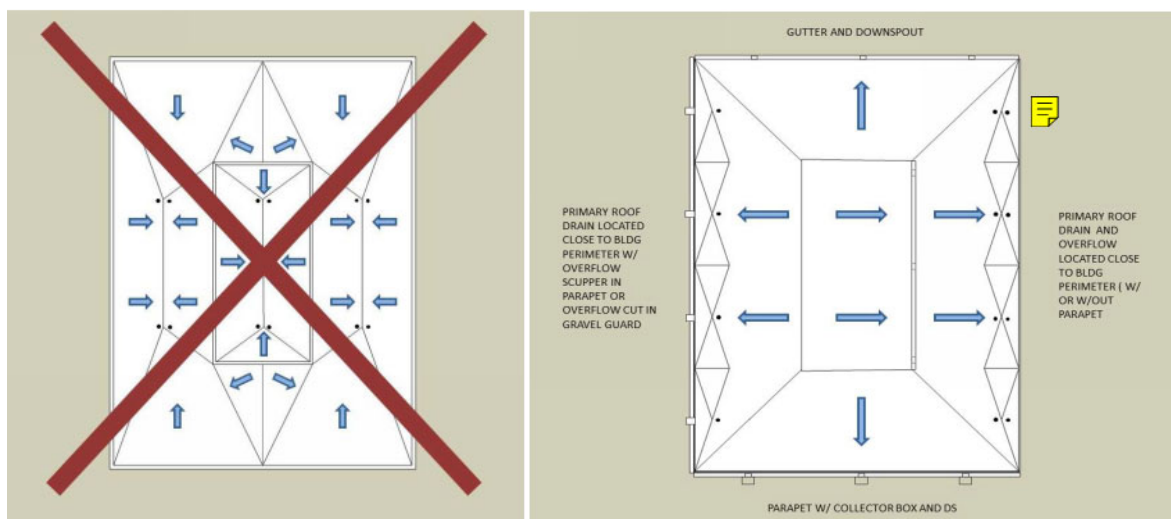
1 1/2" = 1'-0"

Diagram 04\_03 (Refer to Division 04) – Masonry Control Joint Detail

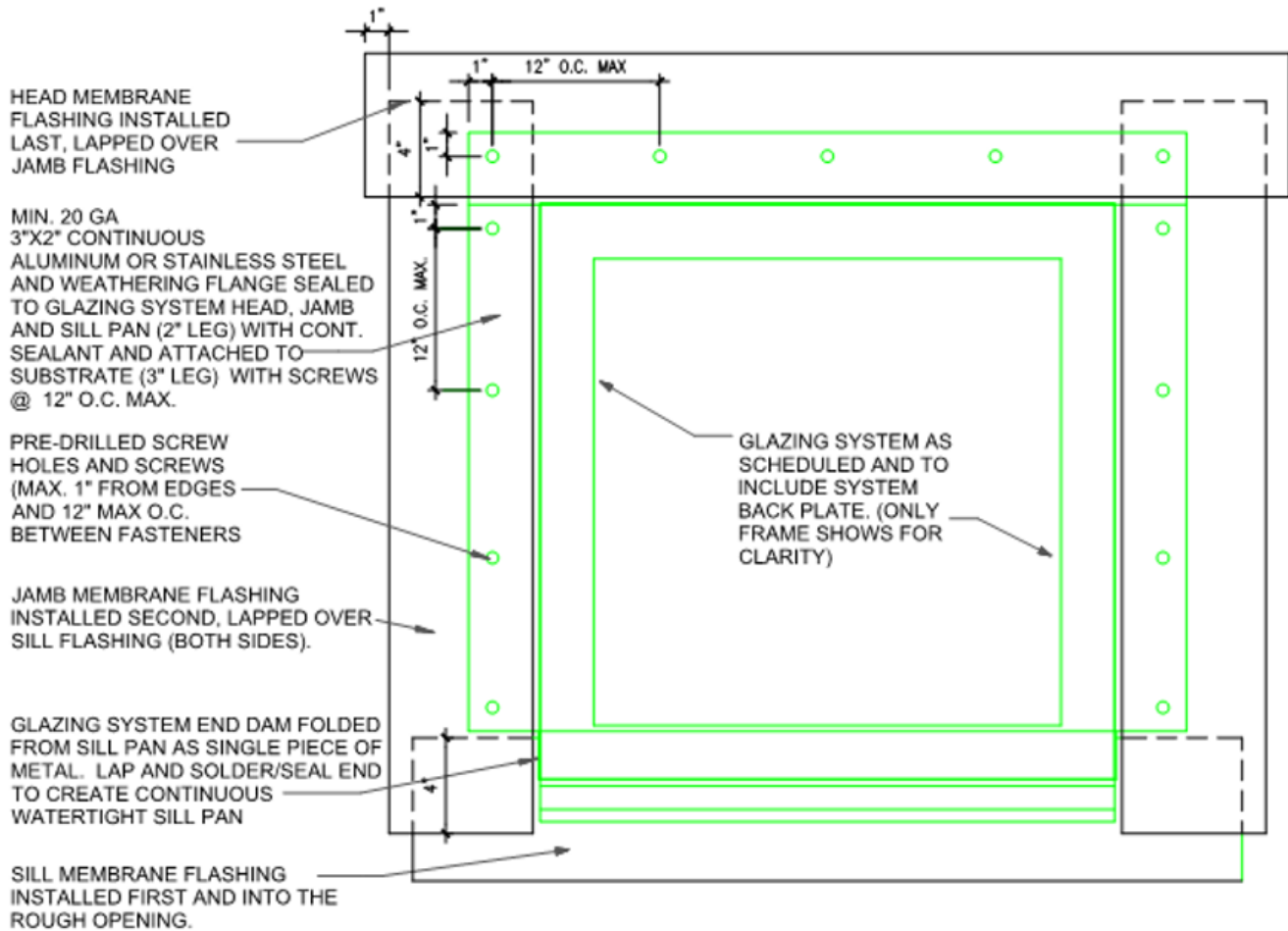




**Diagram 07\_01 (Refer to Division 07) – Completion of Moisture and Thermal Envelopes at Exterior Alcoves**

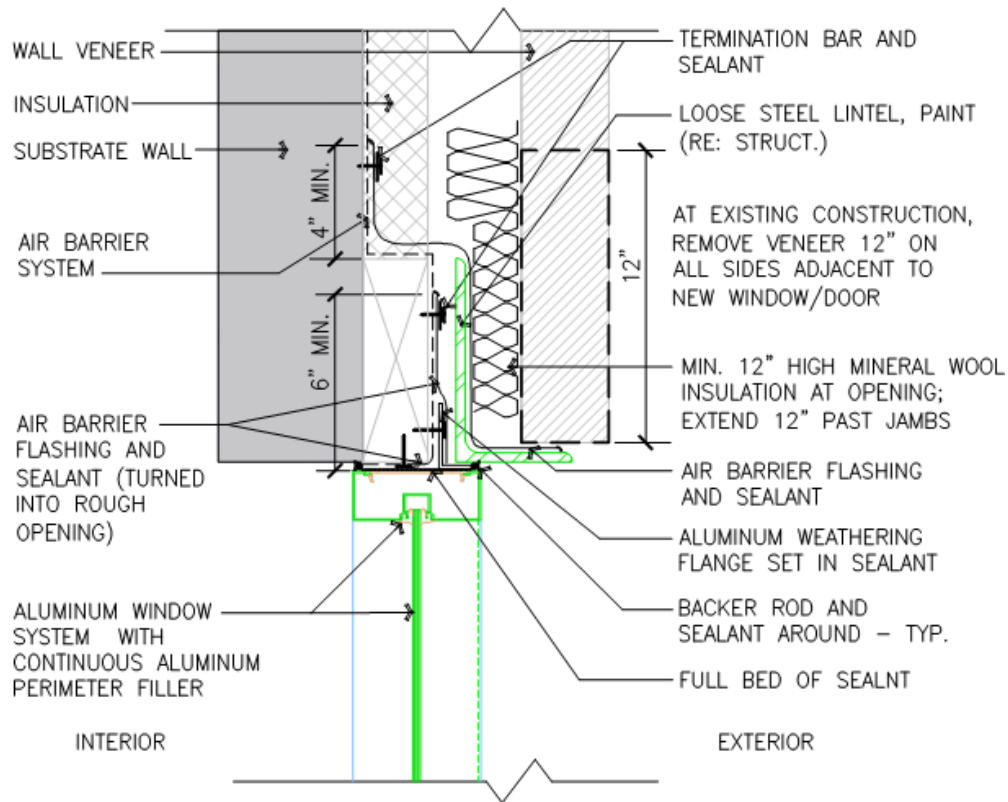


**Diagram 07\_02 (Refer to Division 07) – Roof Drain Locations to Avoid (Left) and Recommended Roof Designs (Right)**

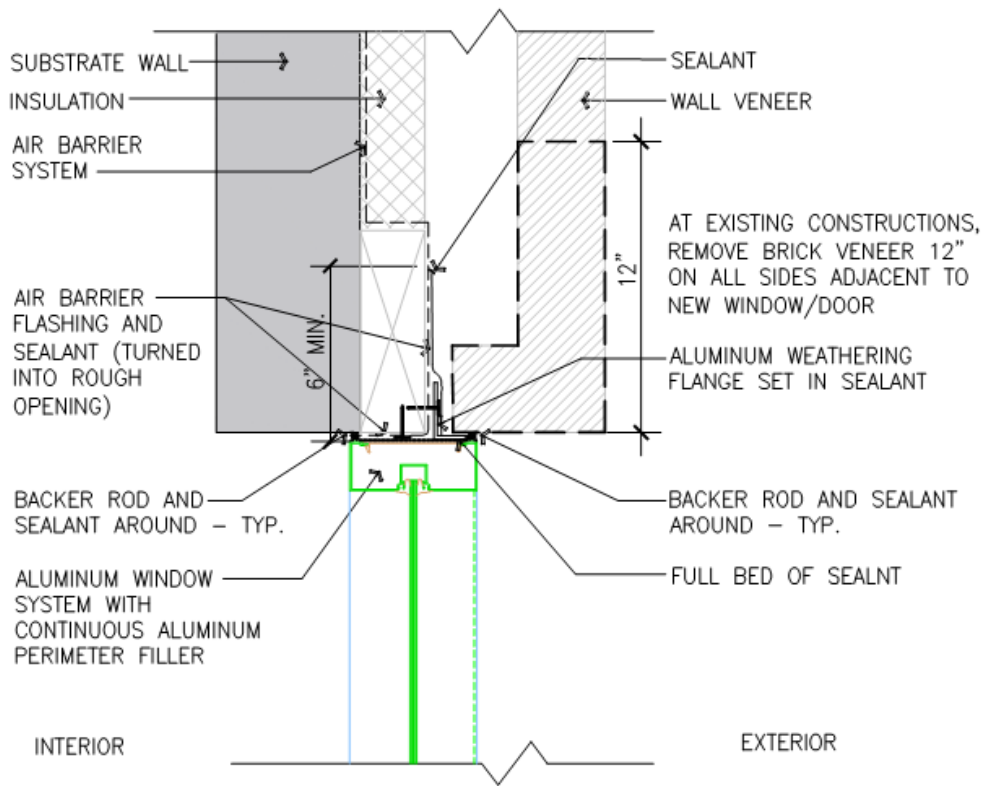


**PRIOR TO WINDOW FRAME BEING SET, INSTALL FLEXIBLE SELF-ADHERED FLASHING ON WOOD BLOCKING AND INTO THE ROUGH OPENING AT HEAD, JAMB, AND SILL LOCATIONS**

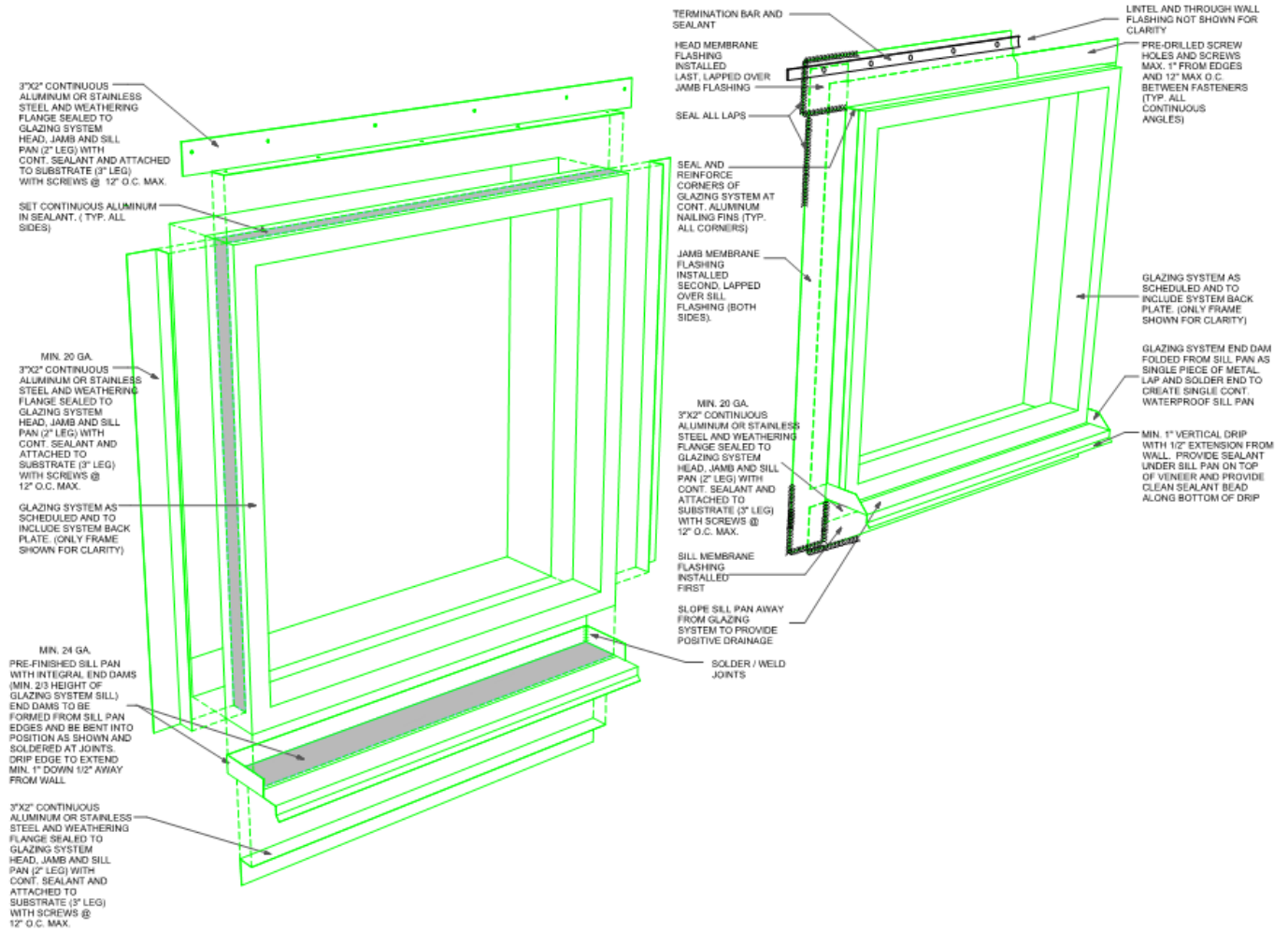
**Diagram 07\_03 (Refer to Division 07) – Storefront Elevation – Edge Condition**



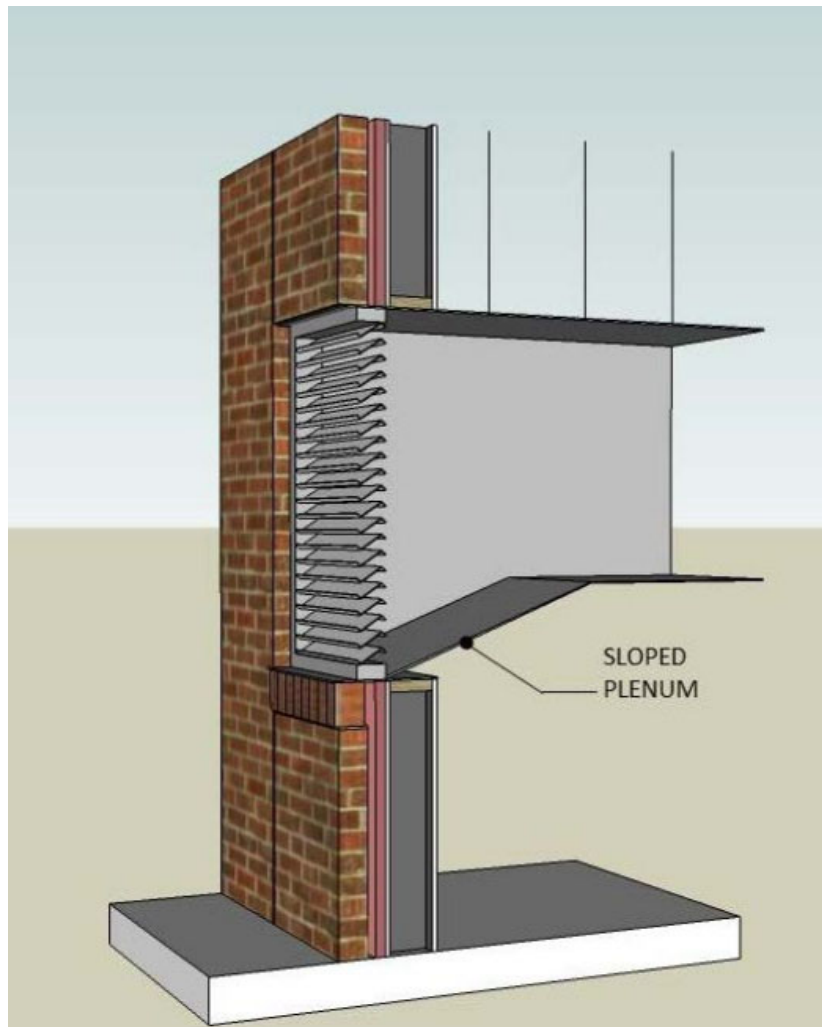
**Diagram 07\_04 (Refer to Division 07) – Head Flashing – Aluminum Frame**



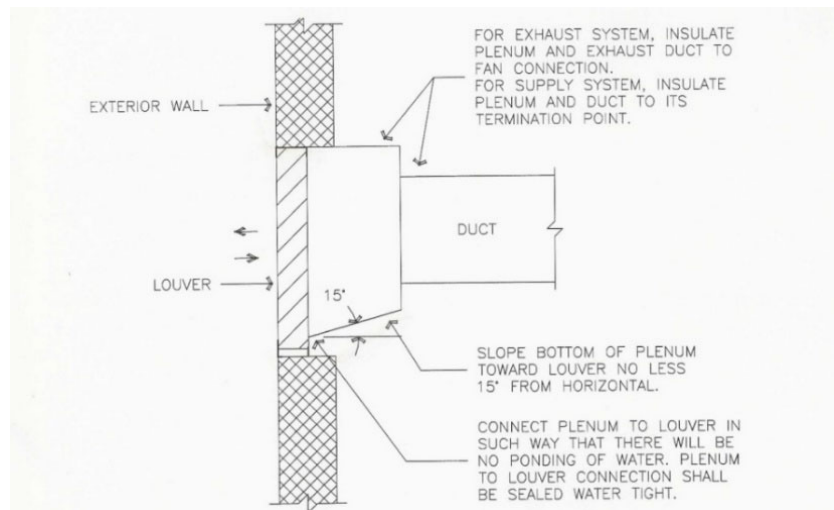
**Diagram 07\_05 (Refer to Division 07) – Jamb Flashing – Aluminum**



**Diagram 07\_06 (Refer to Division 07) – Exploded Views of Window Flashings (Doors/Louvers Similar)**



\*Refer to Diagram 07\_06 for additional information

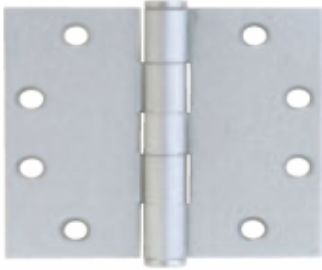


**Diagram 08\_01 (Refer to Division 08) – Fully, welded plenum boxes**

## Full Mortise Hinges - 5 Knuckle

### 5PB1

5 Knuckle, Plain Bearing



#### PLAIN BEARING • LOW FREQUENCY • STANDARD WEIGHT

For use on Standard Weight Doors with Low Frequency Usage, not intended for use with door closing devices.

**5PB1** Steel with steel pin

**5PB1** Brass with stainless steel pin

**5PB1** Stainless steel with stainless steel pin (630 finish)

NRP = Non-Removable Pin

- Dimensions & tolerances conform to ANSI - A156.7
- Packed with wood and machine screws
- 5PB1 Steel description conforms to ANSI - A8133
- 5PB1 Brass conforms to ANSI - A2133
- 5PB1 Stainless Steel description conforms to ANSI - A5133

Size (Inches)	Size (mm)	Gauge
3.5 x 3.5	89 x 89	0.123
4.5 x 4	114 x 102	0.134
4.5 x 4.5	114 x 114	0.134

### 5BB1

5 Knuckle, Ball Bearing



#### 2 BALL BEARING • MEDIUM FREQUENCY • STANDARD WEIGHT

For use on Standard Weight Doors with Medium Frequency Usage

**5BB1** Steel with steel pin

**5BB1** Brass with stainless steel pin

**5BB1** Stainless steel with stainless steel pin (630 finish only)

NRP = Non-Removable Pin

- Dimensions & tolerances conform to ANSI - A156.7
- 5BB1 Steel description conforms to ANSI - A8112
- 5BB1 Brass conforms to ANSI - A2112
- 5BB1 Stainless steel description conforms to ANSI - A5112
- Packed with wood and machine screws

Size (Inches)	Size (mm)	Gauge
4 x 4	102 x 102	0.130
4.5 x 4	114 x 102	0.134
4.5 x 4.5	114 x 114	0.134
4.5 x 5	114 x 127	0.146
5 x 4.5	127 x 114	0.146

Diagram 08\_02 (Refer to Division 08) – Door Hardware Product Cut Sheets



## Pin and barrel hinges **IVES**



### 600 Full mortise pin and barrel continuous hinge - steel

### 700 Full mortise pin and barrel continuous hinge - stainless steel

- 1/4" diameter pin with nylon self-lubricating, medical grade split bearing
- For doors weighing up to 300 pounds without reinforcing, 600 pounds with reinforcing
- 1/8" Inset recommended for 1 3/4" doors
- 48" Maximum door width
- Non handed for custom cut lengths
- Bevel or square edge door

#### Certifications

- Meets ANSI 156.26
- UL10C certified

#### Standard lengths

- 83", 85", 95", 120"

#### Standard mounting hardware

- #10 X 1/2" Self Drilling, Self Tapping Screws
- #10 X 1" Wood Screws

#### Material

- 600 - 1012 Cold-rolled steel
- 700 - 14 Gauge Type 304 stainless steel

#### Finishes

BE-HMA	Description	Substrate	Finish
600	Grey primer paint	Steel	USP
630	Satin stainless steel	Stainless steel	US32D

Custom paint available on 600 series, consult factory.

#### Options

- HT.....Hospital tip
- EPT.....Electric power transfer
- TW8.....Electrical through wire
- CON.....Allegion Connect

#### Optional mounting hardware

- SECHM.....Security screws - hollow metal door and frame
- SECWDHM.....Security screws - 1/2 wood, 1/2 hollow metal
- SECWDWD.....Security screws - wood door and frame
- WD.....Wood door and frame

#### For single door applications:

For pairs of doors see chart and general information.

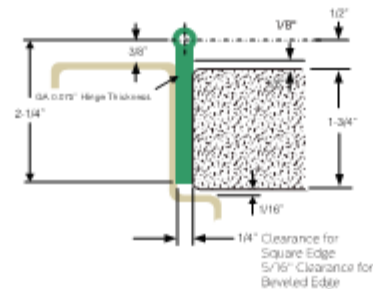
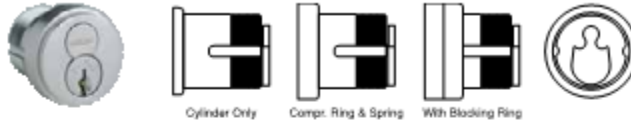


Diagram 08\_03 (Refer to Division 08) – Door Hardware Product Cut Sheets



## Small Format Interchangeable Core Mortise Cylinders



### Cylinders for Schlage L-Series Mortise Locks

	Design	Function	Core Mechanism			
			Everest 29 Restricted (GD Suffix)	Keyed Construction (HD Suffix)	Disposable Construction (BDC Suffix)	Housing Less Core (BD Suffix)
	<b>L &amp; N Escutcheons</b> (cylinders with compression ring and spring)	All Except L9060 Outside	80-308	80-138	80-115	80-108
		L9060P Outside	80-304	80-134	80-134	80-104
	<b>Sectional Trim</b> (cylinder with compression ring, spring and 1/4" blocking ring)	All* Except L9060 Outside	80-301	80-131	80-131	80-101
		L9060 Outside	80-304 + 36-082-050	80-134 36-082-050	80-134 36-082-050	80-104 36-082-050

Notes 1. Available 605, 606, 612, 613, 619, 625, and 626 finish. Cores furnished 606 and 626 only.  
2. All cylinders are 1 1/8" long.



### Mortise Cylinders with Straight Cam for Exit Devices

Number	Core Type
80-302	Everest 29 restricted core
80-110	Disposable constr. core
80-132	Keyed constr. core
80-102	Housing less core



















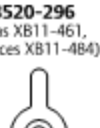

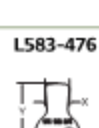


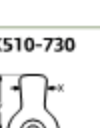



Furnished with compression ring, spring and 1/4" blocking ring.

Notes 1. Available 605, 606, 612, 613, 629, 625, and 626 finish. Cores furnished 606 and 626 only.  
2. All cylinders are 1 1/8" long.

## Diagram 08\_04 (Refer to Division 08) – Door Hardware Product Cut Sheets

## Cams for Schlage Mortise Cylinders in Other Manufacturers' Mortise Locks

	Modular Cylinder	Modular Cylinder	Classic Conventional Non-IC	Interchangeable Core	Everest 29 & Primus Non-IC
	Cyl. length 1 1/8", 1 3/8", 1 5/8"	Cyl. length 1 1/4", 1 1/2", 1 3/4"	20-001	20-061, 20-771, 26-094, 80-102, 80-110, 80-132, 80-302	20-001 Everest 29 Conventional 20-500 and 20-700 Primus
<b>Corbin Russwin</b> DL4000 Series (Old <b>Corbin</b> 420 and <b>Russwin</b> 1503)	<b>B520-730</b>  Dim. X = .153 Y = .761	<b>B520-731</b>  Dim. X = .153 Y = .761	<b>B520-295</b>  Dim. X = .155 Y = .775	<b>B520-254</b> (was XB11-426) 	<b>B520-366</b> (was XB11-656) 
<b>Corbin Russwin</b> ML2200 Series (Old <b>Corbin</b> 7000-9000 and <b>Russwin</b> 4000-5000) All functions except ML2255 and ML2242 inside (see straight cam)	<b>B520-732</b>  Dim. X = .236 Y = .731	<b>B520-733</b>  Dim. X = .236 Y = .731	<b>B520-233</b> (was XB08-899)  Dim. X = .232 Y = .729	<b>B520-253</b> (was XB11-352) 	<b>B520-309</b> (was XB11-629) 
<b>Corbin Russwin A65</b> ML2200 master ring deadbolt functions manufactured before 6/10/93 and old <b>Russwin</b> cast iron residential locks. For all <b>Best</b> 40H Series & 30H Deadbolt function	<b>B520-734</b>  Dim. X = .242 Y = .757	<b>B520-735</b>  Dim. X = .242 Y = .757	<b>B520-223</b> (was XB03-142)  Dim. X = .235 Y = .729	<b>B520-360</b> (was XB11-817) 	<b>B520-367</b> (was XB11-887) 
<b>Yale</b> 2160 <b>Arrow</b> #004 <b>Sargent</b> 13-0660 All functions except 16 inside and 50 outside	<b>B520-736</b>  Dim. X = .187 Y = .727	<b>B520-737</b>  Dim. X = .187 Y = .727	<b>B520-256</b> (was XB11-430, replaces XB10-659)  Dim. X = .186 Y = .718	<b>B520-296</b> (was XB11-461, replaces XB11-484) 	<b>B520-329</b> (was XB11-631, replaces XB11-630) 
<b>Best</b> 30 Latch Function	<b>L583-476</b>  Dim. X = .35 Y = .72	<b>L583-477</b>  Dim. X = .35 Y = .72	<b>B502-191</b> Classic Conventional  Dim. X = .338 Y = .71	<b>K510-730</b>  Dim. X = .338 Y = .71	<b>B502-948</b> Everest 29 & Primus  Dim. X = .338 Y = .71

The following complete cylinders are available. Specify the desired cam from the correct column above:

### Cylinder Mechanism

Conventional cylinder  
Primus XP cylinder  
Primus XP UL437 Listed cylinder  
Full size IC with conventional core  
Full size IC with Primus XP core  
Full size IC housing less core  
SFIC with Everest 29 core  
SFIC with keyed construction core  
SFIC with disposable construction core  
SFIC housing less core

### Collar

compression ring and spring  
compression ring and spring  
compression ring and spring  
compression ring, spring, 3/8" blocking ring  
compression ring, spring, 3/8" blocking ring  
compression ring, spring, 3/8" blocking ring  
compression ring, spring, 1/4" blocking ring  
compression ring, spring, 1/4" blocking ring  
compression ring, spring, 1/4" blocking ring  
compression ring, spring, 1/4" blocking ring

### How to Order

20-001 x cam number  
20-700 x cam number  
20-500 x cam number  
20-061 x cam number  
20-771 x cam number  
26-094 x cam number  
80-102 x cam number  
80-110 x cam number  
80-132 x cam number  
80-302 x cam number

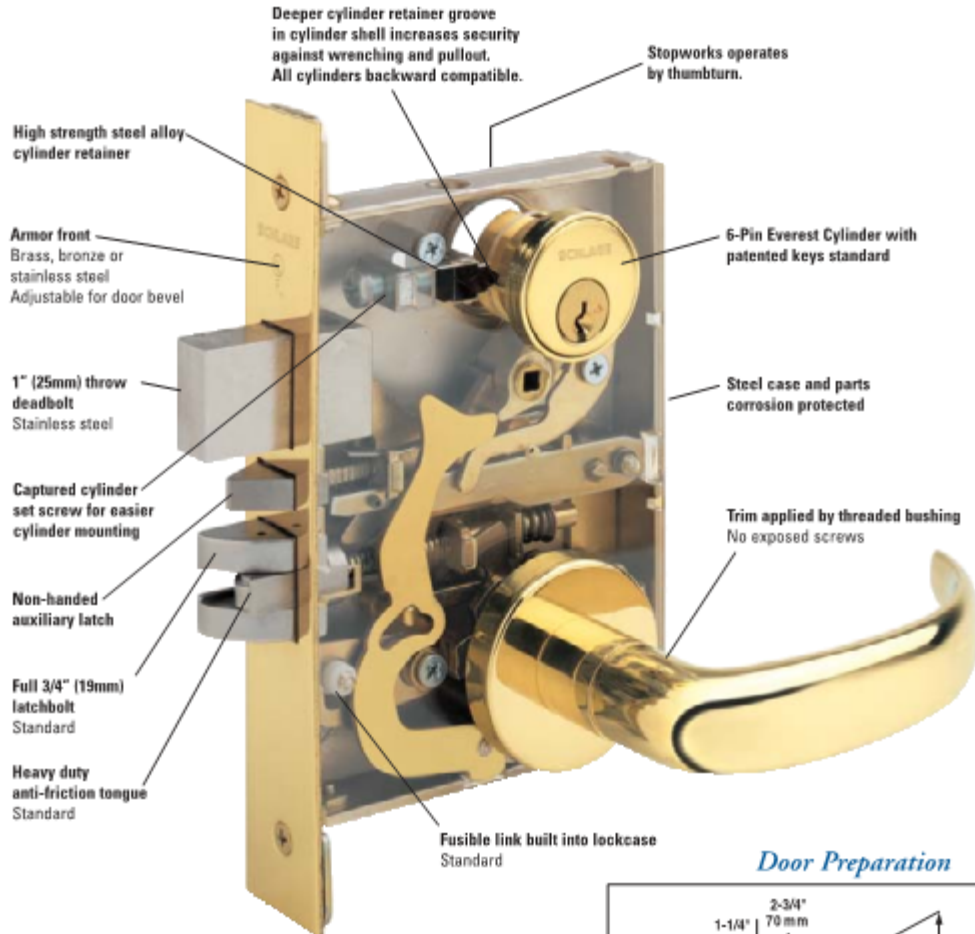
22

Other manufacturers' registered trade names are for identification and reference only.

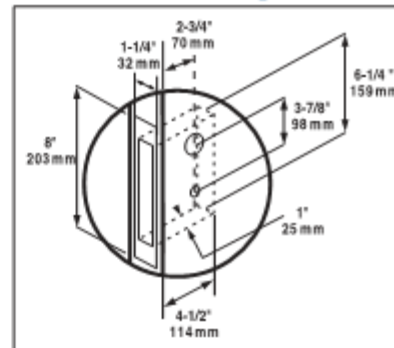
Diagram 08\_05 (Refer to Division 08) – Door Hardware Product Cut Sheets

# **L** SERIES

## *L9000-Series Cutaway View*



### *Door Preparation*



**SCHLAGE**

Diagram 08\_06 (Refer to Division 08) – Door Hardware Product Cut Sheets

## L SERIES

### Specifications

#### Handing:

L9000-Series lock bodies are field reversible without disassembly.  
L400-Series locks are non-handed.

#### Door Thickness:

1¾" (44mm) standard. 1¾" (35mm) to 2½" (64mm) optional.  
Over 2½" (64mm) door ranges vary by function. N escutcheon available for 1¾" (44mm) doors standard. 2" (51mm) to 2¾" (60mm) optional. Specify door thickness if other than 1¾".

#### Backset:

2¾" (70mm) only.

#### Armored Front:

L9000-Series: 1¼" x 8" x 7/32" (32mm x 203mm x 6mm) standard. 1½" x 8" x 7/32" (27mm x 203mm x 6mm) optional.  
L400-Series: 1¼" x 5 19/32" (32mm x 142mm).

#### Case Size:

L9000-Series: 47/16" x 61/16" x 1" (113mm x 154mm x 25mm).  
L400-Series: 47/16" x 35/16" x 1" (113mm x 92mm x 25mm).

#### Spacing:

4. Knob or lever to 4. cylinder, 37/8" (98mm); 4. knob or lever to 4. thumbturn hub, 211/16" (68mm).

#### Bolts:

1" (25mm) throw stainless steel deadbolt and ¾" (19mm) throw stainless steel latch with anti-friction tongue

#### Exposed Trim:

**Knobs:** #41 and #42 heavy duty wrought brass, bronze or stainless steel knobs match D-Series knobs.

**Levers:** Forged brass or bronze and cast stainless steel. Designs available to match D-Series levers.

**93 Lever Design:** Extruded brass, bronze or stainless steel.

**Mediterranean Designs:** Forged brass lever and rose.

**Escutcheons:** L escutcheons are cold forged brass or bronze and stainless steel. N escutcheons are heavy wrought reinforced brass, bronze and stainless steel.

**Trim Combinations:** Available with knob both sides, lever both sides, or knob x lever with rose or escutcheon both sides.

#### Strike:

L9000-Series: ANSI curved lip strike 1¼" x 47/8" (32mm x 124mm) x 1½" (30mm) lip to center with dust box standard.  
L400-Series: 1½" x 3¾" (29mm x 92mm) with dust box.

#### Cylinder & Keys:

6-pin Everest® C123 keyway cylinder with two patented keys standard.

#### Keying Options:

Interchangeable core and Primus® high security cylinders.  
Master keying, grand master keying and construction keying.

### Certifications

#### ANSI:

L9000: ANSI A156.13 Series 1000, Grade 1 Operational and Security, UL Listed for 3-hour fire door (except L9076 and L9077).  
With interchangeable core cylinders: Grade 2 Security.  
**With Concealed Shell Cylinder:** A156.13 Grade 1 Operational and Security; ANSI/ASTM F476-76 Grade 40, UL Listed.  
L400: ANSI A156.5 Grade 1

#### California State Reference Code:

(Formerly Title 19, California State Fire Marshal Standard)

All levers with returns comply; levers return to within ½" of door face.

#### UL / cUL:

All locks listed for A label single doors, 4' x 10'.  
Letter F and UL symbol on latch front indicate listing.  
Electrified functions are UL19X Listed for single point locking applications.  
UL437 Listed locking cylinder optional: specify Primus 20-500 Series cylinder.



Diagram 08\_07 (Refer to Division 08) – Door Hardware Product Cut Sheets

**L** SERIES**L-SERIES WITH VANDLGARD™**

Schlage L-Series keyed lever locks with Vandlgard provide vandal resistant technology. Designed for maximum accessibility, security and durability, Vandlgard sets the standard for door hardware in educational facilities and other applications subject to heavy traffic or abuse. The unique features of Vandlgard prevent damage to internal lock components caused by excessive force from persons kicking, hitting or standing on the lever to gain access. Vandlgard functions maintain total key system and architectural design compatibility with Schlage's regular L-Series cylindrical locks.

Levers have virtually replaced knobs in the marketplace for handicap accessibility. The added grip and leverage has created an increased opportunity for abuse or vandalism. This abuse often renders locks inoperable. In some cases the security of the door is violated leaving computer and laboratory equipment susceptible to theft. While this type of abuse is commonly associated with junior and senior high schools, it also occurs in universities, office buildings, commercial buildings, and public buildings.



Locked lever freely rotates up and down while remaining securely locked. The Vandlgard function also increases resistance to over-rotation of the lever.

**Benefits & Features****Superb warranty.**

All Vandlgard functions have a 7-year warranty.

**Reduce lever wobble and play.**

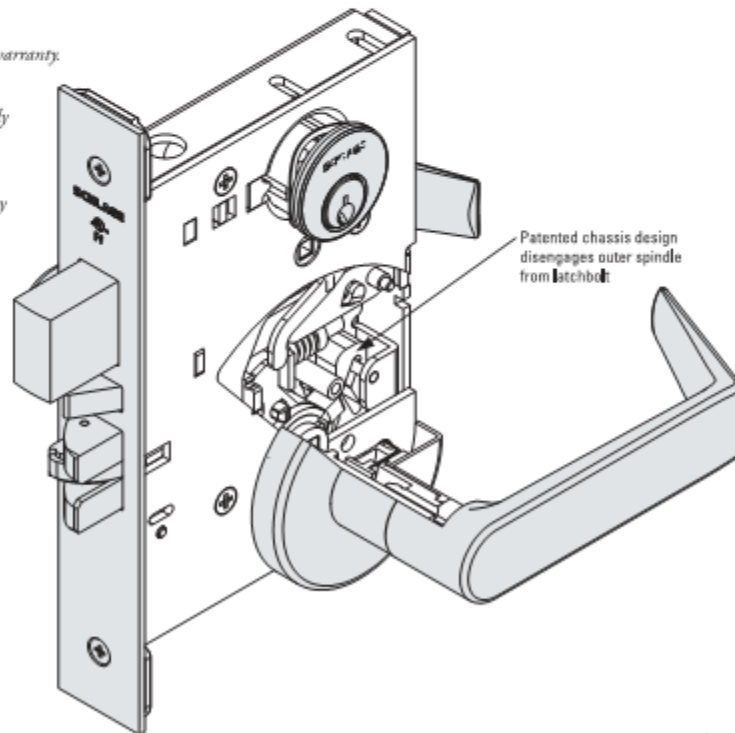
Integrated spindle and spring cage greatly reduces lever sag and wobble.

**Resists vandalism.**

Free-wheeling lever eliminates the ability to stand or exert excessive force on the end of the lever.

**Ease of installation.**

Installs in under 2 minutes.



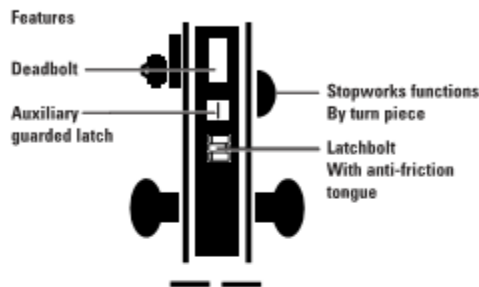
L-Series Vandlgard levers comply with ADA requirements. ♿

**Diagram 08\_08 (Refer to Division 08) – Door Hardware Product Cut Sheets**

# L SERIES

## Functions • L

### Functions



### Product Identification

L	9	4	53	P
Cylinder Suffix				
P = 6-Pin Full Face Mortise Cylinder with Schlage Logo*				
L = Less Full Face Cylinder				
C = Concealed Mortise Cylinder				
W = Less Concealed Cylinder				
R = Full Size Interchangeable Core with Schlage Logo				
J = Less Full Size Interchangeable Core				
F = Full Size Interchangeable Core Less Schlage Logo				
T = Full Size Construction Core				
BD = SFIC Less Core				
BDC = Disposable SFIC				
GD = Everest® Patented SFIC				
HD = Construction SFIC				
Function				
0 = No Deadbolt				
1 = Dummy Trim				
4 = With Deadbolt				
- = Small Case Deadlock				
0 = Dummy Trim without Lock Case				
9 = Functions with Lock Case				
Lock Series				

\* To order less Schlage logo specify lock "with KS10-612 faceplate".

SFIC = Small Format (Best® Style) Interchangeable Core

### Symbols

	Cylinder		Solid spindle
	Outside knob or lever		Two piece spindle
	Inside knob or lever		Emergency turn piece
	Thumbturn		Occupancy indicator
	Thumbturn Cylinder		
	Coin turn		

Diagram 08\_09 (Refer to Division 08) – Door Hardware Product Cut Sheets



## VON DUPRIN® Auxiliary Hardware and General Information

### REMOVABLE MULLIONS



Mullions provide single door performance in double door openings with rim devices. Mullions are easily removed by loosening bottom set screw and removing top fitting cover.

The top mullion fitting is attached to the frame and is concealed by the fitting cover.

Mullions are shipped presized, with mounting screws and prepared for strikes.

Strikes are not included except where indicated.

#### To order, specify:

1. Model number.
2. Height of opening.
3. Finish.
4. Handing as required.
5. Center line deviation (refer to device template for standard centerline).
6. Strikes, when required, should be ordered with device.

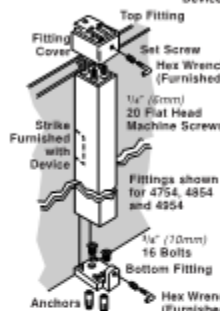
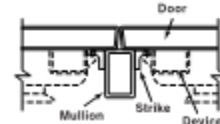
### Stock Hollow Metal Applications

Devices mounted to cover ANSI 161 cutouts are higher than the standard mullion strike location. Consult the factory for special strike preparation or order a blank mullion.

### Blank Mullions

Furnished without strike preparation and without fittings or stabilizers. Used to mount devices at a strike height different from the standard mullion preparation. Note: 9954 blank mullion is furnished less UL label.

### SIX STEEL MULLIONS



#### Electric and Monitor Strikes

Includes an electric cable for transferring power from frame to strikes. The cable has five wires to a twist-apart plug that is connected to a mating socket through a hole in the top fitting.

For use with all Von Duprin panic exit rim devices.

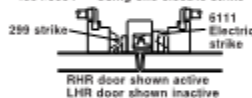
**4754** — Prepared for two 4263 monitor strikes.

4854/9854 — Using one electric strike



**4854** — Prepared for one 299 and one 6111 electric strike. Indicate handing for electric strike.

4854/9854 — Using one electric strike



#### Standard Doors

**4954** — Prepared for two 264 or 299 strikes. For use with all Von Duprin panic rim devices. Note: specify strike choice with device.

**9854** — Prepared for one 499-F and one 6111 electric strike. Indicate handing for electric strike UL fire label mullion for 90 minute openings up to 8' x 8' (2438mm x 2438mm). This mullion is not easily removed due to special fittings.

#### Fire Doors

**9954** — UL fire label mullion for up to 3 hour openings up to 8' x 8' (2438mm x 2438mm) using Von Duprin fire exit rim devices. Must be used with two 268 (for 88-F) or two 499F (for 22-F, 98-F, 99-F) strikes. This mullion is not easily removed due to special fittings.

**1654** — Prepared for two 1606 strikes.

**Sizes** — 4754, 4854, 4954, 1654 — 7'2" (2184mm), 8'2" (2489mm), 10'2" (3099mm). 9854/9954 — 7'3" (2209mm), 8' (2438mm), 10'3" (3124mm) (no UL label on 10' (3048mm)).

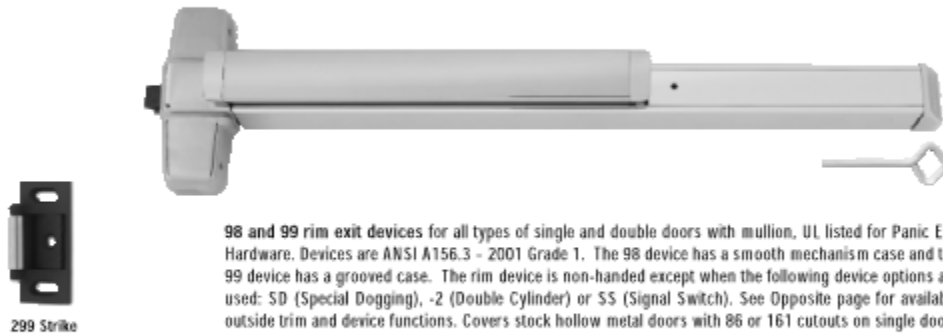
#### Finishes

SP28 (sprayed aluminum), SP313 (sprayed dark bronze) or sprayed black.

Diagram 08\_10 (Refer to Division 08) – Door Hardware Product Cut Sheets



## VON DUPRIN® 98/99™ Rim Exit Device



98 and 99 rim exit devices for all types of single and double doors with mullion, UL listed for Panic Exit Hardware. Devices are ANSI A156.3 - 2001 Grade 1. The 98 device has a smooth mechanism case and the 99 device has a grooved case. The rim device is non-handed except when the following device options are used: SD (Special Dogging), -2 (Double Cylinder) or SS (Signal Switch). See Opposite page for available outside trim and device functions. Covers stock hollow metal doors with 86 or 161 cutouts on single doors (may cover cutouts on pairs - consult template).

The 98/99 devices are available in the following finishes: US3, US4, US10, US26, US26D, US28, 313AN, 315AN and US32D for the 98 device only. See page 52 for component finishes and the inside cover for finish chips.

### Specifications

<b>Device Functions</b>	Device ships EQ/DT/NL. Field selectable. For TP,K, or L remove NL drive screw from device		
<b>Device Lengths</b>	3'	2'4" to 3' (711 mm to 914 mm)	Door Size
	4'	2'10" to 4' (864 mm to 1219 mm)	Door Size
<b>Strikes</b>	299 - Dull Black Optional Strikes - see page 39		
<b>Dogging Feature</b>	Hex key dogging standard		
<b>Dogging Options</b>	CD	Cylinder Dogging	see page 48
	SD	Special Center Case Dogging	see page 48
	LD	Less Dogging	see page 48
<b>Electric Options</b>	LX	Latchbolt Monitor Switch	see page 42
	RX	Pushpad Monitor Switch	see page 42
	RX2	Double Pushpad Monitor Switch	see page 42
	E	Electric Locking & Unlocking	see page 44
	EL	Electric Latch Retraction	see page 43
	SS	Signal Switch	see page 43
	CX	Chexit Delayed Exit	see page 45
<b>Miscellaneous Options</b>	ALK	Alarm Exit Kit	see page 42
	PN	Pneumatic Latch Retraction	see page 48
	-2	Double Cylinder	see page 48
<b>Fasteners &amp; Sex Bolts (SNB)</b>	Includes 1 3/4" (19mm) - 2 1/4" (57mm) Wood & Metal Doors		
	Optional SNB available for device, see next page for quantities		
<b>Latch Bolt</b>	Deadlocking, 3/4" (19mm) throw		
<b>Device Centerline from Finished Floor</b>	39 13/16" (1011 mm)		
	39 13/16" (1008 mm) with Mullion		
<b>Center Case Dimensions</b>	8" x 2 3/4" x 2 3/8" (203mm x 70mm x 60mm)		
<b>Mechanism Case Dimensions</b>	2 1/4" x 2 1/4" (57mm x 57mm)		
<b>Projection</b>	Pushbar Neutral - 3 13/16" (97 mm)		
	Pushbar Depressed - 3 1/16" (78 mm)		

Diagram 08\_11 (Refer to Division 08) – Door Hardware Product Cut Sheets

## VON DUPRIN® XP98/99™ Rim Exit Device

### Introduction

Balancing security and safety has always been a challenge with any panic exit device design. With the new XP98/99 Rim exit device, Von Duprin has engineered a device that reaches a new standard for security while enhancing the safety performance features. The new patented center case design takes the proven reliability of the 98/99 series and adds a new latch bolt concept that delivers the industry's highest level of latching security.

Additionally, upgrading for current 98/99 owners will be made easy and affordable. The new device will match the existing 98/99 device footprint, eliminating costly door prep changes. A new retrofit kit will allow conversion of existing 99 devices into the new XP99 function, making higher security an affordable function.

For over 100 years Von Duprin has set the standard for innovation and quality in the world of exit devices. The XP98/99 Rim device is another page in this long honored story of excellence.



Von Duprin push pad exit devices are available in two external surface styles, designated XP98 Series and XP99 Series. The two styles are mechanically and dimensionally identical and provide a wide selection of appearance options.

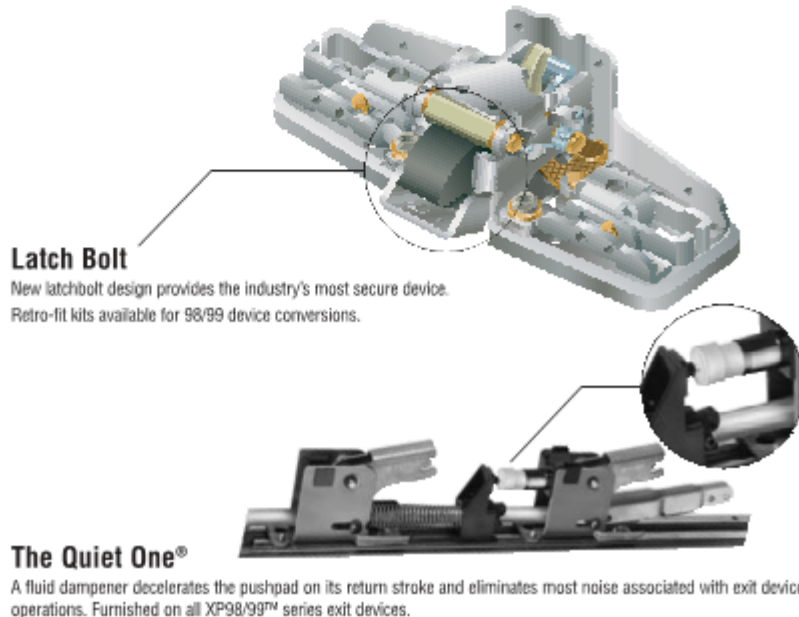


Diagram 08\_12 (Refer to Division 08) – Door Hardware Product Cut Sheets

## VON DUPRIN® XP98/99™ Rim Exit Device



909 Strike

954 Strike  
With 9854/9954  
Mullion

**XP98 and XP99 rim exit devices** for all types of single and double doors with mullion, UL listed for accident hazard installations. Covers stock hollow metal doors with 86 or 161 cutouts.




**XP98-F and XP99-F fire exit rim devices** for all types of 4' x 10' (1219mm x 2438mm) single doors or 8' x 10' (2438mm x 2438mm) double doors with 9954 mullion, UL listed A, B, C, D, or E fire labeled installations.

### Specifications

<b>Device Functions</b>	Device ships EO/DT/NL. Field selectable. For TP,K,or L remove NL drive screw from device
<b>Device Lengths</b>	3' 2'4" to 3' (711mm to 914 mm) Door Size 4' 2'10" to 4' (864 mm to 1219 mm) Door Size
<b>Strikes</b>	909 – Panic and Fire Single Door 954 — Mullion Fire
<b>Dogging Feature</b>	Hex key dogging standard
<b>Dogging Options</b>	CD Cylinder Dogging SD Special Center Case Dogging LD Less Dogging
<b>Electric Options</b> (Consult factory)	RX Pushpad Monitor Switch* RX2 Double Pushpad Monitor Switch* E Electric Locking & Unlocking ALK Alarm Exit Kit*
<b>Miscellaneous Options</b>	-2 Double Cylinder* GBK Glass Bead Kit
<b>Fasteners &amp; Sex Bolts (SNB)</b>	Includes 1 3/4" (19mm) – 2 1/4" (57mm) Wood & Metal Doors Optional SNB available for device, see next page for quantities
<b>Latch Bolt</b>	Deadlocking, 3/4" (19mm) throw
<b>Device Centerline from Finished Floor</b>	39 13/16" (1011 mm) 39 11/16" (1008 mm) with Mullion
<b>Center Case Dimensions</b>	8" x 2 3/4" x 2 3/8" (203mm x 70mm x 60mm)
<b>Mechanism Case Dimensions</b>	2 1/4" x 2 1/4" (57mm x 57mm)
<b>Projection</b>	Pushbar Neutral – 3 13/16" (97 mm) Pushbar Depressed – 3 1/16" (78 mm)

Diagram 08\_13 (Refer to Division 08) – Door Hardware Product Cut Sheets

# VON DUPRIN® 98/99™ Rim Exit Device Standard Trim

	Exit only	Dummy Trim Pull when Dogged	Night Latch Key Retracts Latchbolt	Night Latch Key Retracts Latchbolt Optional Pull Required
				
Product Description	98EO 99EO	98DT 99DT	98NL 99NL	98NL-OP 99NL-OP
Trim Description	--	990DT	990NL-R/V	110NL-MD 110NL-WD
Escutcheon Plate Size	--	3" x 14 <sup>3</sup> / <sub>16</sub> " x <sup>3</sup> / <sub>32</sub> " (76x360x2mm)	3" x 14 <sup>3</sup> / <sub>16</sub> " x <sup>3</sup> / <sub>32</sub> " (76x360x2mm)	--
Pull Center to Center	--	5 <sup>1</sup> / <sub>2</sub> " (140mm)	5 <sup>1</sup> / <sub>2</sub> " (140mm)	--
Projection	--	2" (51mm)	2" (51mm)	--
ANSI Function	01	02	03	03
Cylinder Type	--	--	Rim	Rim
Optional Trim (See pages 32 - 34)	x990EO x992EO x994EO x996EO	x991K-DT x992L-DT x994L-DT x996L-DT x696DT x697DT	x991K-NL x992L-NL x994L-NL x996L-NL x696NL x697NL	
Optional #425 Sex Bolt Quantity for Device	6	2	2	6





	Lever Key Locks & Unlocks	Lever - Night Latch Key Retracts Latchbolt	Lever - Blank Escutcheon Always operable (No Cylinder)	Lever Dummy Trim Pull when Dogged
				
Product Description	98L 99L	98L-NL 99L-NL	98L-BE 99L-BE	98L-DT 99L-DT
Trim Description	996L-R/V	996L-NL-R/V	996L-BE-R/V	996L-DT-R/V
Escutcheon Plate Size	2 <sup>3</sup> / <sub>4</sub> " x 10 <sup>3</sup> / <sub>4</sub> " x <sup>27</sup> / <sub>32</sub> " (70x273x21mm)	2 <sup>3</sup> / <sub>4</sub> " x 10 <sup>3</sup> / <sub>4</sub> " x <sup>27</sup> / <sub>32</sub> " (70x273x21mm)	2 <sup>3</sup> / <sub>4</sub> " x 10 <sup>3</sup> / <sub>4</sub> " x <sup>27</sup> / <sub>32</sub> " (70x273x21mm)	2 <sup>3</sup> / <sub>4</sub> " x 10 <sup>3</sup> / <sub>4</sub> " x <sup>27</sup> / <sub>32</sub> " (70x273x21mm)
Pull Center to Center	--	--	--	--
Projection	2 <sup>7</sup> / <sub>8</sub> " (73mm)	2 <sup>7</sup> / <sub>8</sub> " (73mm)	2 <sup>7</sup> / <sub>8</sub> " (73mm)	2 <sup>7</sup> / <sub>8</sub> " (73mm)
ANSI Function	08	09	--	02
Cylinder Type	Rim	Rim	--	--
Optional Trim (See pages 32 - 34)	x992L x994L	x992L-NL x994L-NL	x992L-BE x994L-BE	x992L-DT x994L-DT
Optional #425 Sex Bolt Quantity for Device	2	2	2	2

Diagram 08\_14 (Refer to Division 08) – Door Hardware Product Cut Sheets

## VON DUPRIN® 98/99™ Options

### Pneumatic Controlled Exit Devices-PN



The PN feature provides remote latch bolt retraction in hazardous areas where electrically operated devices would not be permitted. The pneumatic solenoid will retract the latch bolt for momentary or prolonged periods. PN exit devices are particularly suited for use with automatic door operators. The PN feature is available on both Panic and Fire Exit Hardware devices.

The PN feature includes a special actuating linkage that gives building owners the option of mechanically or pneumatically dogging the exit device. If manual hex-key dogging is required, specify HD-PN (Dogging the device, whether mechanically or pneumatically, makes the device function as a push/pull unit and reduces the wear on its moving parts.) If cylinder dogging is required, the standard cylinder dogging is not available, but special center case dogging is available, specify SD-PN. SD-PN is not available on the 9875 or 9975 devices.

When activated pneumatically, the latch bolt(s) of the exit device retract in ½ to 1 ½ seconds. This pneumatic operation uses air pressure ranging from 50 to 100 pounds per square inch.

This product will function only when it is part of a pneumatic system (air compressor, air lines, pneumatic system, etc.). Contact LCN for correct control boxes

#### To Order, Specify:

- Standard -- Use prefix PN, example PN99NL
- Hex Key Dogging -- Use prefix HD-PN, example HD-PN99NL
- Special Center Case Dogging -- Use prefix SD-PN, example SD-PN99NL

### Double Cylinder - 2



Double cylinder features an inside key cylinder which locks or unlocks the outside trim and an outside key cylinder which retracts the latch bolt only (Night Latch Function). Available on rim or mortise lock device.

Rim requires two rim type cylinders. Mortise device requires 1 rim cylinder and 1 mortise cylinder with a straight cam. (Schlage cam reference B502-191.)

Available functions are thumbpiece, knob or lever.

#### To Order, Specify:

1. Suffix-2 with device/trim number, example 99TP-2.
2. Handing required, LHR or RHR.

### Less Dogging - LD

Less Dogging is available in all 98/99™ Panic Exit devices to remove the dogging option.

#### To Order, Specify:

- Use prefix LD, example LD99L

### Special Center Case Dogging - SD



Special cylinder dogging in the center case is available for Chexit, EL, ALK panic devices to allow for mechanical push/pull operation. With this option, the latchbolt is held retracted and pushbar is still operable. Specify handing -- RHR or LHR.

SD requires 1 ¼" (32mm) mortise cylinder with a straight cam. (Schlage cam reference B502-191.)

*Note: Available on Rim and Vertical Rod Panic Exit Devices only.*

#### To Order, Specify:

- Use prefix SD, example SD99L

### Cylinder Dogging — CD



Cylinder dogging is available on all 98/99™ Panic Exit devices to replace the standard hex key dogging. Unit requires a standard 1 ¼" (32mm) mortise cylinder with a straight cam (Schlage Cam B502-191 reference).

#### To Order, Specify:

- Use prefix CD, example CD99L

### Cylinder Dogging Kit — CDK

For field conversion, a cylinder dogging conversion kit is available. Cannot be added to fire exit hardware.

Order: 33A/99CDK or 35A/98CDK, specify finish.

### Hex Key Dogging Kit — HDK

For field conversion, a hex key dogging conversion kit is available. Cannot be added to fire exit hardware.

Order: 33A/99HDK or 35A/98HDK, specify finish.

### Braille, Embossed and Knurled Touchpads



Braille touchpad is embossed with the message "CAUTION STAIRWELL" in braille and raised letters provides assistance to person with impaired vision. Letters are ½" (13mm) high and braille is #2, raised height is ⅜" (2mm). Other messages are available on special order, limited to 20 characters per line.

Embossed touchpad is embossed with the word "PUSH"  
Knurled touchpad is to provide warning to person with impaired vision.

Diagram 08\_15 (Refer to Division 08) – Door Hardware Product Cut Sheets

# VON DUPRIN. 98/99™ Additional Information

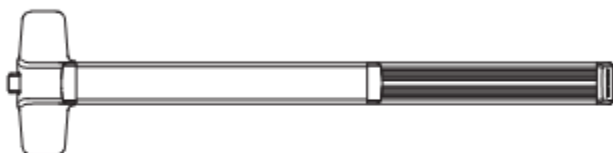
## Nomenclature - How To Order

		EL	99	27	-L	-16	-F	LBR	3'	US3	RHR
SD	-- Special Dogging - Panic Only										
CD	-- Cylinder Dogging - Panic Only										
CX	-- Chexit										
E	-- Electric Locking (Rim or Mortise)										
EL	-- Electric Latch Retraction										
LX	-- Latch Bolt Monitoring										
PL	-- Pullman Latch										
PN	-- Pneumatic Latch Retraction										
RX	-- Request to Exit										
RX2	-- Double Request to Exit										
SS	-- Signal Switch										
98	-- Series 98-smooth										
99	-- Series 99-grooved										
None	-- Rim Device										
27	-- Surface Mounted Vertical Rod Device										
47	-- Concealed Vertical Rod Device										
47WDC	-- Concealed Vertical Rod Wood Door Device										
48	-- Concealed Vertical Rod Device										
57	-- Three Point Latch Device										
75	-- Mortise Lock Device										
DT	-- Dummy Trim										
EO	-- Exit Only										
K	-- Knob (Classroom)										
K-BE	-- Knob-Blank Escutcheon										
K-DT	-- Knob-Dummy Trim										
K-NL	-- Rigid Knob - NightLatch (Key retracts Latchbolt)										
L	-- Lever (Classroom)										
L-BE	-- Lever-Blank Escutcheon										
L-DT	-- Lever-Dummy Trim										
L-NL	-- Rigid Lever - Night Latch (Key retracts Latchbolt)										
NL	-- Night Latch (Key retracts Latchbolt)										
NL-OP	-- Night Latch Cylinder Assembly -- Optional Pull										
TL	-- Turn Lever										
TL-BE	-- Turn Lever-Blank Escutcheon										
TP	-- Thumbpiece										
TP-BE	-- Thumbpiece-Blank Escutcheon										
XX	-- Lever Style 06 standard optional -- 01, 02, 03, 05, 07, 12, 16, 17, 18										
F	-- Fire Exit Device										
LBR	-- Less Bottom Rod										
2	-- Double Cylinder (Rim & Mortise Only)										
ALK	-- Standard Alarm Kit										
ALK-EI	-- External Inhibit Alarm Kit										
ALK-AR1	-- Auto-Reset 1½ minute Alarm Kit										
ALK-AR3	-- Auto-Reset 3 minute Alarm kit										
ALK-AR6	-- Auto-Reset 6 minute Alarm Kit										
3'	-- 3' Device (2' 4" -- 3' Door Size)										
4'	-- 4' Device (2' 10" -- 4' Door Size)										
US3, US4, US10, US26, US26D, 313AN, 315AN											
US32D - 98 ONLY											
- HR	-- Handling - RHR or LHR										

Diagram 08\_16 (Refer to Division 08) – Door Hardware Product Cut Sheets

# VON DUPRIN®

## Quiet Electric Latch Retraction - QEL



### About the product

The QEL option provides electronic control of an exit device and is ideally suited for environments where limited operational noise is desired. The QEL option allows for the electronic unlatching of exit devices for continuous push-pull operation and/or access control and can be activated through a building automation system, access control system or by a control system operator.

The device always provides mechanical egress but can also be tied to an access system to unlatch when a credential is presented or may be held unlatched (dogged) for extended periods to provide free entry. If manual dogging is also required, special center case dogging is available for 98/99 rim and vertical systems, specify SD-QEL.

QEL devices are also useful with automatic door operators, and may be applied to fire-rated applications when under the control of an automatic fire alarm system.

### Features and Benefits

- Quiet operation both mechanically and electrically
- On-board installation and troubleshooting diagnostics built into device
- Automatic calibration – automatically adjusts latch throw and pull
- Pushbar is pulled in electronically for quieter operation when dogged
- Vandal resistant – detects and responds to vandals

### Specifications Compliance

- Devices are BHMA Certified to ANSI/BHMA A156.3 (2001) Grade 1 for Exit Devices
- Devices are UL and cUL Listed as "Panic Hardware" (UL 305) and as "Fire Exit Hardware" (UL 10C)
- The QEL Conversion Kit is UL Classified under "Accessories for Single-Point Locks and Latches and Fire Exit Hardware" (UL 10C)

### System Components / Compatible Products

QEL is an option for 98/99 series (including XP), 94/95 Series and 33A/35A Series devices.

The PS 900 Series with the 900-2RS option card is the minimum option card requirement. Other option cards are available for various functions.

QEL Electrical Load	
Voltage	24 VDC
Current	1.4 A Inrush (0.5 sec.) 0.14 A Holding 2.0 A Calibrate (3 sec. one time)

QEL Run Lengths	
Distance (one-way)	Wire Gauge
200'	18 AWG
320'	16 AWG
500'	14 AWG
800'	12 AWG

The QEL option does not include the power transfer from door to frame, the power supply, or the control operator. Refer to Von Duprin catalog for information on EPT-2/10 power transfer and the 900 Series power supplies.

### To order, specify:

- Standard — Use prefix QEL, example QEL99L.
- Special Center Case Dogging — Use prefix SD-QEL, example SD-QEL99L.

Diagram 08\_17 (Refer to Division 08) – Door Hardware Product Cut Sheet



## Diagram 09\_01 (Refer to Division 09) – FBISD Elementary School Finish Schedules

### FBISD Elementary School Finish Schedule

Area	Preferable Wall Finish	Optional Wall Finish	Preferable Floor Finish	Optional Floor Finish
Administration – Public Spaces	Impact resistant wainscot, tackable surface above wainscot	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Porcelain tile or Terrazzo**
Administration – Non-public spaces (offices)	Paint	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Carpet*
Clinic	Impact resistant wainscot, scrub resistant paint above wainscot	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Resinous flooring
Academic – classroom spaces	Tackable Surface FF to ceiling Paint on non-tackable walls	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Carpet*
Academic - non-classroom spaces (non-public spaces)	Paint	Tackable Surface FF to top of door frame Paint on non-tackable walls	Resilient flooring	Sealed concrete
Academic areas – public spaces	Impact resistant wainscot, tackable surface above wainscot	Paint on unit masonry	Resilient flooring – with robust scratch coat	Porcelain tile or Terrazzo**
Special Education	Impact resistant wainscot, tackable surface above wainscot	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring with cushion at classroom spaces	Resilient flooring
			Resilient flooring without cushion at non-classrooms spaces	
Cafeteria – Commons	Impact resistant wainscot, tackable surface above wainscot	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Porcelain tile or Terrazzo**
Kitchen Areas	Ceramic tile behind serving line (unit masonry or gypsum partitions)		Quarry tile	
Custodial Areas	Impact resistant material - wet walls and paint non-wet walls	Paint	Resilient flooring Sealed concrete @ custodial closets	
Library	Tackable surface from Finish Floor (FF) to top of door frame	Paint	Resilient flooring	Carpet*

Area	Preferable Wall Finish	Optional Wall Finish	Preferable Floor Finish	Optional Floor Finish
Athletics	Paint on unit masonry	Impact resistant on gypsum partitions	Resilient athletic flooring	
Fine Arts Spaces	Paint on CMU partitions (white - preferred)	Impact Resistant – low, tackable surface above wainscot	Resilient flooring - Music Resilient flooring - Art	Carpet*
Extended Learning Program	Impact resistant wainscot, tackable surface above wainscot	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	

Refer to TDG Section 09 05 00 - for ceiling type locations

Impact resistant gypsum wallboard does not constitute an impact resistant material or an impact resistant wainscot.

\* Permitted if partial flooring replacement is occurring in the area.

\*\* Permitted if matching existing flooring or design manager approves use.

## Diagram 09\_02 (Refer to Division 09) – FBISD Middle and High School Finish Schedules

### FBISD Middle and High School Finish Schedule

Area	Preferable Wall Finish	Optional Wall Finish	Preferable Floor Finish	Optional Floor Finish
Administration – Public Spaces	Impact resistant wainscot, tackable surface above wainscot	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Porcelain tile or Terrazzo **
Administration and Counseling areas - Non-public spaces (offices)	Paint	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Carpet*
Clinic	Impact resistant wainscot, scrub resistant paint above wainscot	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Resinous flooring
Academic – classroom spaces	Tackable Surface FF to ceiling Paint on non-tackable walls	Finished unit masonry or painted unit masonry	Resilient flooring	Carpet*
Academic – science classroom areas	chemical resistant paint		Resilient flooring	
Academic non-classroom spaces (non-public spaces)	Paint	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Sealed concrete
Academic areas – public spaces	Impact resistant wainscot, tackable surface above wainscot	Finished unit masonry or painted unit masonry	Resilient flooring	Porcelain tile or Terrazzo **
Special Education	Impact resistant wainscot, tackable surface above wainscot	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring with cushion at classroom spaces  Resilient flooring without cushion at non-classrooms spaces	Resilient flooring
Cafeteria – Commons	Impact resistant wainscot, tackable surface above wainscot	Tackable surface from Finish Floor (FF) to top of door frame	Resilient flooring	Porcelain tile or Terrazzo **
Kitchen Areas	Ceramic tile behind serving line (unit masonry or gypsum partitions)		Quarry tile	
Custodial	Impact resistant material - wet walls and paint non-wet walls	Paint	Resilient flooring Sealed concrete @ custodial closets	

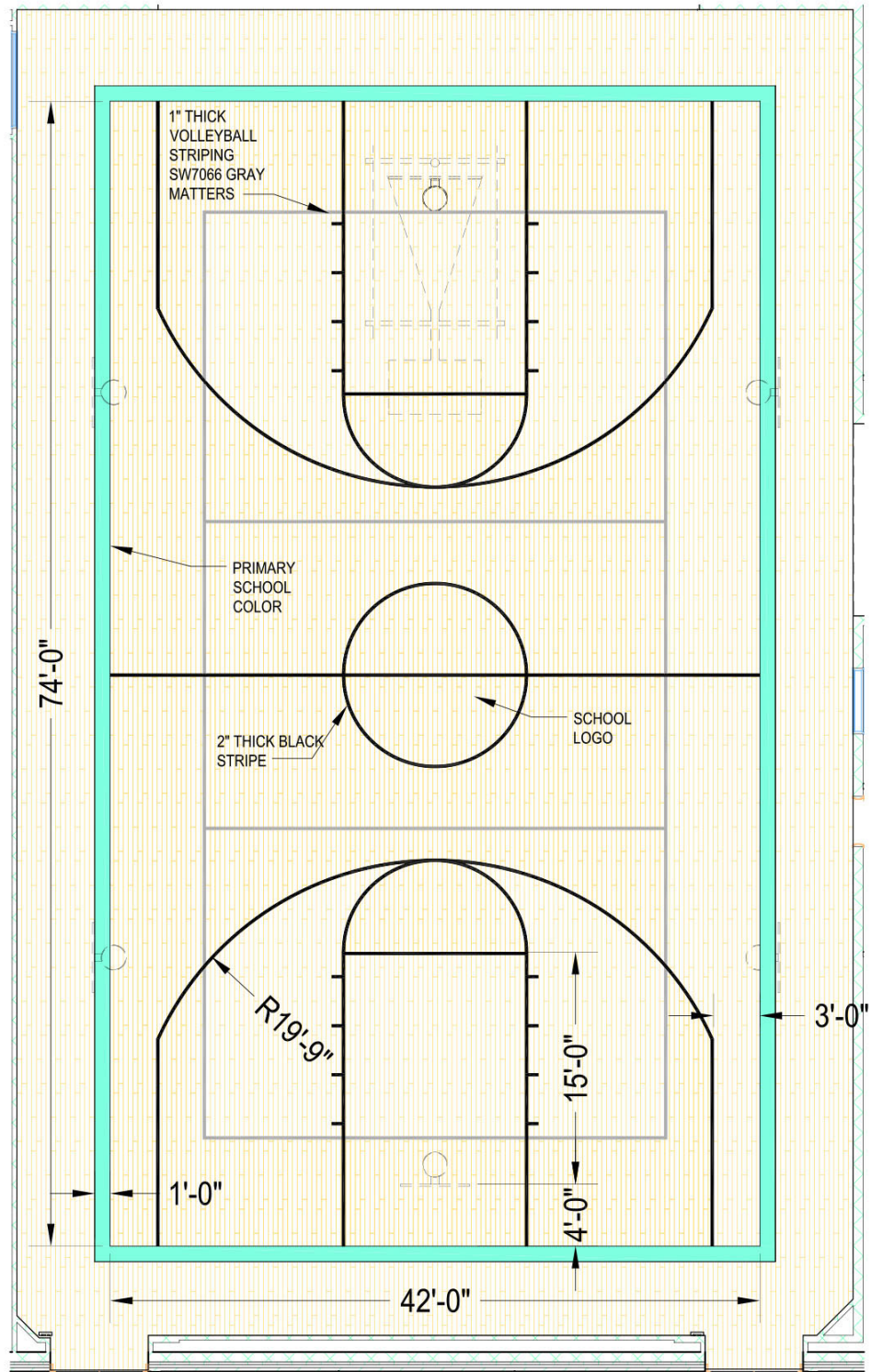
Area	Preferable Wall Finish	Optional Wall Finish	Preferable Floor Finish	Optional Floor Finish
CTE Classrooms & Labs	Paint on unit masonry partitions	Impact resistant wainscot, tackable surface above wainscot	Resilient flooring	Sealed concrete
Library	Tackable surface from Finish Floor (FF) to top of door frame	Paint	Resilient flooring	Carpet*
Athletics - Locker Room & Field House	Paint on unit masonry partitions	Finished unit masonry	Resinous flooring	Sealed concrete
Athletics - Gyms	Paint on unit masonry partitions	Finished unit masonry	Wood Floor	
Band, Choir and Orchestra	Paint on unit masonry partitions	Finished unit masonry	Resilient flooring	Carpet*
Art	Paint on unit masonry partitions(white - preferred)	Impact resistant wainscot, tackable surface above wainscot	Sealed Concrete - Art	Resilient flooring

Refer to TDG Section 09 05 00 - for ceiling type locations

Impact resistant gypsum wallboard does not constitute an impact resistant material or an impact resistant wainscot.

\* Permitted if partial flooring replacement is occurring in the area.

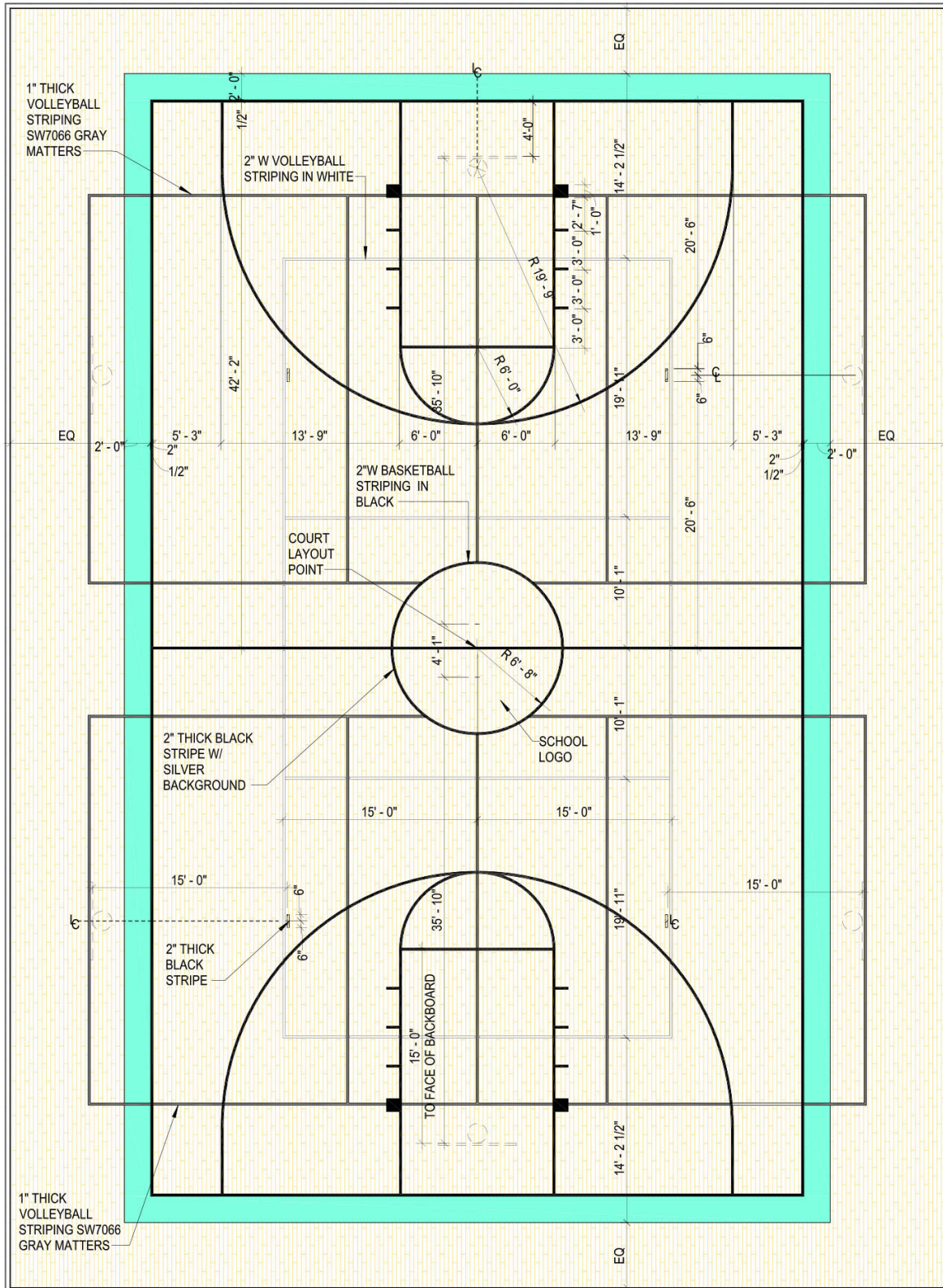
\*\* Permitted if matching existing flooring or design manager approves use.



1 ELEMENTARY SCHOOL VOLLEYBALL / BASKETBALL COURT LAYOUT

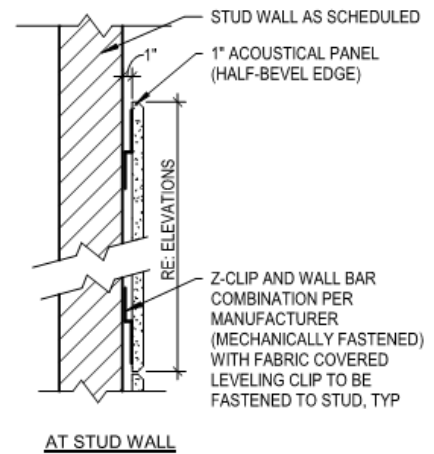
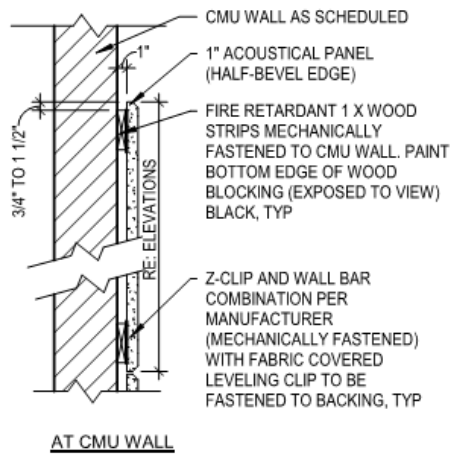
Diagram 09\_03 (Refer to Division 09) – Court Flooring Pattern Plan – Elementary Schools





## 2 MIDDLE SCHOOL & HIGH SCHOOL VOLLEYBALL / BASKETBALL COURT LAYOUT

Diagram 09\_04 (Refer to Division 09) – Court Flooring Pattern Plan – Middle and High Schools



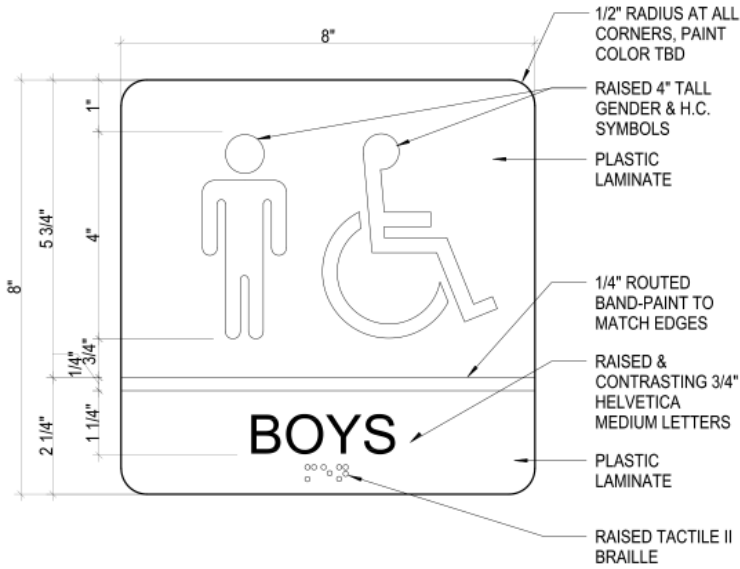
1

## ACOUSTICAL PANEL MOUNTING DETAIL

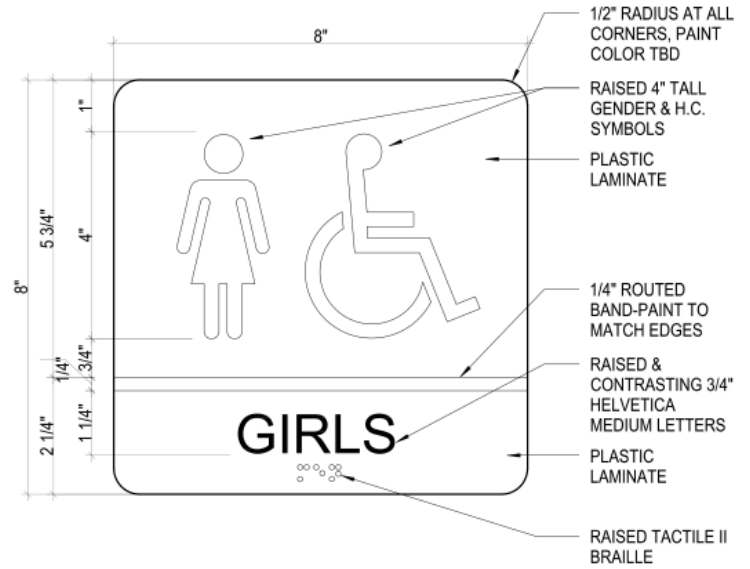
1" = 1'-0"

Diagram 09\_05 (Refer to Division 09) – Acoustical Panel Mounting Detail



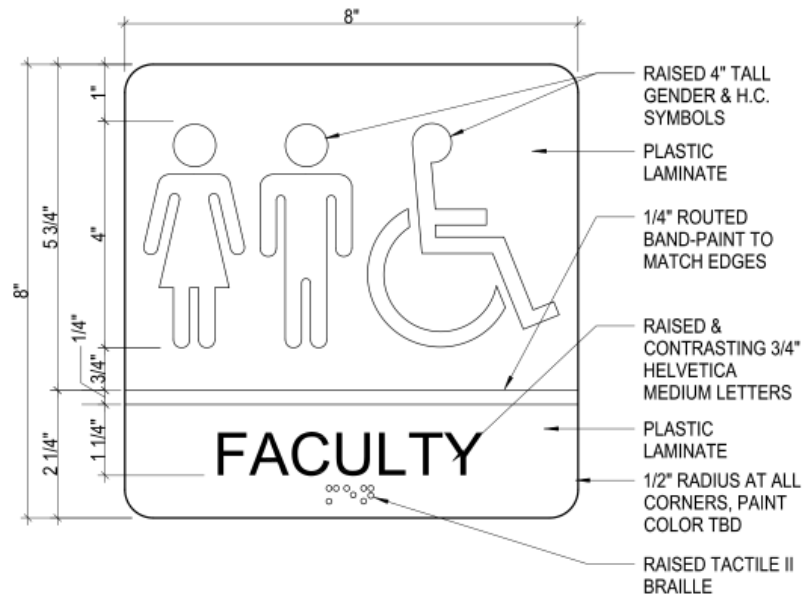


1 BOYS RESTROOM  
6" = 1'-0"



2 GIRLS RESTROOM  
6" = 1'-0"

Diagram 10\_01 (Refer to Division 10) – Restroom Room Signage



3 UNISEX RESTROOM  
6" = 1'-0"

Diagram 10\_02 (Refer to Division 10) – Unisex Restroom Signage

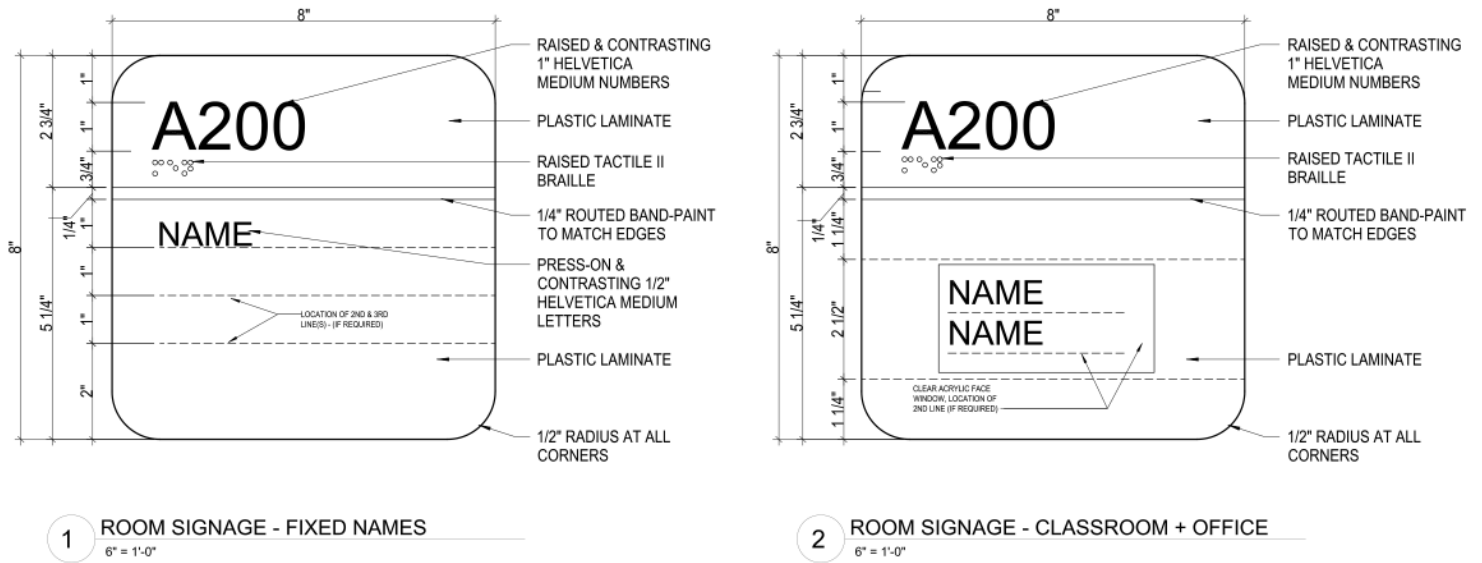


Diagram 10\_03 (Refer to Division 10) – Functional Room Signage

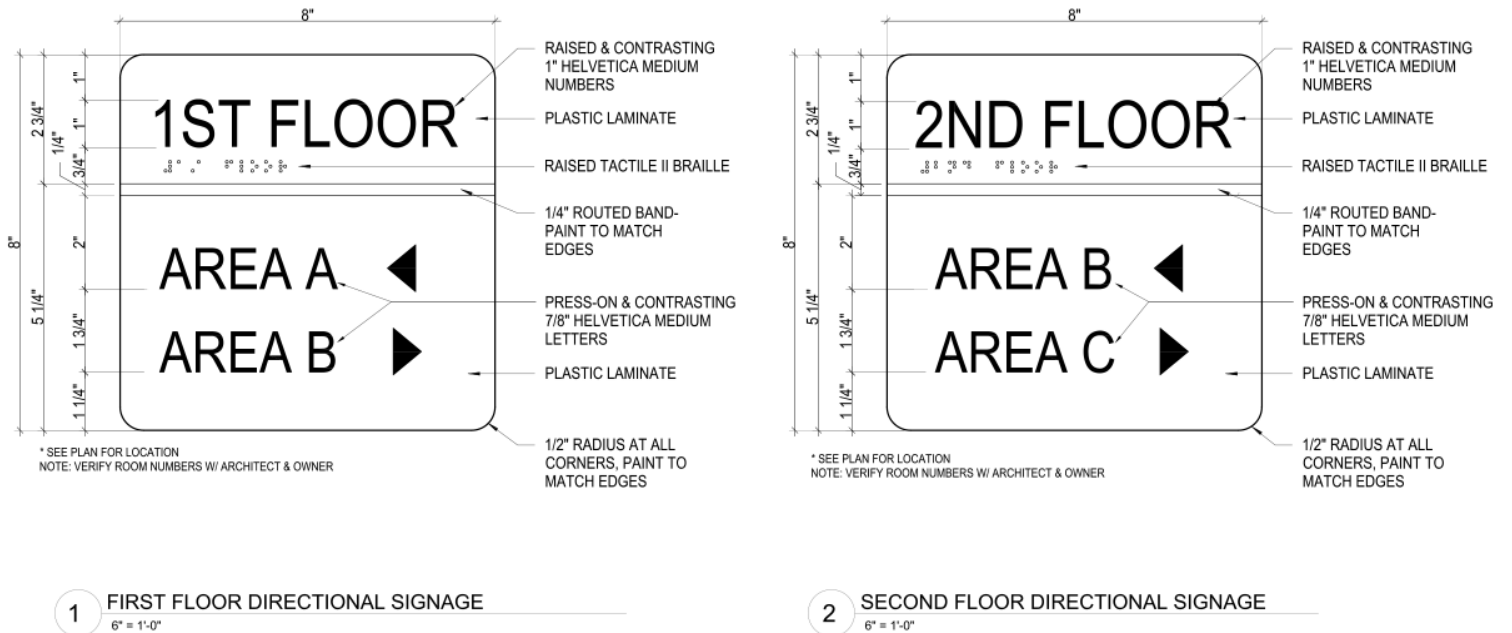
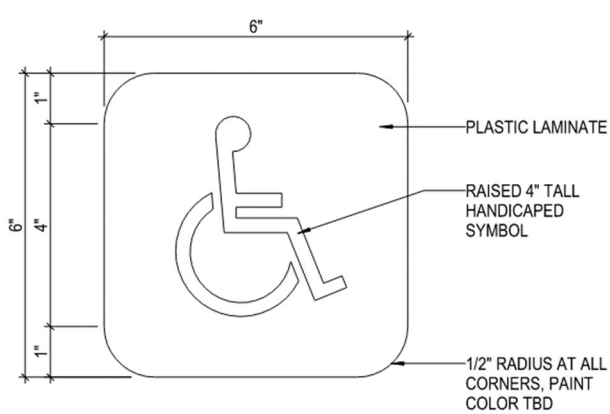
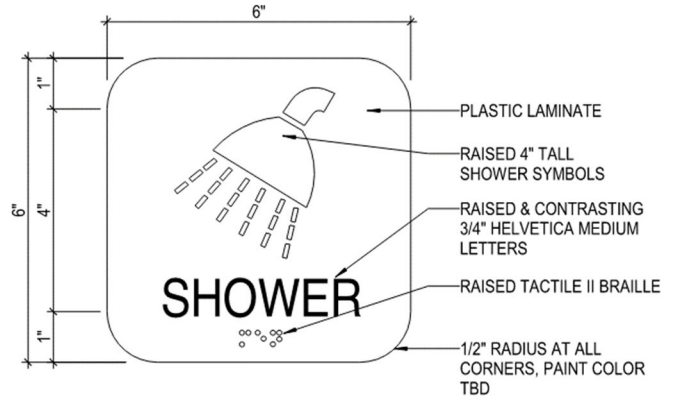


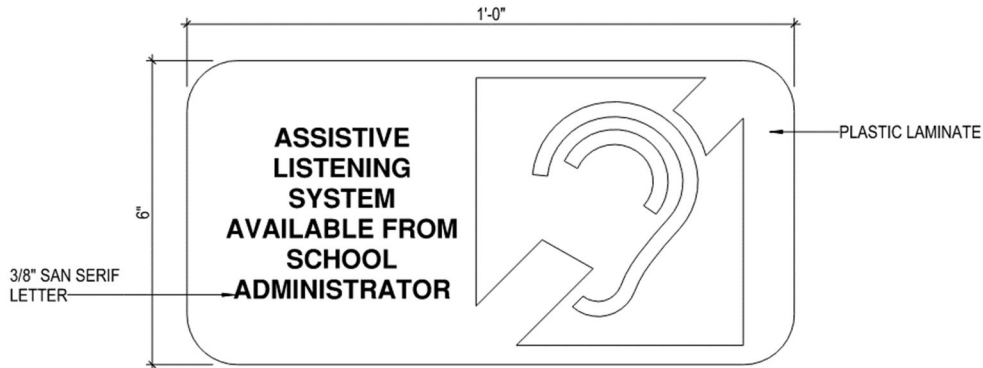
Diagram 10\_04 (Refer to Division 10) – Directional Signage



1 ACCESSIBLE SIGNAGE  
6" = 1'-0"



2 ACCESSIBLE SHOWER SIGNAGE  
6" = 1'-0"



3 ASSISTIVE LISTENING SIGNAGE  
6" = 1'-0"

Diagram 10\_05 (Refer to Division 10) – ADA Signage

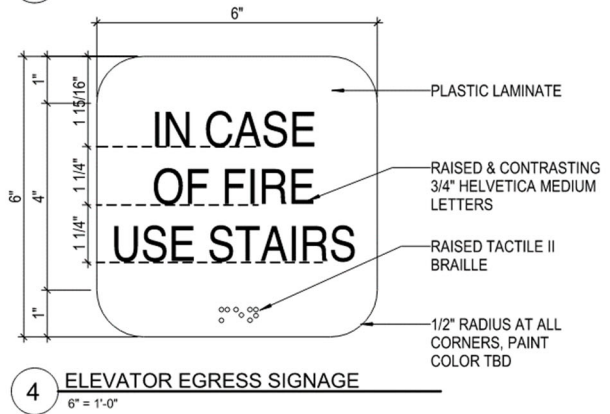
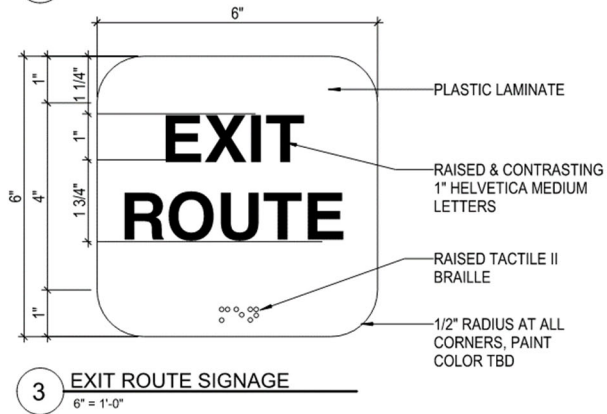
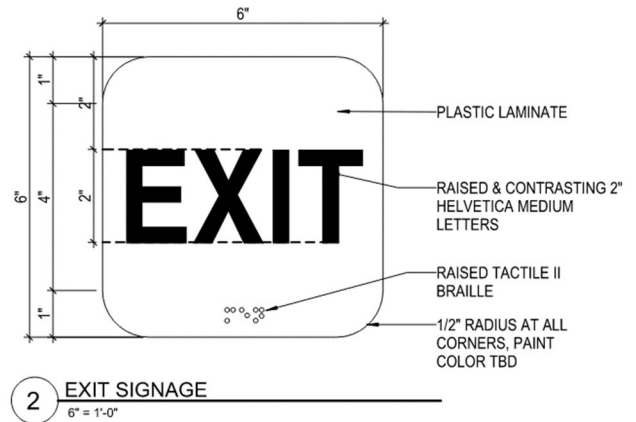
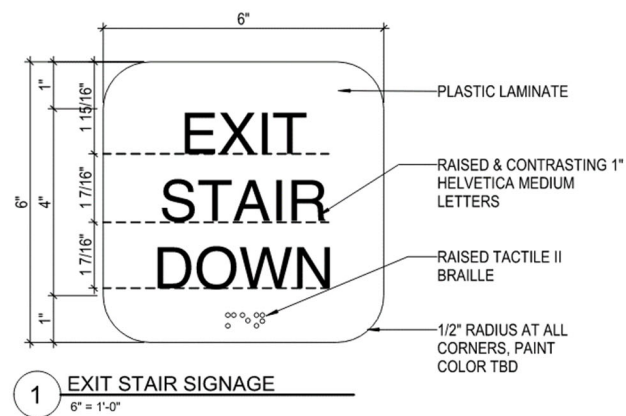
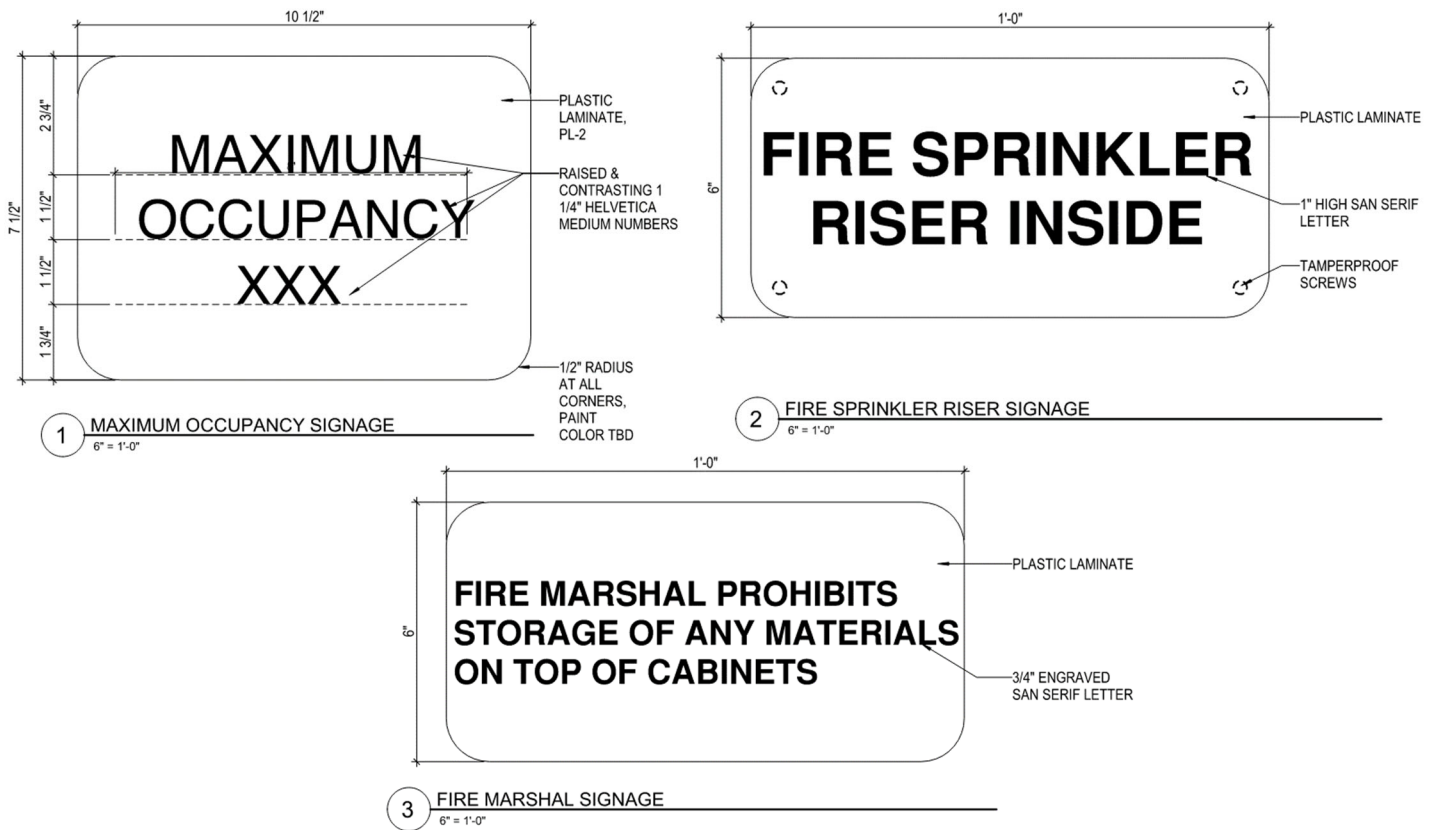
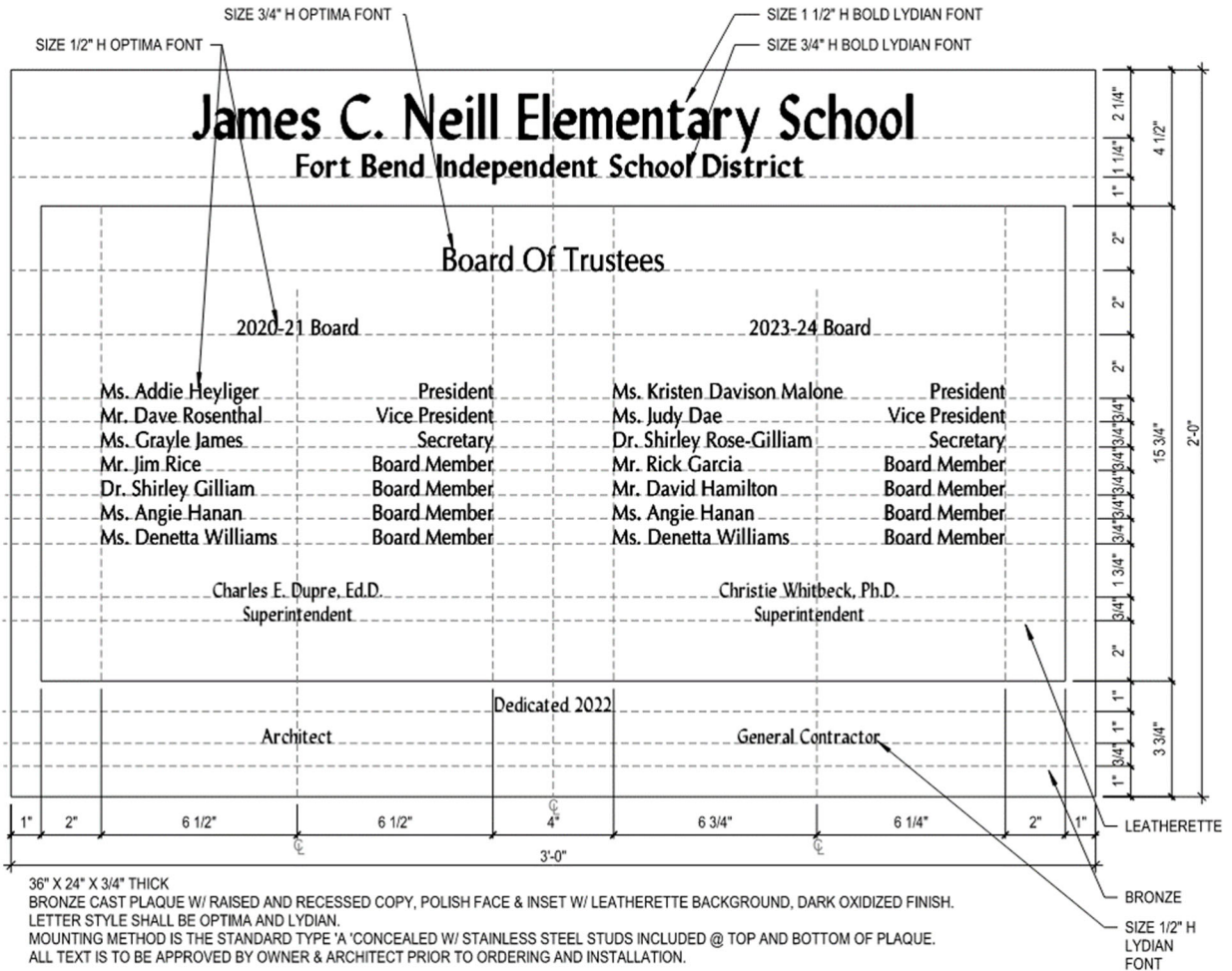


Diagram 10\_06 (Refer to Division 10) – Egress Signage



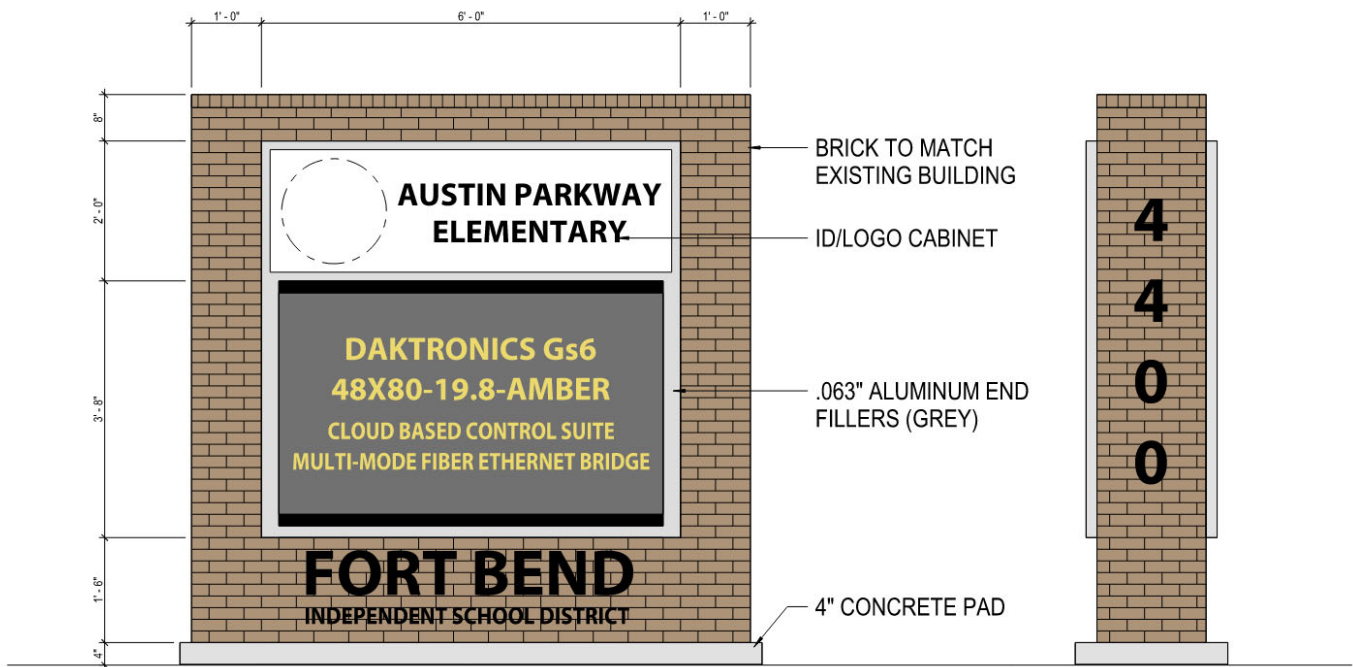
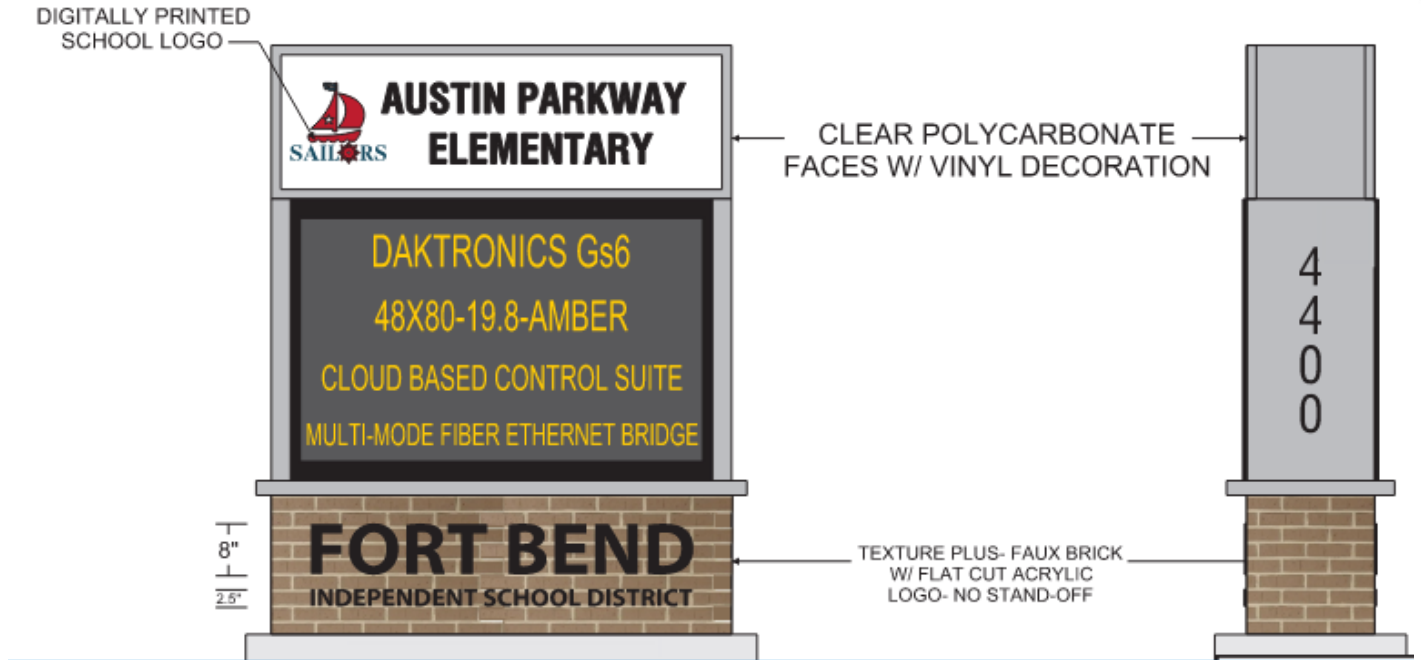
**Diagram 10\_07 (Refer to Division 10) – Fire Marshal Signage**



1 DEDICATION PLAQUE

3" = 1'-0"

Diagram 10\_08 (Refer to Division 10) – Dedication Plaque Detail



1 MARQUEE SIGN - MISSOURI CITY  
3/4" = 1'-0"

Diagram 10\_09 (Refer to Division 10) - Marquee Sign for Elementary and Middle Schools



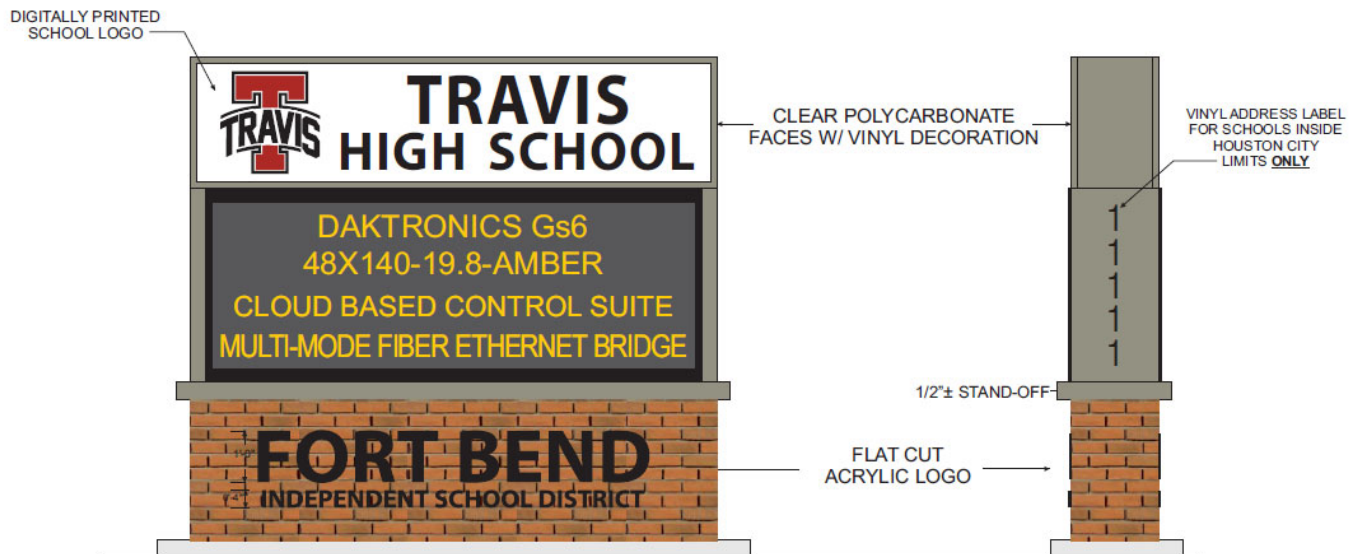


Diagram 10\_10 (Refer to Division 10) – Marquee Sign for High Schools



opti**SERV**®

## 86860 - OptiServ Roll Towel Dispenser, White Translucent

### Features and Benefits

The OptiServ® hands-free dispensing system offers the hygiene of hands-free dispensing without the need for batteries. Metered dispensing discourages waste and controls cost. The OptiServ® is easy to use and accommodates up to 1,000 feet of toweling, making it ideal for high-traffic facilities where cleanliness is essential. Each pull of the exposed towel dispenses and cuts a single 11-inch towel to discourage waste and control cost. A locking cover prevents pilferage. High-capacity hands-free reduces cross-contamination. Reversible cover can be configured to open from left or right. Built-in transfer features eliminates stub roll waste and reduces service interruptions. Accommodates a variety of 8-in. controlled roll towels in Artisan®, DublNature® and EcoSoft® brands.

ADA Compliant.

### Technical Specifications

**Brand Name:** OptiServ®  
**Product Number:** 86860  
**Product Level:** Select  
**System Identifier:** H80 System  
**TorkSelect:** --  
**Replaces:** --  
**Description:** OptiServ Roll Towel Dispenser  
**Color:** White Translucent  
**Material:** Plastic  
**Country of Origin:** United States

### Technical Specifications (cont.)

**Dispenser Dimensions HxWxD (Inches):** 12.125 x 16.8125 x 9.8125  
**Dispenser Capacity:** 1 Roll  
**Units Per Case:** 1  
**Approx. Lbs. Per Case:** 7.95  
**Cubic Feet Per Case:** 1.21  
**Approx. Product Net Wt Per Case:** 6.85  
**Dispensers Per Tier:** 10  
**Cases Per Tier:** 10  
**Tiers Per Unit Load:** 10  
**Unit Order Quantity (Cases):** 100  
**Case Dimensions LxWxH (Inches):** 12.25 x 16.89 x 10.12  
**Dispenser Key Number:** Wausau Dual Key 18002  
**Meets ADA Technical Requirements:** ADA Compliant  
**Product Options:** 30620, 31040, 34540, 38040, 20100, 21400, 31000, 31060, 31300, 31400, 31500, 31600, 31900  
**Dispenser Parts:** --  
**Shipping Container Code:** 0 85806 86860 3  
**Inner Pack UPC:** --  
**Additional Info:** Special Order Colors: Red (86830), Green (86840), Blue (86850)

All specifications are subject to change without notice.  
 1-6-17

Diagram 10\_11 (Refer to Division 10) – Owner Provided Toilet Accessory Cut Sheets

# ELEVATE: Better Skin Care Dispensing Starts Here...

## ELEVATE Foam Soap Refills



Description	Color	Fragrance	Certified EcoLogo	USDA Bio-Preferred	MANUAL		TOUCHFREE	
					700 mL (4/cs)	1250 mL (3/cs)	700 mL (3/cs)	1250 mL (2/cs)
Serenity Fragrance/ Dye Free Hand Cleaner	Clear/No Dye	Fragrance Free	■	■	34097	34103	34109	34114
Tangy Citrus Foam Hand & Body Cleaner	Green-Yellow	Ginger/Citrus	■	■	34098	34104	—	—
Floral Delight Foam Hand Cleaner	Green	Floral/Fruit	■	■	34099	34105	—	—
Fresh Pomegranate Foam Hand Cleaner	Blue	Pomegranate/ Fruit	■	■	—	—	34110	34115
Advance Antibacterial Foam Hand Cleaner	Purple	Plum	—	■	34100	34106	34111	34116



## ELEVATE Dispensers

Description	MANUAL		TOUCHFREE	
	700 mL	1250mL	700 mL	1200 mL
ELEVATE Gray/White	34101	34107	34112	34117
ELEVATE Black/Black	34102	34108	34113	34118
ELEVATE Black/Chrome	—	—	34119	34120

MESSANGER  
Dispenser  
Station  
1091-WHT-12\*\*

ELEVATE  
Wall Plate  
8790-WHT-12

SHIELD  
Floor & Wall  
Protector  
1045-WHT-12



Shown with  
1250 mL Dispenser

\*\*More messages available at:  
[www.triple-s.com/elevatemessages.html](http://www.triple-s.com/elevatemessages.html)

## ELEVATE Messaging & Accessories

Description	Color	Case Pk.	MANUAL		TOUCHFREE	
			700 mL	1250 mL	700 mL	1200 mL
Elevate Wall Plate	White	12	8790-WHT-12	8890-WHT-12	1390-WHT-12	1990-WHT-12
Elevate Wall Plate	Black	12	8790-BLK-12	8890-BLK-12	1390-BLK-12	1990-BLK-12
Messenger Dispenser Station*	White	12	1091-WHT-12	1091-WHT-12	1091-WHT-12	1091-WHT-12
Messenger Dispenser Station*	Black	12	1091-BLK-12	1091-BLK-12	1091-WHT-12	1091-WHT-12
Shield Floor & Wall Protector	White	12	1045-WHT-12	1045-WHT-12	1045-BLK-12	1045-BLK-12
Shield Floor & Wall Protector	Black	12	1045-BLK-12	1045-BLK-12	1045-BLK-12	1045-BLK-12

\*Requires ELEVATE Wall Plate

Specifications and product descriptions subject to change without notice.



Diagram 10\_12 (Refer to Division 10) – Owner Provided Toilet Accessory Cut Sheets



### 565828 - Tork 3 Roll Bath Tissue Roll Dispenser for OptiCore®, Black

#### Features and Benefits

Tork® 3 Roll Bath Tissue Roll Dispenser for OptiCore® dispensing system is designed to minimize maintenance and maximize cost savings for high-traffic washrooms. It ensures that toilet paper will always be available for guests by holding three full rolls of tissue. OptiCore® technology reduces waste and cost by ensuring maximum use of each roll before the next roll is accessible. Features a locking cover to prevent product pilferage. ADA compliant to ensure accessibility for all washroom patrons.

Also Available in White 565820.

Replaces Wausau Paper 80300.

#### Technical Specifications

**Brand Name:** Tork® OptiCore®  
**Product Number:** 565828  
**Product Level:** Value Added  
**System Identifier:** T11 System  
**TorkSelect:** Yes  
**Replaces:** 80300  
**Description:** Tork® 3 Roll Bath Tissue Roll Dispenser for OptiCore®  
**Color:** Black  
**Material:** Plastic  
**Country of Origin:** United States

#### Technical Specifications (cont.)

**Dispenser Dimensions HxWxD (Inches):** 14.56 x 14.12 x 6.31  
 (36.98 x 35.86 x 16.03 cm)  
**Dispenser Capacity:** 3 Rolls  
**Units Per Case:** 1  
**Approx. Lbs. Per Case:** 4.3 (2.0 kg)  
**Cubic Feet Per Case:** 0.82 (0.0232 cubic meter)  
**Approx. Product Net Wt Per Case:** 3.6 (1.6 kg)  
**Dispensers Per Tier:** 20  
**Cases Per Tier:** 20  
**Tiers Per Unit Load:** 3  
**Unit Order Quantity (Cases):** 60  
**Case Dimensions LxWxH (Inches):** 14.688 x 6.688 x 14.438  
 (37.317 x 16.99 x 36.67 cm)  
**Dispenser Key Number:** 18002  
**Meets ADA Technical Requirements:** ADA Compliant  
**Product Options:** 106390, 112990, 161990, 162090,  
**Dispenser Parts:** --  
**Shipping Container Code:** 1 00 7328663913 1  
**Inner Pack UPC:** --  
**Additional Info:** This is a TorkSelect Product; a signed agreement is required.

All specifications are subject to change without notice.  
 12/6/2016

### Diagram 10\_13 (Refer to Division 10) – Owner Provided Toilet Accessory Cut Sheets

### WausauPaper® Dubl-Serv® OptiCore® Dispenser

Item #: BW80200EACH



#### Features and Benefits:

The Dubl-Serv® 2-roll side-by-side tissue dispenser will accommodate OptiCore® tissue products for controlled-use dispensing and optimum savings in maintenance time and costs. The Dubl-Serv® is designed for high-capacity applications and features a locking cover to prevent product pilferage and waste. When installed according to the ADA guidelines, this Dubl-Serv® dispenser is ADA Title III compliant.

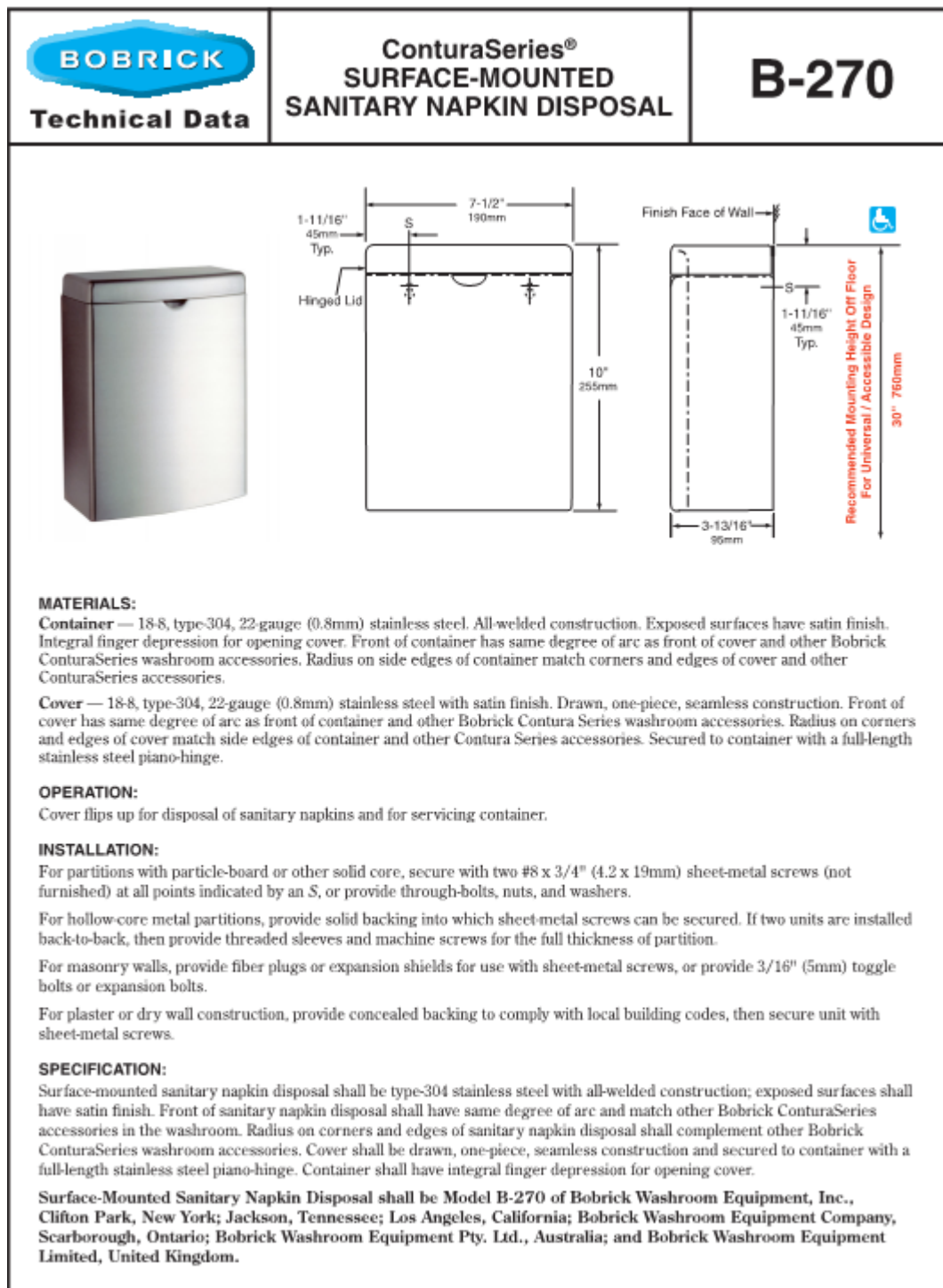
-11 1/16" W x 8 13/16" H x 7 3/16" D

#### TECHNICAL SPECIFICATIONS

Classification	controlled
Item Number	565728
Replaces	Wausau Paper DublServ® Side-by-Side 80200
UPC	1 00 73296 63911 7
Color	Black Translucent
Dispenser Size	11 1/16" x 8 13/16" x 7 3/16"
Dispenser Weight	2.2 lbs.
Cases per Unit	102
Average Case Cube	0.44
Case Size	11 3/8" x 8 15/16" x 7 5/8"
Approximate Case Weight	3 lbs.

**Diagram 10\_14 (Refer to Division 10) – Owner Provided Toilet Accessory Cut Sheets**





**Diagram 10\_15 (Refer to Division 10) – Owner Provided Toilet Accessory Cut Sheets**

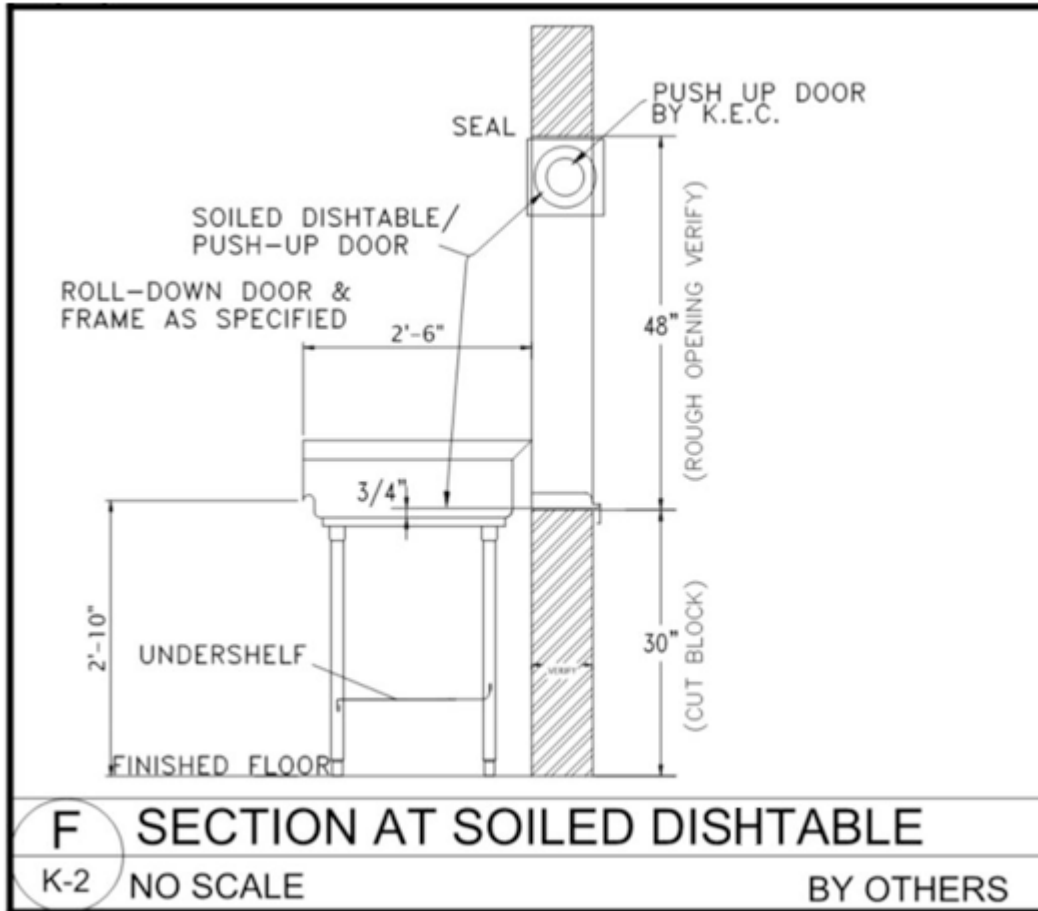


Diagram 11\_01 (Refer to Division 11) – Kitchen Chute Tray Detail 1



Diagram 11\_02 (Refer to Division 11) – Kitchen Chute Tray Detail 2



**Diagram 11\_03 (Refer to Division 11) – Foodservice Equipment List****ITEM NO. 102 COLD STORAGE ASSEMBLY**

Manufacturer: American Panel  
 Model: ---  
 Pre-Approved Equal: Kolpak, Thermokool

Factory installation, startup and final inspection required.

**ITEM NO. 103 COLD STORAGE REFRIGERATION SYSTEM**

Manufacturer: RDT  
 Model: ZS Series  
 Pre-Approved Equal: Kairak, Cold Zone

**ITEM NO. 104 COLD STORAGE SHELVING**

Manufacturer: InterMetro Industries  
 Model: MetroMax Q  
 Pre-Approved Equal: Amco

**ITEM NO. 105 DUNNAGE RACK**

Manufacturer: Metro  
 Model: MetroMax i  
 Alternate: Amco

**ITEM NO. 107 DRY STORAGE SHELVING**

Manufacturer: InterMetro Industries  
 Model: MetroMax Q  
 Pre-Approved Equal: Amco

**ITEM NO. 109 ICE MAKER W/ BIN**

Manufacturer: Manitowoc  
 Model: **ES / MS** IYT-0450A/D-570  
 Model: **HS** IYT-1500A/D-970  
 Pre-Approved Equal: Follett, Scotsman, Hoshizaki

**ITEM NO. 110A CLOTHES DRYER**

Manufacturer: GE  
 Model: Residential  
 Pre-Approved Equal: Whirlpool

Final connections by Div. 26. Coordinate with G.C.

**ITEM NO. 110C CLOTHES WASHER**

Manufacturer: GE  
 Model: Residential  
 Pre-Approved Equal: Whirlpool

Final connections by Div. 22 & Div. 26. Coordinate with G.C.



## Diagram 11\_03 (Refer to Division 11) – Foodservice Equipment List (Continued)

### ITEM NO. 111 CHEMICAL SHELF

Manufacturer: InterMetro Industries

01. One (1) MetroMax Q unit:

- A. Four tiers high with open grid mats.
- B. Four (4) 74" posts per unit.
- C. Refer to drawings for sizes, widths and lengths.

02. One (1) Smart Wall unit:

- A. Shelf Material /type: vinyl coated steel / wire.
- B. Post Material/size: epoxy finish / 60".
- C. Complete shelf assemblies indicate.
- D. Shelf to be located above Washer/Dryer. (Not shown on drawings).

03. Special instruction: Shelving furnished and installed by 114000. G.C. to provide wall blocking when required. 114000 to coordinate size and location of wall blocking

### ITEM NO. 121 TWO COMPARTMENT SINK W/DISPOSER

Manufacturer: Custom Fabricated

### ITEM NO. 123 DISPOSER

Manufacturer: BUSBOY  
Model: B2000 / B5000 -CM-BRS-S

### ITEM NO. 124 WORKTABLE

Manufacturer: Custom Fabricated

### ITEM NO. 125 20 QT. MIXER W/STAND (QTY: 2)

Manufacturer: Hobart  
Model: HL200

### ITEM NO. 128 MOBILE UTILITY CART

Manufacturer: Lakeside  
Model: 522

Carts to contain three (3) shelves.

### ITEM NO. 129 WORKTABLE W/S.BAR UT.RACK

Manufacturer: Custom Fabricated

**Diagram 11\_03 (Refer to Division 11) – Foodservice Equipment List (Continued)****ITEM NO. 131                      FOOD PROCESSOR**

Manufacturer:                      Mannhart  
 Model:                                M2000

**ITEM NO. 136                      BAKER'S TABLE W/ BINS**

Manufacturer:                      Custom fabricated

Four (4) Rubbermaid no. 3602 ingredient bins.  
 3-Drawer base

**ITEM NO. 138                      MOBILE PAN RACK**

Manufacturer:                      Cres Cor  
 Model: **ES / MS**                      207-UA-12AD  
 Model: **HS**                              207-UA-12A

Models at High School to be Roll In racks without perimeter bumpers

**ITEM NO. 139                      MOBILE HEATED CABINET**

Manufacturer:                      Winston  
 Model:                                HA4522  
 Pre-Approved Equal              Cres-Cor

**ITEM NO. 151                      FIRE PROTECTION SYSTEM**

Manufacturer:                      Ansul  
 Model:                                R102

**ITEM NO. 152                      EXHAUST HOOD**

Manufacturer:                      Mod-U-Serve  
 Model:                                W-FM / CPB / W  
 Alternate:                          Avtec, Gaylord

**ITEM NO. 161                      CONVECTION OVEN**

Manufacturer:                      Blodgett  
 Model:                                DFG-200 Double

Units to contain Bakery Depth cavities

**ITEM NO. 161.1                    CONVECTION OVEN**

Manufacturer:                      Blodgett  
 Model:                                DFG-200 Single

Units to contain Bakery Depth cavities



## Diagram 11\_03 (Refer to Division 11) – Foodservice Equipment List (Continued)

ITEM NO. 163A            TILT BRAISING PAN - 30GAL.  
Manufacturer:           Groen  
Model:                 BPP-30G

ITEM NO. 168            S/S WALL CAP  
  
Manufacturer:           Custom Fabricated

ITEM NO. 172            COMBI OVEN - SINGLE  
  
Manufacturer:           Rational  
Model:                 102 - Natural Gas  
Pre-Approved Equal    Electrolux

ITEM NO. 187            PASS-THRU HEATED CABINET - 2DR  
  
Manufacturer:           Traulsen  
Model: ES / MS         RHF 2-32 WP  
Model: HS               RIH-232-LP- FHS/HHS

High Schools to have Roll Thru cabinets. Half height doors at Served, Full height doors at Kitchen.

ITEM NO. 189            PASS-THRU REFRIGERATOR - 2DR  
  
Manufacturer:           Traulsen  
Model: **ES / MS**         RHT 2-32WPUT  
Model : **HS**               RRI-232-LPUT-FHS/HHS

High Schools to have Roll Thru cabinets. Half height doors at Served. Full height doors at Kitchen.

ITEM NO. 201            SERVING COUNTER  
  
Manufacturer:           Mod-U-Serve  
Model:                 Modular/Mobile  
Pre-Approved Equal    CounterCraft

Beverage coolers to be integral to counters.

ITEM NO. 212            MOBILE TRAY DISPENSER  
  
Manufacturer:           Mod-U-Serve  
Model:                 MCT-CTD-MOD

- 01. Mobile tray lowerator.
- 02. Accommodates two stacks of 10" x 14-1/2" trays.

ITEM NO. 213            MOBILE ICE CREAM DISPENSER  
  
Manufacturer:           Purveyor Furnished  
Model:                 ---

ITEM NO. 214            CASH REGISTER  
  
Manufacturer:           Owner furnished  
Model:                 ---

**Diagram 11\_03 (Refer to Division 11) – Foodservice Equipment List (Continued)**

ITEM NO. 249                      THREE COMPARTMENT SINK  
 Manufacturer:                      Custom fabricated  
 Model:                                      ---

ITEM NO. 250                      DISHMACHINE  
  
 Manufacturer:                      Hobart  
 Model: **ES / MS**                      CL44en BAS  
 Model: **HS**                              CL64en BAS

ITEM NO. 252                      BOOSTER HEATER  
  
 Manufacturer:                      Hatco  
 Model:                                      C-36

ITEM NO. 254                      CLEAN AND SOILED DISHTABLE / TRAY DROP

Manufacturer:                      Custom fabricated

1. 14 gauge stainless steel sloping **trash chute**. 12" wide x 10" high, set into wall Opening with the bottom edge at 40" from floor. Chute to be of sufficient length to discharge into trash container and be constructed same as for silver chute.
2. 14 gauge stainless steel sloping **silver chute** as per drawings.
3. Soiled and cleaned dishtables to be integrally connected with a **rack return track** that extends behind the conveyor dish machine. Rack return to be designed per FBISD's standard requirements.
4. 14 gauge stainless steel, coved cornered, sloping rack **return through**, 14'-0" long, extending from clean dishtable, behind dishwashing machine, to soiled dishtable as shown. Trough welded integrally with dishtables. Trough 3" deep at clean dishtable and 5" deep at soiled dishtable. Provide basket drain in low end. Provide 12" splash around dishwashing machine. Provide trough with Four (4) equal length removal sections of stainless steel rollers.

ITEM NO. 255                      MOBILE UTENSIL RACK  
  
 Manufacturer:                      InterMetro Industries  
 Model:                                      SEC55S-SD

ITEM NO. 614                      FILL FAUCET  
  
 Manufacturer:                      Custom fabricated  
 01. Provide 12 gauge stainless steel mounting plate.  
 02. One (1) Chicago no. 305-VBRCP with check valves.  
 03. One (1) hose support bracket.  
 04. Round outside corners of mounting plate.

ITEM NO. 615                      VIDEO MONITORS  
  
 Manufacturer:                      NEC  
 Model:                                      36" Professional Grade

ITEM NO. 619                      RECESSED GAS VALVE  
  
 Manufacturer:                      Custom Fabricated  
 Model:                                      ---



## Diagram 11\_03 (Refer to Division 11) – Foodservice Equipment List (Continued)

ITEM NO. 650      FOUR BURNER RANGE

Manufacturer:              Southbend  
Model:                      P36A-BBB / P32A-BBB  
Pre-Approved Equal        Wolf, Jade

Range to contain Convection Oven base.  
Width of unit per space requirements.

ITEM NO. 802      SPLASH GUARDS

Manufacturer:              Custom fabricated

ITEM NO. 803      STAINLESS STEEL CORNER GUARD

Manufacturer:              Custom fabricated  
Size and Shape:            Full Height

ITEM NO. 804      WALL BUMPER GUARD

Manufacturer:              Pawling  
Model:                      M-1

ITEM NO. 806      MOBILE NAPKIN/UTENSIL DISPENSER

Manufacturer:              Mod-U-Serve  
Model:                      MCT-PCC-P

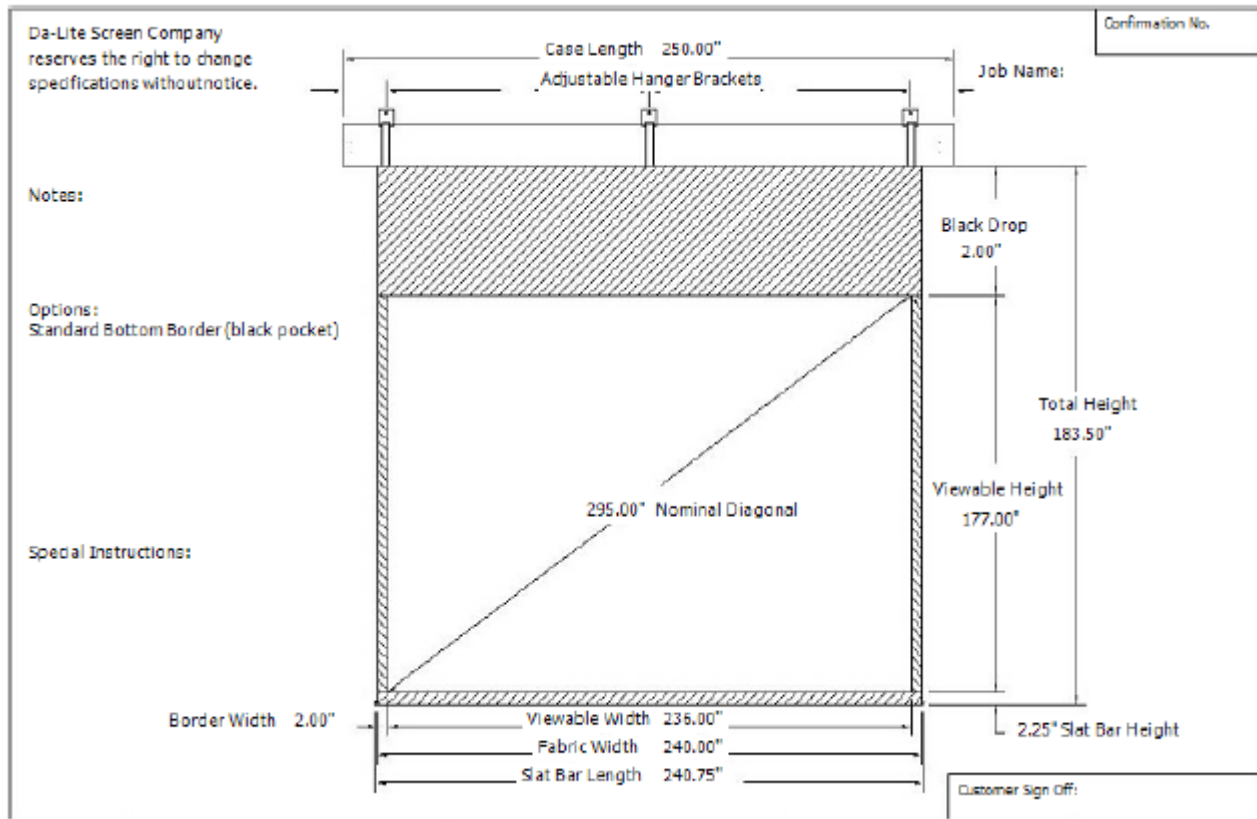
01.    Push / pull handle.
02.    4 Corner bumpers.

**END OF LIST**

**Diagram 11\_03 (Refer to Division 11) – Foodservice Equipment List**

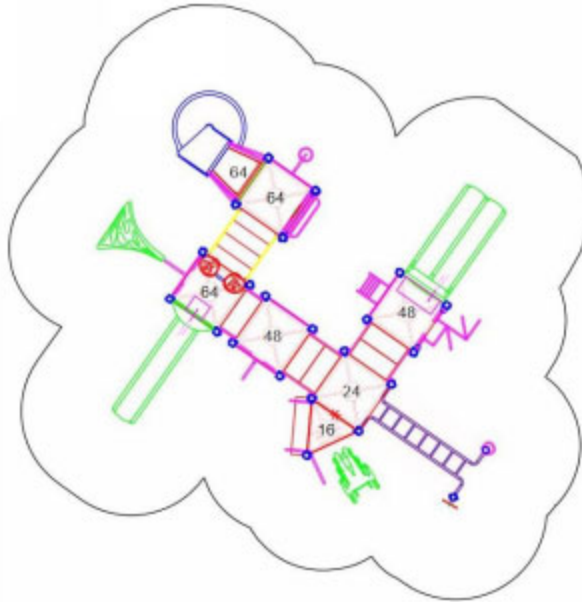
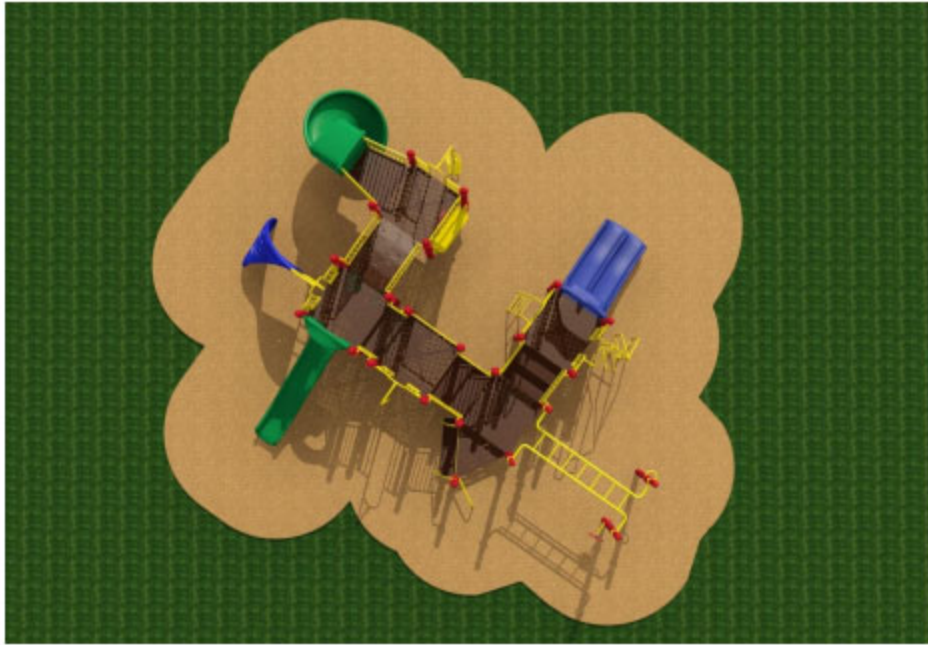






**Diagram 11\_04 (Refer to Division 11) – Projection Screen @ High School  
(Example: Travis High School Cafeteria)**

Top View:



**Diagram 11\_05 (Refer to Division 11) – Playground Equipment – Top Views**

Ground Level Views:



**Diagram 11\_06 (Refer to Division 11) – Playground Equipment – Ground Level Views**



## 1 TYP CLASSROOM CASEWORK ELEVATION



4" BACKSPLASH TO  
MATCH COUNTERTOP  
FINISH \_\_\_\_\_

PVC EDGE AT  
LEADING EDGES OF  
COUNTERTOPS —

PVC EDGE AT PERIMETER OF DOORS AND DRAWERS \_\_\_\_\_

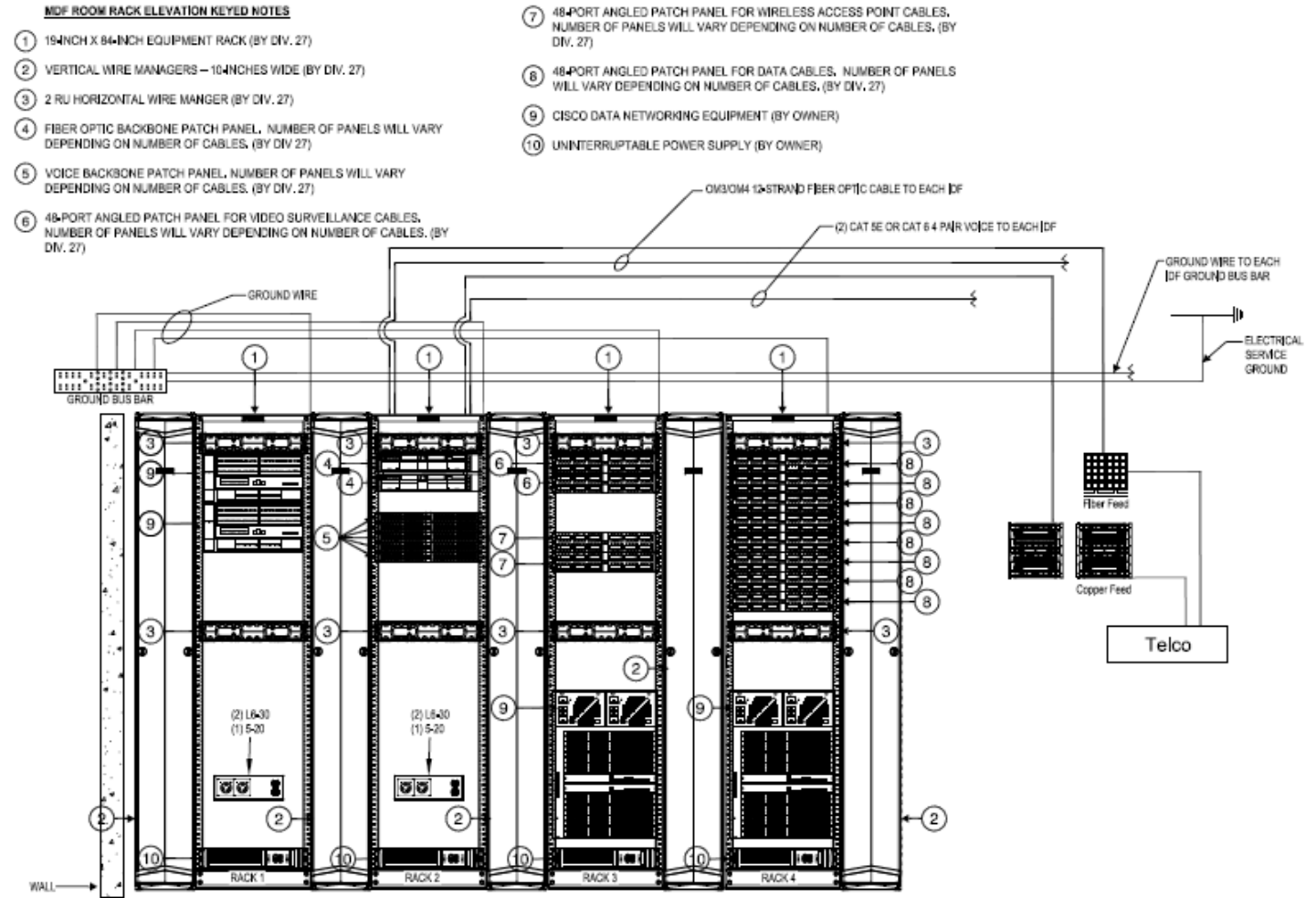
MOISTURE  
RESISTANT BASE

INTERIOR LAMINATE AT ALL OPEN SHELVING TO MATCH EXTERIOR CABINET BODY

- PVC EDGE AT LEADING EDGES AT ALL OPEN CABINETS INCLUDING SHELVES

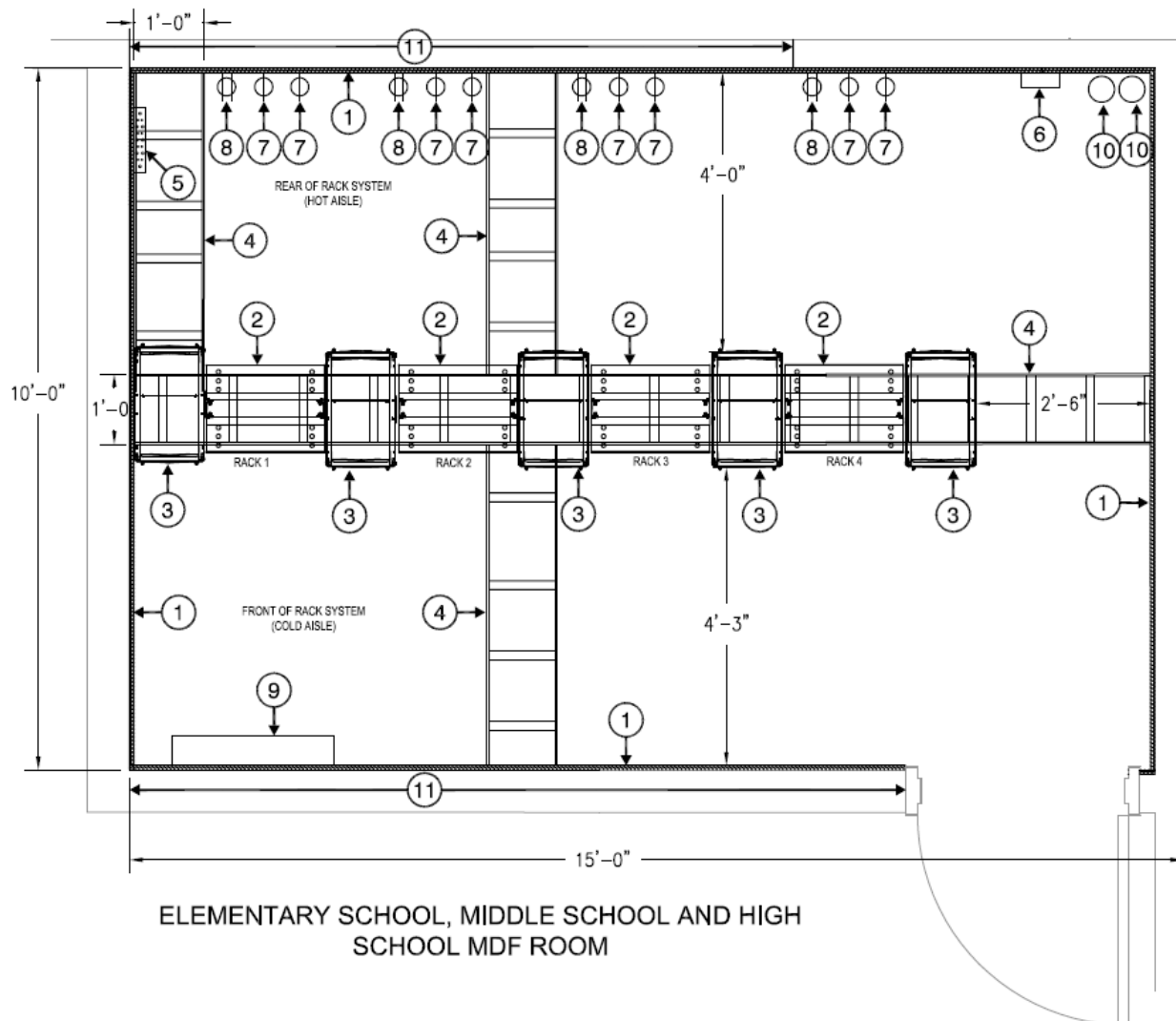
- INTERIOR LAMINATE AT ALL OPEN SHELVING TO MATCH EXTERIOR CABINET BODY

- PVC EDGE AT LEADING EDGES AT ALL OPEN CABINETS INCLUDING SHELVES



**MDF ROOM LAYOUT KEYED NOTES**

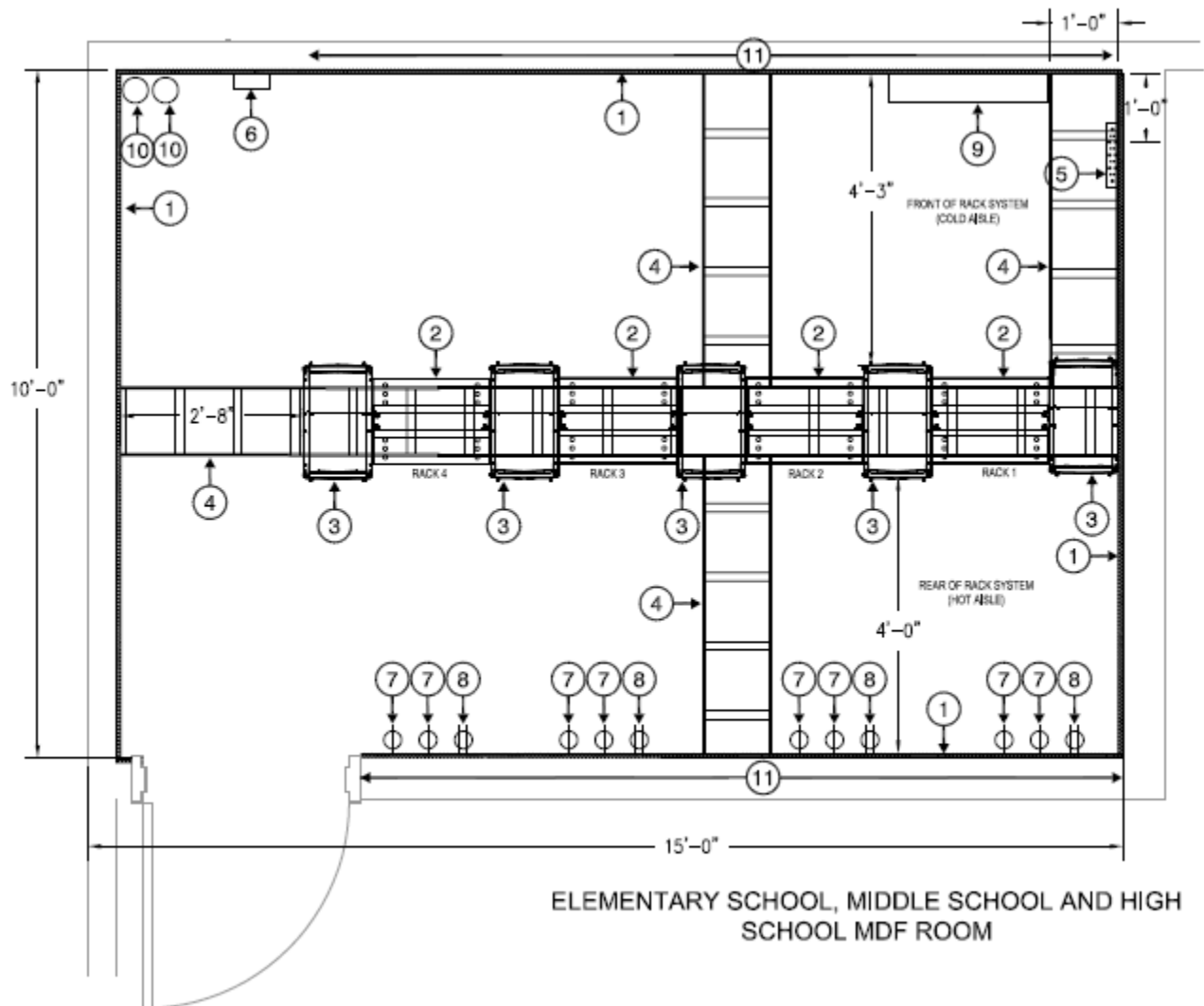
- ① 4-FEET X 8-FEET X 3/4-INCH A-C GRADE, VOID FREE, FIRE RATED PLYWOOD INSTALLED VERTICALLY STARTING AT 24-INCHES ABOVE FINISHED FLOOR. PAINT WITH (2) COATS OF FIRE RETARDANT PAINT. (BY DIV. 27)
- ② 19-INCH X 84-INCH EQUIPMENT RACK, PROVIDE MINIMUM OF 4-FEET CLEAR IN FRONT AND BACK OF EQUIPMENT RACK. (BY DIV. 27)
- ③ VERTICAL WIRE MANAGERS - 10-INCHES WIDE (BY DIV. 27)
- ④ 18-INCH LADDER RACK MOUNTED AT 87-INCHES ABOVE FINISHED FLOOR. (BY DIV. 27)
- ⑤ GROUND BUS BAR MOUNTED AT 84-INCHES ABOVE FINISHED FLOOR. (BY DIV. 27)
- ⑥ WALL MOUNTED BUILDING ENTRANCE TERMINAL. (BY DIV. 27)
- ⑦ DEDICATED 30 AMP CIRCUIT WITH A NEMA L5-30R TWIST LOCK RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK. CIRCUIT SHALL BE ON GENERATOR POWER. (BY DIV. 26)
- ⑧ DEDICATED 20 AMP CIRCUIT WITH A NEMA 5-20R RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK. CIRCUIT SHALL BE ON GENERATOR POWER. (BY DIV. 26)
- ⑨ FLOOR MOUNTED HVAC UNIT. PIPING SHALL EXIT THE ROOM IN THE CORNER. THE DISCONNECT AND HVAC PANEL SHALL BE LOCATED ABOVE THE FLOOR MOUNTED HVAC UNIT. (BY DIV. 23)
- ⑩ CONDUIT DUCT BANK FROM OUTSIDE FOR TELECO SERVICES (BY DIV. 26)
- ⑪ WALL SPACE RESERVED FOR OWNER PROVIDED / OWNER INSTALLED EQUIPMENT/PANELS. CONTRACTOR(S) (ALL TRADES) SHALL NOT INSTALL ANY EQUIPMENT, PANEL ETC. AT THIS LOCATION WITHOUT PRIOR WRITTEN APPROVAL FROM OWNER.

**Diagram 27\_02 (Refer to Division 27) – Sample MDF Plan #1**



**MDF ROOM LAYOUT KEYED NOTES**

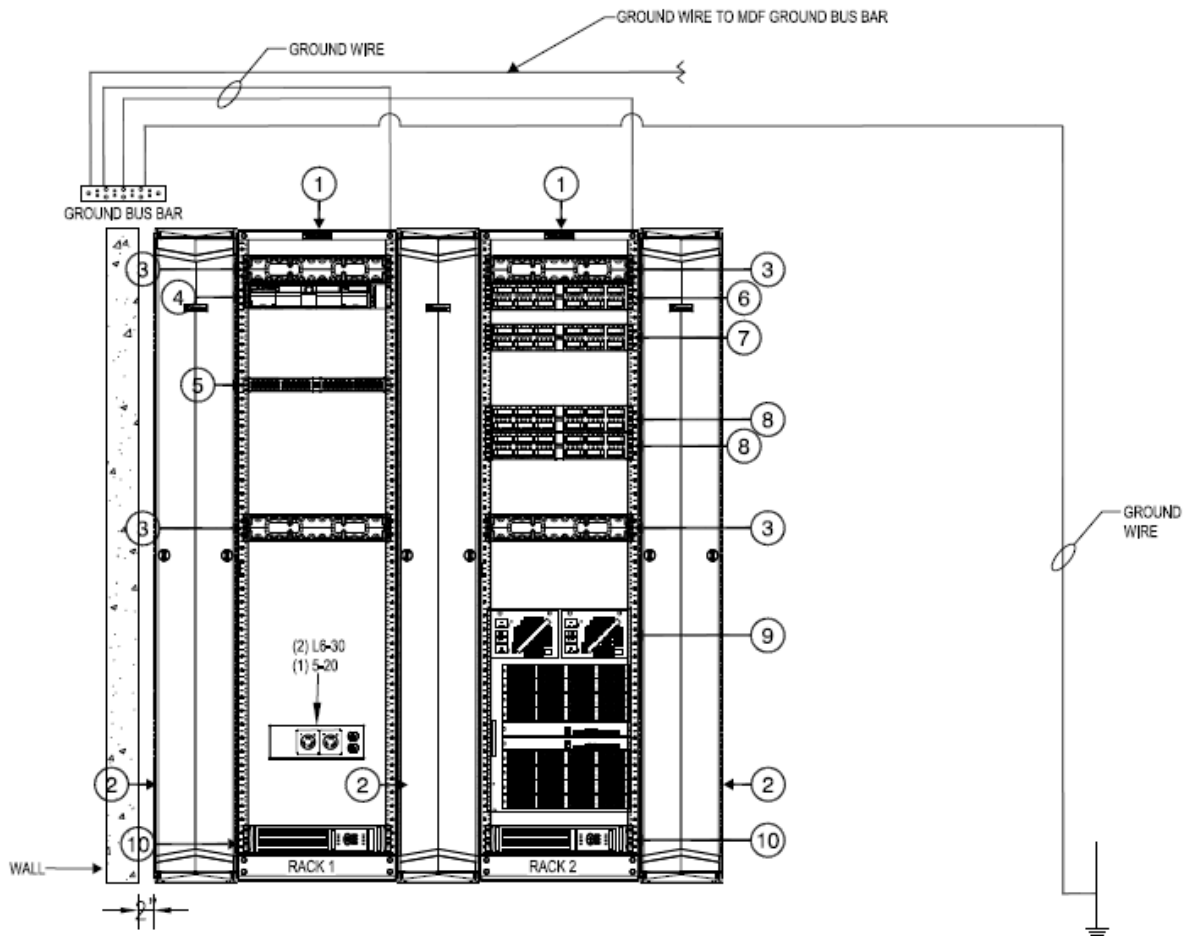
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- ② 19-INCH X 84-INCH EQUIPMENT RACK, PROVIDE MINIMUM OF 4-FEET CLEAR IN FRONT AND BACK OF EQUIPMENT RACK. (BY DIV. 27)
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- ④ 18-INCH LADDER RACK MOUNTED AT 87-INCHES ABOVE FINISHED FLOOR. (BY DIV. 27)
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- ⑥ WALL MOUNTED BUILDING ENTRANCE TERMINAL. (BY DIV. 27)
- ⑦ DEDICATED 30 AMP CIRCUIT WITH A NEMA L5-30R TWIST LOCK RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK. CIRCUIT SHALL BE ON GENERATOR POWER. (BY DIV. 26)
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- ⑨ FLOOR MOUNTED HVAC UNIT. PIPING SHALL EXIT THE ROOM IN THE CORNER. THE DISCONNECT AND HVAC PANEL SHALL BE LOCATED ABOVE THE FLOOR MOUNTED HVAC UNIT. (BY DIV. 23)
- ⑩ CONDUIT DUCT BANK FROM OUTSIDE FOR TELECO SERVICES (BY DIV. 26)
- ⑪ WALL SPACE RESERVED FOR OWNER PROVIDED / OWNER INSTALLED EQUIPMENT/PANELS. CONTRACTOR(S) (ALL TRADES) SHALL NOT INSTALL ANY EQUIPMENT, PANEL ETC. AT THIS LOCATION WITHOUT PRIOR WRITTEN APPROVAL FROM OWNER.

**Diagram 27\_03 (Refer to Division 27) – Sample MDF Plan #2**



**IDF ROOM RACK ELEVATION KEYED NOTES**

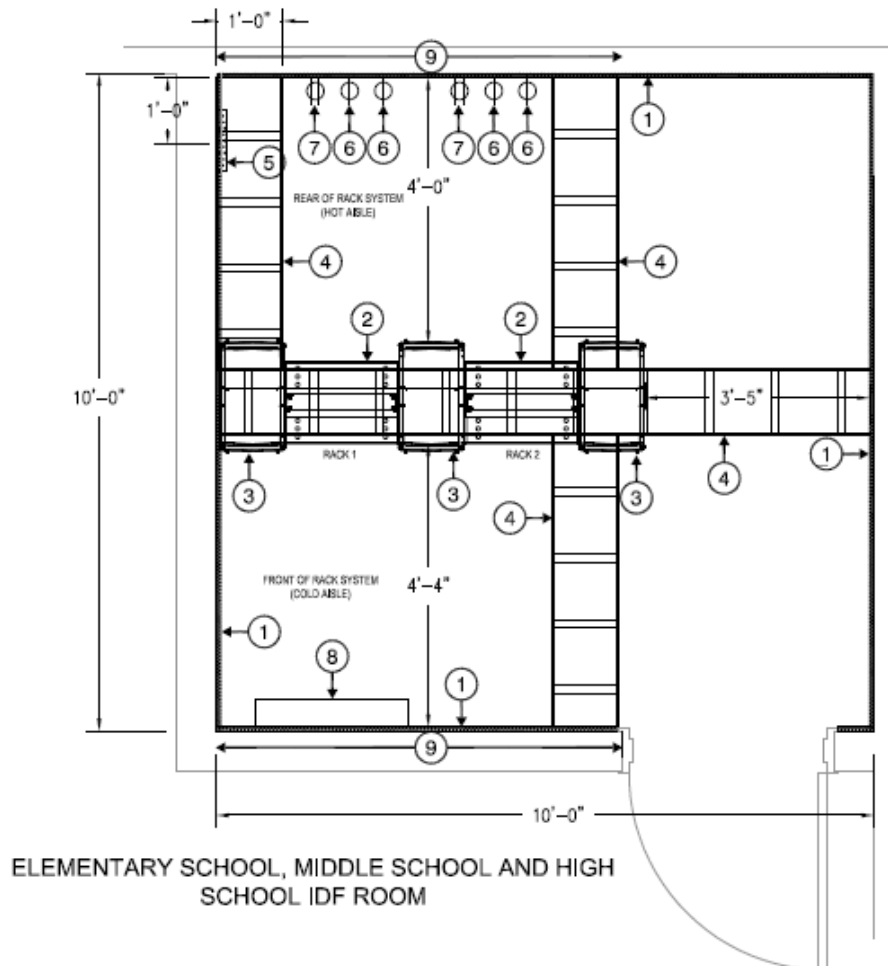
- ① 19-INCH X 84-INCH EQUIPMENT RACK (BY DIV. 27)
- ② VERTICAL WIRE MANAGERS – 10-INCHES WIDE (BY DIV. 27)
- ③ 2 RU HORIZONTAL WIRE MANGER (BY DIV. 27)
- ④ FIBER OPTIC BACKBONE PATCH PANEL (BY DIV. 27)
- ⑤ VOICE BACKBONE PATCH PANEL (BY DIV. 27)
- ⑥ 48-PORT ANGLED PATCH PANEL FOR VIDEO SURVEILLANCE CABLES, NUMBER OF PANELS WILL VARY DEPENDING ON NUMBER OF CABLES. (BY DIV. 27)
- ⑦ 48-PORT ANGLED PATCH PANEL FOR WIRELESS ACCESS POINT CABLES, NUMBER OF PANELS WILL VARY DEPENDING ON NUMBER OF CABLES. (BY DIV. 27)
- ⑧ 48-PORT ANGLED PATCH PANEL FOR DATA CABLES, NUMBER OF PANELS WILL VARY DEPENDING ON NUMBER OF CABLES. (BY DIV. 27)
- ⑨ CISCO DATA NETWORKING EQUIPMENT (BY OWNER)
- ⑩ UNINTERRUPTIBLE POWER SUPPLY (BY OWNER)



**Diagram 27\_04 (Refer to Division 27) – Typical IDF Rack Elevation (2 racks)**

**IDF ROOM LAYOUT KEYED NOTES**

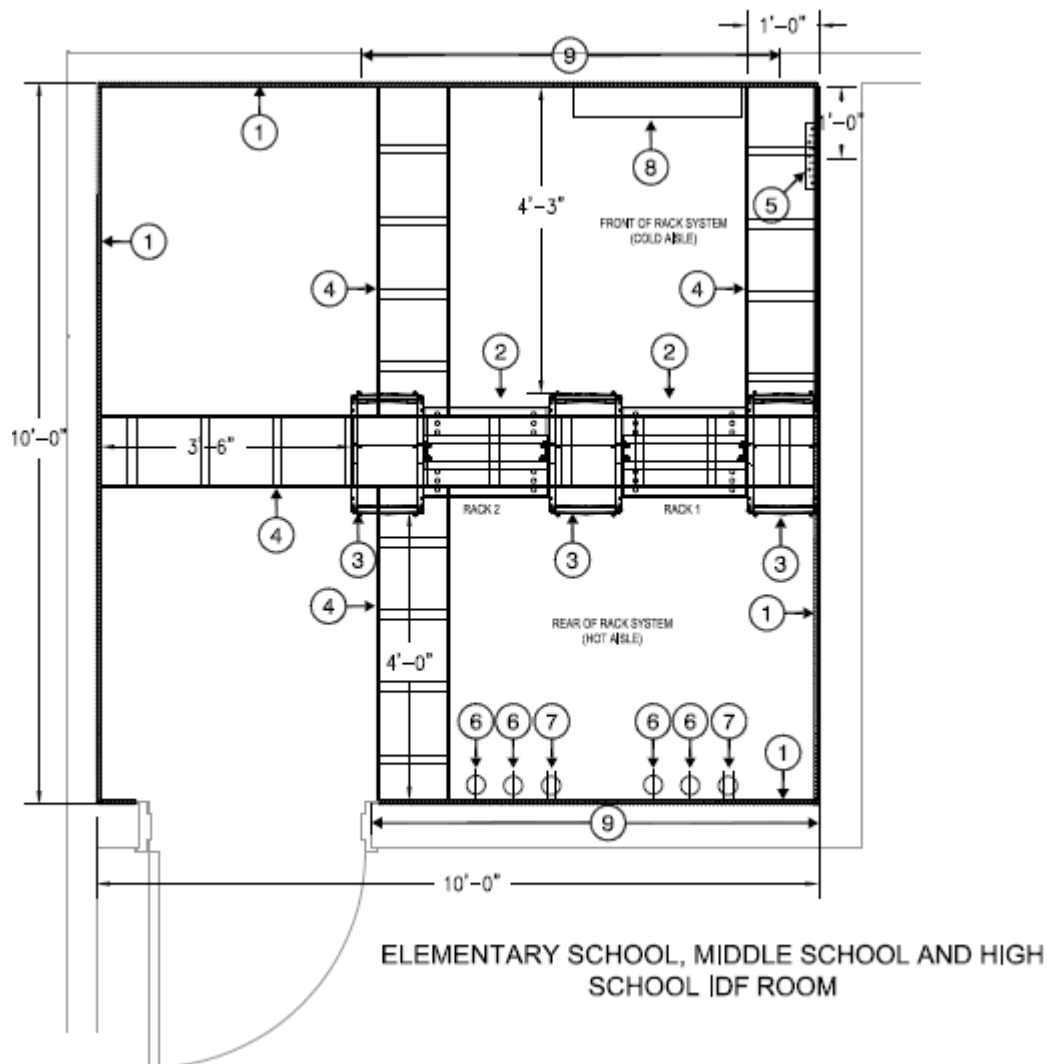
- ① 4-FEET X 8-FEET X ¾-INCH A-C GRADE, VOID FREE, FIRE RATED PLYWOOD INSTALLED VERTICALLY STARTING AT 24-INCHES ABOVE FINISHED FLOOR, PAINT WITH (2) COATS OF FIRE RETARDANT PAINT, (BY DIV. 27)
- ② 19-INCH X 84-INCH EQUIPMENT RACK, PROVIDE MINIMUM OF 4-FEET CLEAR IN FRONT AND BACK OF EQUIPMENT RACK, (BY DIV. 27)
- ③ VERTICAL WIRE MANAGERS – 104-INCHES WIDE (BY DIV. 27)
- ④ 12-INCH LADDER RACK MOUNTED AT 87-INCHES ABOVE FINISHED FLOOR, (BY DIV. 27)
- ⑤ GROUND BUS BAR MOUNTED AT 84-INCHES ABOVE FINISHED FLOOR, (BY DIV. 27)
- ⑥ DEDICATED 30 AMP CIRCUIT WITH A NEMA L6-30R TWIST LOCK RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK, CIRCUIT SHALL BE ON GENERATOR POWER, (BY DIV. 26)
- ⑦ DEDICATED 20 AMP CIRCUIT WITH A NEMA 5-20R RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK, CIRCUIT SHALL BE ON GENERATOR POWER, (BY DIV. 26)
- ⑧ FLOOR MOUNTED HVAC UNIT, PIPING SHALL EXIT THE ROOM IN THE CORNER. THE DISCONNECT AND HVAC PANEL SHALL BE LOCATED ABOVE THE FLOOR MOUNTED HVAC UNIT, (BY DIV. 23)
- ⑨ WALL SPACE RESERVED FOR OWNER PROVIDED / OWNER INSTALLED EQUIPMENT/PANELS, CONTRACTOR(S) (ALL TRADES) SHALL NOT INSTALL ANY EQUIPMENT, PANEL, ETC. AT THIS LOCATION WITHOUT PRIOR WRITTEN APPROVAL FROM OWNER.



**Diagram 27\_05 (Refer to Division 27) – Sample IDF Plan #1**

**IDF ROOM LAYOUT KEYED NOTES**

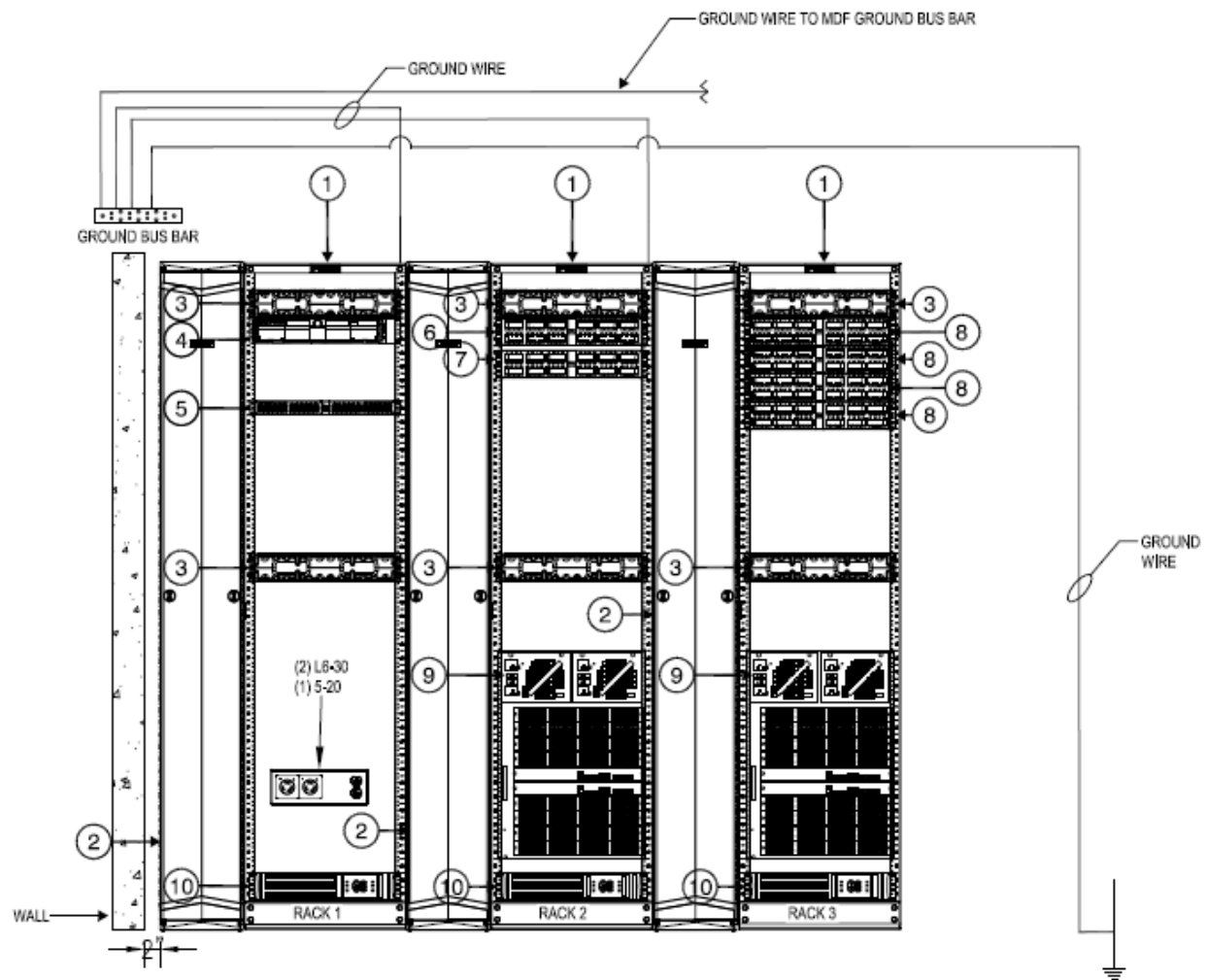
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- ⑦ DEDICATED 20 AMP CIRCUIT WITH A NEMA 5-20R RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK. CIRCUIT SHALL BE ON GENERATOR POWER. (BY DIV. 26)
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**Diagram 27\_06 (Refer to Division 27) – Sample IDF Plan #2**

**IDF ROOM RACK ELEVATION KEYED NOTES**

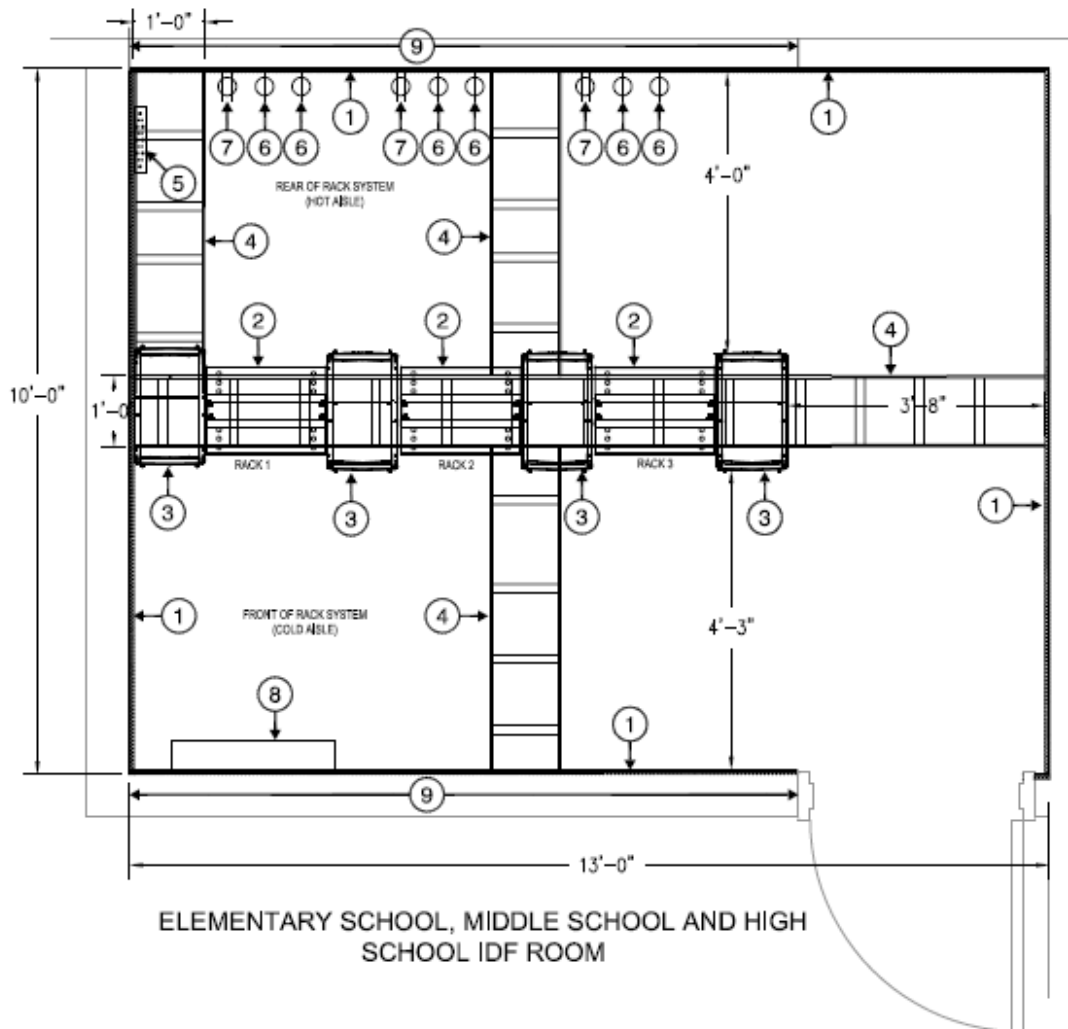
- ① 19-INCH X 84-INCH EQUIPMENT RACK (BY DIV. 27)
- ② VERTICAL WIRE MANAGERS – 10-INCHES WIDE (BY DIV. 27)
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- ⑦ 48-PORT ANGLED PATCH PANEL FOR WIRELESS ACCESS POINT CABLES, NUMBER OF PANELS WILL VARY DEPENDING ON NUMBER OF CABLES, (BY DIV. 27)
- ⑧ 48-PORT ANGLED PATCH PANEL FOR DATA CABLES, NUMBER OF PANELS WILL VARY DEPENDING ON NUMBER OF CABLES, (BY DIV. 27)
- ⑨ CISCO DATA NETWORKING EQUIPMENT (BY OWNER)
- ⑩ UNINTERRUPTIBLE POWER SUPPLY (BY OWNER)



**Diagram 27\_07 (Refer to Division 27) – Typical IDF Rack Elevation (3 racks)**

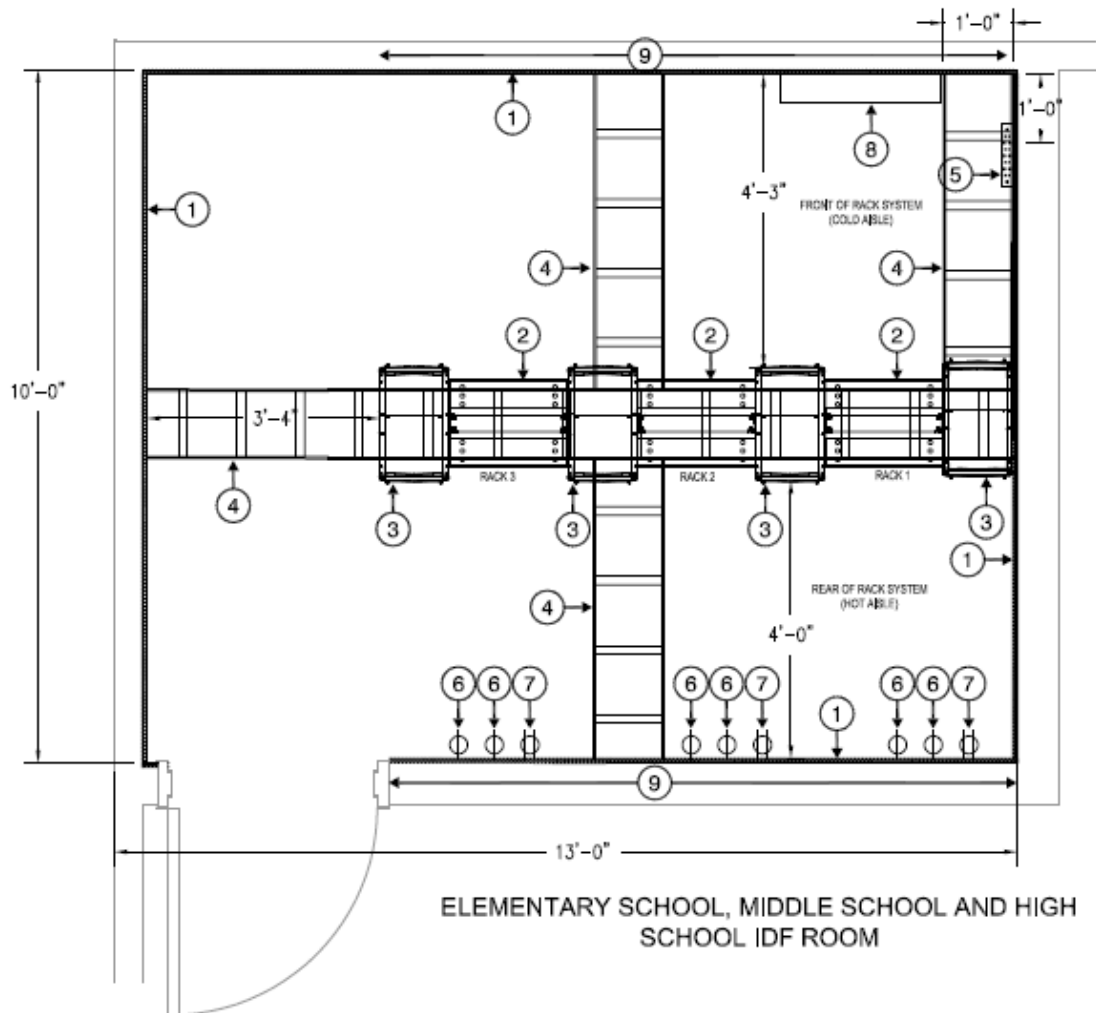
**IDF ROOM LAYOUT KEYED NOTES**

- ① 4-FEET X 8-FEET X ¾-INCH A-C GRADE, VOID FREE, FIRE RATED PLYWOOD INSTALLED VERTICALLY STARTING AT 24-INCHES ABOVE FINISHED FLOOR. PAINT WITH (2) COATS OF FIRE RETARDANT PAINT. (BY DIV. 27)
- ② 19-INCH X 84-INCH EQUIPMENT RACK, PROVIDE MINIMUM OF 4-FEET CLEAR IN FRONT AND BACK OF EQUIPMENT RACK. (BY DIV. 27)
- ③ VERTICAL WIRE MANAGERS – 104-INCHES WIDE (BY DIV. 27)
- ④ 12-INCH LADDER RACK MOUNTED AT 87-INCHES ABOVE FINISHED FLOOR. (BY DIV. 27)
- ⑤ GROUND BUS BAR MOUNTED AT 84-INCHES ABOVE FINISHED FLOOR. (BY DIV. 27)
- ⑥ DEDICATED 30 AMP CIRCUIT WITH A NEMA L6-30R TWIST LOCK RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK. CIRCUIT SHALL BE ON GENERATOR POWER. (BY DIV. 26)
- ⑦ DEDICATED 20 AMP CIRCUIT WITH A NEMA 5-20R RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK. CIRCUIT SHALL BE ON GENERATOR POWER. (BY DIV. 26)
- ⑧ FLOOR MOUNTED HVAC UNIT. PIPING SHALL EXIT THE ROOM IN THE CORNER. THE DISCONNECT AND HVAC PANEL SHALL BE LOCATED ABOVE THE FLOOR MOUNTED HVAC UNIT. (BY DIV. 23)
- ⑨ WALL SPACE RESERVED FOR OWNER PROVIDED / OWNER INSTALLED EQUIPMENT/PANELS. CONTRACTOR(S) (ALL TRADES) SHALL NOT INSTALL ANY EQUIPMENT, PANEL, ETC. AT THIS LOCATION WITHOUT PRIOR WRITTEN APPROVAL FROM OWNER.

**Diagram 27\_08 (Refer to Division 27) – Sample IDF Plan #3**

**IDF ROOM LAYOUT KEYED NOTES**

- ① 4-FEET X 8-FEET X ¾-INCH A-C GRADE, VOID FREE, FIRE RATED PLYWOOD INSTALLED VERTICALLY STARTING AT 24-INCHES ABOVE FINISHED FLOOR. PAINT WITH (2) COATS OF FIRE RETARDANT PAINT. (BY DIV. 27)
- ② 19-INCH X 84-INCH EQUIPMENT RACK, PROVIDE MINIMUM OF 4-FEET CLEAR IN FRONT AND BACK OF EQUIPMENT RACK. (BY DIV. 27)
- ③ VERTICAL WIRE MANAGERS – 104-INCHES WIDE (BY DIV. 27)
- ④ 12-INCH LADDER RACK MOUNTED AT 87-INCHES ABOVE FINISHED FLOOR. (BY DIV. 27)
- ⑤ GROUND BUS BAR MOUNTED AT 84-INCHES ABOVE FINISHED FLOOR. (BY DIV. 27)
- ⑥ DEDICATED 30 AMP CIRCUIT WITH A NEMA L6-30R TWIST LOCK RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK. CIRCUIT SHALL BE ON GENERATOR POWER. (BY DIV. 26)
- ⑦ DEDICATED 20 AMP CIRCUIT WITH A NEMA 5-20R RECEPTACLE FLUSH MOUNTED TO THE FINISHED WALL SURFACE AT 18-INCHES ABOVE FINISHED FLOOR BEHIND EACH EQUIPMENT RACK. CIRCUIT SHALL BE ON GENERATOR POWER. (BY DIV. 26)
- ⑧ FLOOR MOUNTED HVAC UNIT. PIPING SHALL EXIT THE ROOM IN THE CORNER. THE DISCONNECT AND HVAC PANEL SHALL BE LOCATED ABOVE THE FLOOR MOUNTED HVAC UNIT. (BY DIV. 23)
- ⑨ WALL SPACE RESERVED FOR OWNER PROVIDED / OWNER INSTALLED EQUIPMENT/PANELS. CONTRACTOR(S) (ALL TRADES) SHALL NOT INSTALL ANY EQUIPMENT, PANEL, ETC. AT THIS LOCATION WITHOUT PRIOR WRITTEN APPROVAL FROM OWNER.



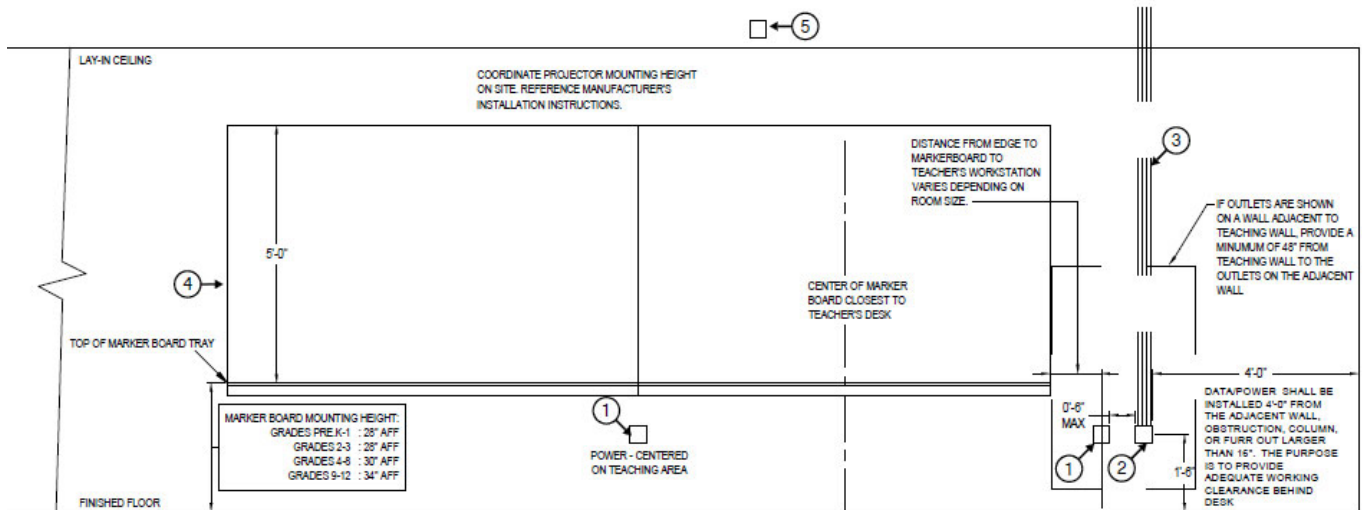
**Diagram 27\_09 (Refer to Division 27) – Sample IDF Plan #4**

**KEYED NOTES:**

- ① QUAD ELECTRICAL RECEPTACLE.
- ② DATA JACK WALL PLATE.
- ③ (2) 1-INCH EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING IN THE SAME ROOM WHERE THE DEVICE IS LOCATED.
- ④ MARKER BOARD
- ⑤ JUNCTION BOX WITH ELECTRICAL CIRCUIT ABOVE ACCESSIBLE CEILING FOR FUTURE USE (BY DIV. 26)

**GENERAL NOTES:**

1. CLASSROOM ORIENTATION CAN BE REVERSED TO MATCH FLOOR-PLAN LAYOUT.
2. BEFORE THE INSTALLATION AND ROUGH-IN OF CONDUITS FOR TECHNOLOGY AND AUDIOVISUAL OUTLETS IN THE TYPICAL CLASSROOM THE CONTRACTOR SHALL MOCK UP ONE CLASSROOM AND ONE LAB WITH RESPECT TO POWER, DATA, AND AUDIOVISUAL BACKBOXES ROUGH-INS FOR APPROVAL BY THE OAC TEAM.



**Diagram 27\_10 (Refer to Division 27) – Typical Classroom Elevation**

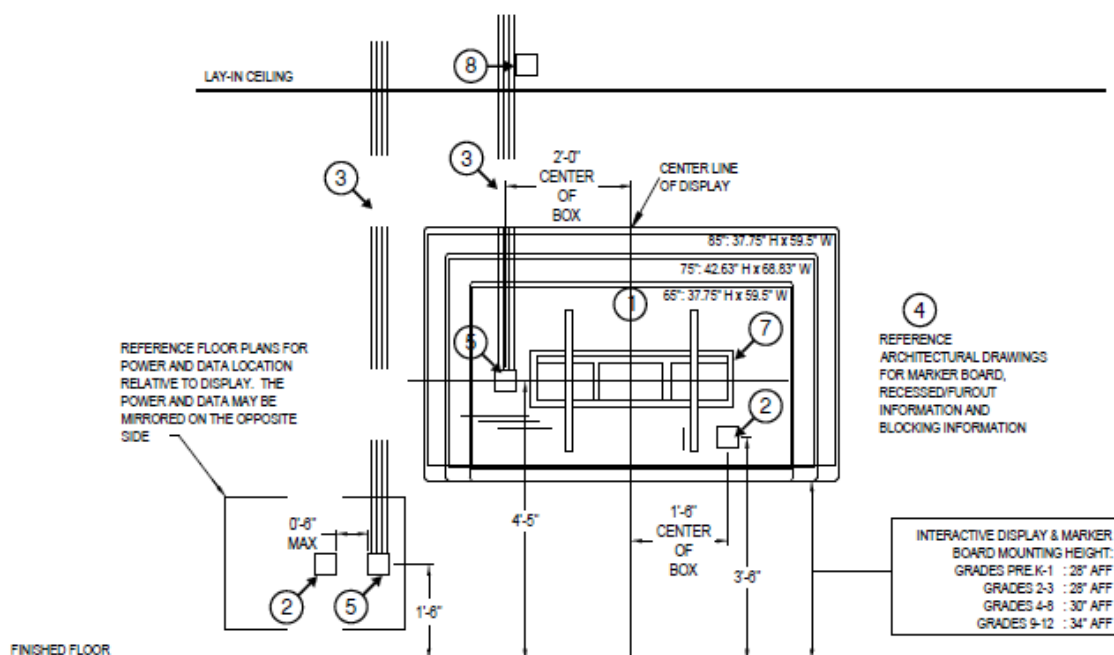


KEYED NOTES:

- ① WALL MOUNTED INTERACTIVE DISPLAY , OWNER FURNISHED, OWNER INSTALLED (OFOI)
- ② QUAD ELECTRICAL RECEPTACLE.
- ③ (2) 1-INCH EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING.. IF OPEN CEILING, STUB OUT TO NEAREST ACCESSIBLE CEILING (BY DIV 26).
- ④ MARKER BOARD - REFERENCE ARCHITECTURAL DRAWINGS FOR MARKER BOARD, RECESSED/FURROUT INFORMATION AND BLOCKING INFORMATION
- ⑤ DATA JACK WALL PLATE.
- ⑥ ABOVE CEILING DATA BISCUIT WITH PATCH CABLE(S) PROVIDED BY DATA CONTRACTOR.
- ⑦ FIXED DISPLAY MOUNT, OWNER FURNISHED OWNER INSTALLED (OFOI).
- ⑧ JUNCTION BOX WITH ELECTRICAL CIRCUIT ABOVE ACCESSIBLE CEILING FOR FUTURE USE (BY DIV. 26)

GENERAL NOTES:

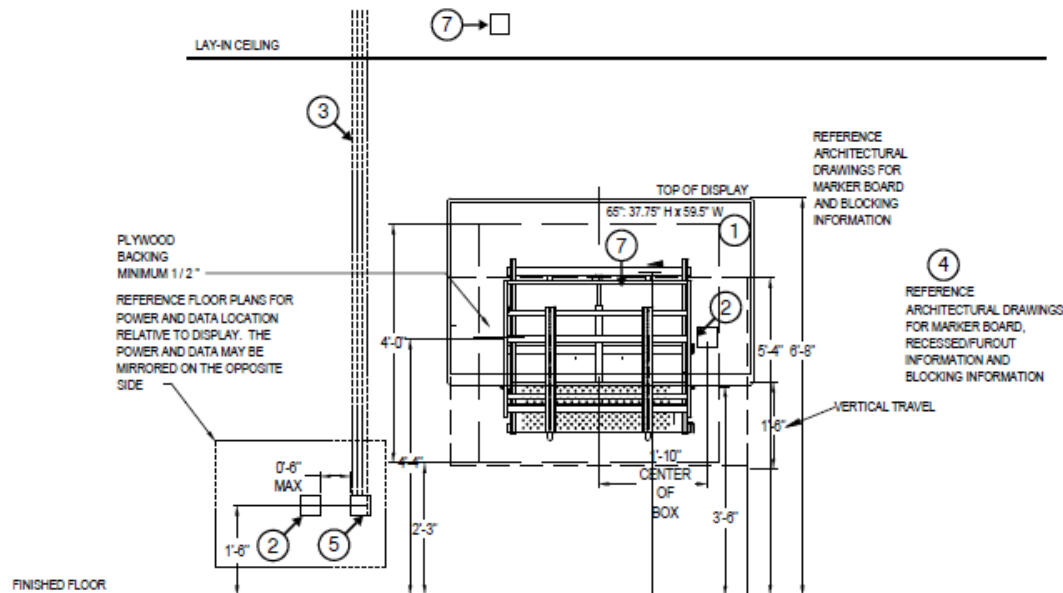
1. INTERACTIVE DISPLAY AND MOUNT ARE OWNER FURNISHED OWNER
2. BEFORE THE INSTALLATION AND ROUGH-IN OF CONDUITS FOR TECHNOLOGY AND AUDIOVISUAL OUTLETS IN THE TYPICAL CLASSROOM THE CONTRACTOR SHALL MOCK UP ONE CLASSROOM AND ONE LAB WITH RESPECT TO POWER, DATA, AND AUDIOVISUAL BACK BOXES ROUGH-INS FOR APPROVAL BY THE OAC TEAM.



**Diagram 27\_11 (Refer to Division 27) – Typical Collaboration Elevation – Fixed Height Installation**

GENERAL NOTES:

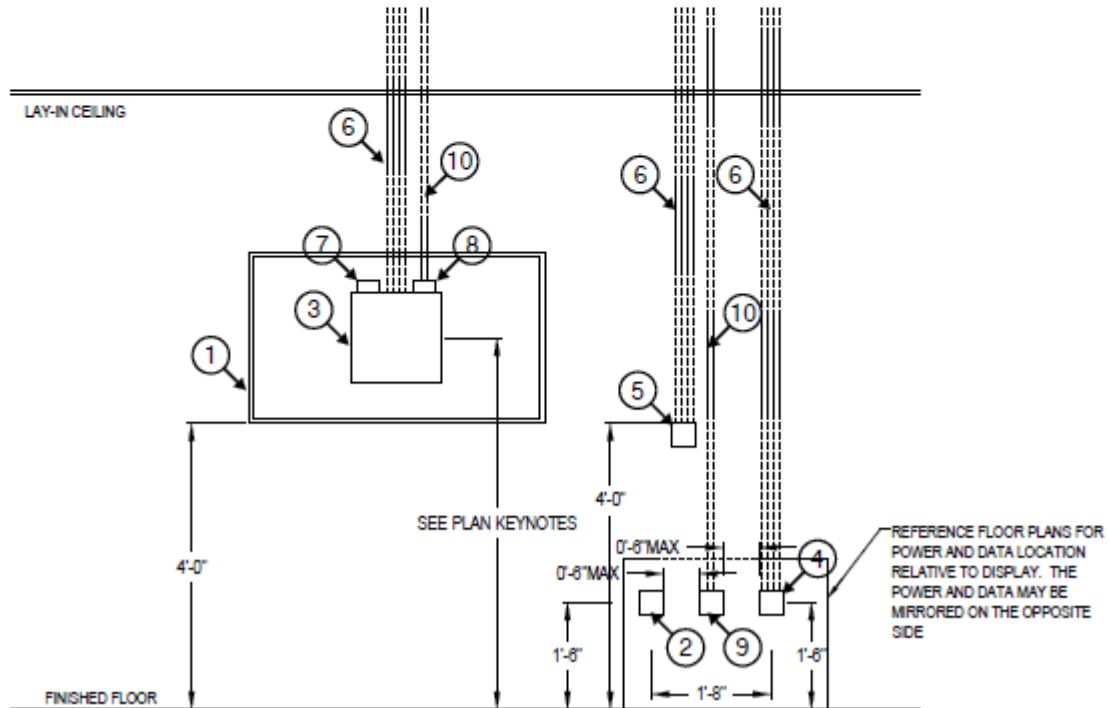
- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1 WALL MOUNTED INTERACTIVE DISPLAY , OWNER FURNISHED, OWNER INSTALLED (OFOI)</li> <li>2 QUAD ELECTRICAL RECEPTACLE.</li> <li>3 (2) 1-INCH EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING.. IF OPEN CEILING,STUB OUT TO NEAREST ACCESSIBLE CEILING (BY DIV 26).</li> <li>4 MARKER BOARD - REFERENCE ARCHITECTURAL DRAWINGS FOR MARKER BOARD, RECESSED/FURROUT INFORMATION AND BLOCKING INFORMATION</li> <li>5 ABOVE CEILING DATA BISCUIT WITH PATCH CABLE(S) PROVIDED BY DATA CONTRACTOR.</li> <li>6 HEIGHT ADJUSTABLE DISPLAY MOUNT, CONTRACTOR FURNISHED CONTRACTOR INSTALLED (OFOI).</li> <li>7 JUNCTION BOX WITH ELECTRICAL CIRCUIT ABOVE ACCESSIBLE CEILING FOR FUTURE USE (BY DIV. 26)</li> </ol> | <ol style="list-style-type: none"> <li>1. INTERACTIVE DISPLAY IS OWNER FURNISHED OWNER INSTALLED, HEIGHT ADJUSTABLE MOUNT IS CONTRACTOR FURNISHED CONTRACTOR INSTALLED.</li> <li>2. REFERENCE DISPLAY MOUNT INSTALLATION MANUAL TO CALCULATE PLACEMENT ACHIEVE NOTED DISPLAY HEIGHT(S).</li> <li>3. BEFORE THE INSTALLATION AND ROUGH-IN OF CONDUITS FOR TECHNOLOGY AND AUDIOVISUAL OUTLETS IN THE TYPICAL CLASSROOM THE CONTRACTOR SHALL MOCK UP ONE CLASSROOM AND ONE LAB WITH RESPECT TO POWER, DATA, AND AUDIOVISUAL BACKBOXES ROUGH-INS FOR APPROVAL BY THE OAC TEAM.</li> </ol> |
|--|---|



**Diagram 27\_12 (Refer to Division 27) – Typical Collaboration Elevation – Adjustable Height Installation**

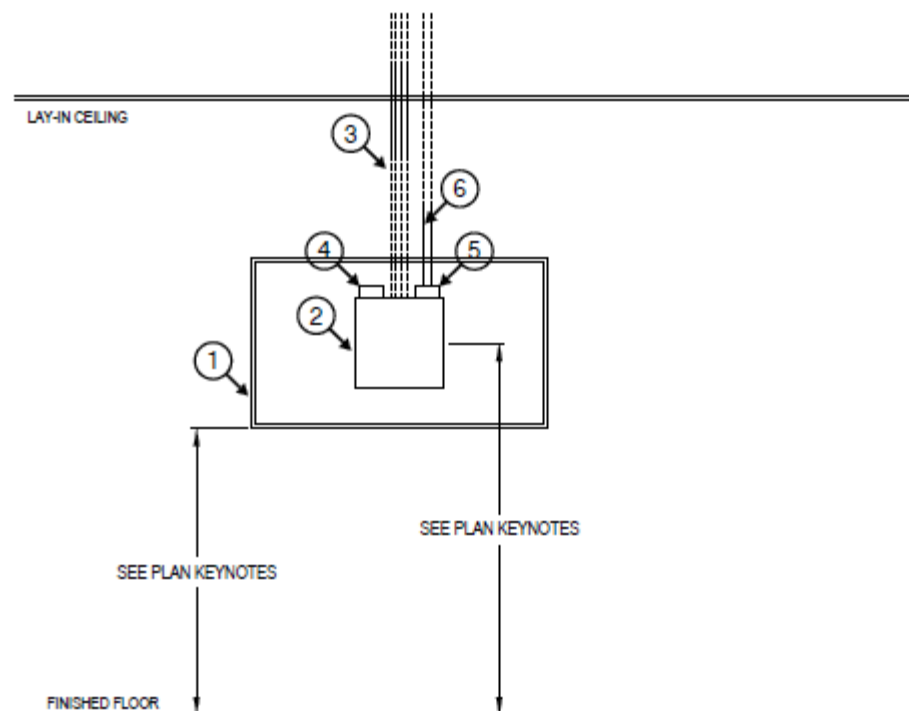
KEYED NOTES:

- ① WALL MOUNTED FLAT PANEL DISPLAY.
- ② QUAD ELECTRICAL RECEPTACLE 120VAC.
- ③ IN WALL EQUIPMENT STORAGE BOX WITH ROUGH-INS FOR POWER, DATA, AND, AUDIO VISUAL.
- ④ MULTIMEDIA INPUT PLATE - HDMI WALL-PLATE TRANSMITTER.
- ⑤ ROUGH IN FOR FUTURE AV CONTROL PANEL.
- ⑥ (2) 1.25" EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING IN THE SAME ROOM WHERE THE DEVICE IS LOCATED. CONDUITS WILL SERVE AS PATHWAY FOR AV CABLING.
- ⑦ DOWNWARD FACING DUPLEX POWER RECEPTACLE WITH ASSOCIATED BOX AND RACEWAY.
- ⑧ DOWNWARD FACING DATA JACK PLATE WITH ASSOCIATED BOX AND RACEWAY.
- ⑨ DATA JACK WALL PLATE.
- ⑩ ONE 1-INCH EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING IN THE SAME ROOM WHERE THE DEVICE IS LOCATED.



KEYED NOTES:

- ① WALL MOUNTED FLAT PANEL DISPLAY.
- ② IN WALL EQUIPMENT STORAGE BOX WITH ROUGH-INS FOR POWER, DATA , AND, AUDIO VISUAL.
- ③ (2) 1.25" EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING IN THE SAME ROOM WHERE THE DEVICE IS LOCATED.
- ④ DOWNWARD FACING DUPLEX POWER RECEPTACLE WITH ASSOCIATED BOX AND RACEWAY.
- ⑤ DOWNWARD FACING DATA JACK PLATE WITH ASSOCIATED BOX AND RACEWAY.
- ⑥ ONE 1-INCH EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING IN THE SAME ROOM WHERE THE DEVICE IS LOCATED.



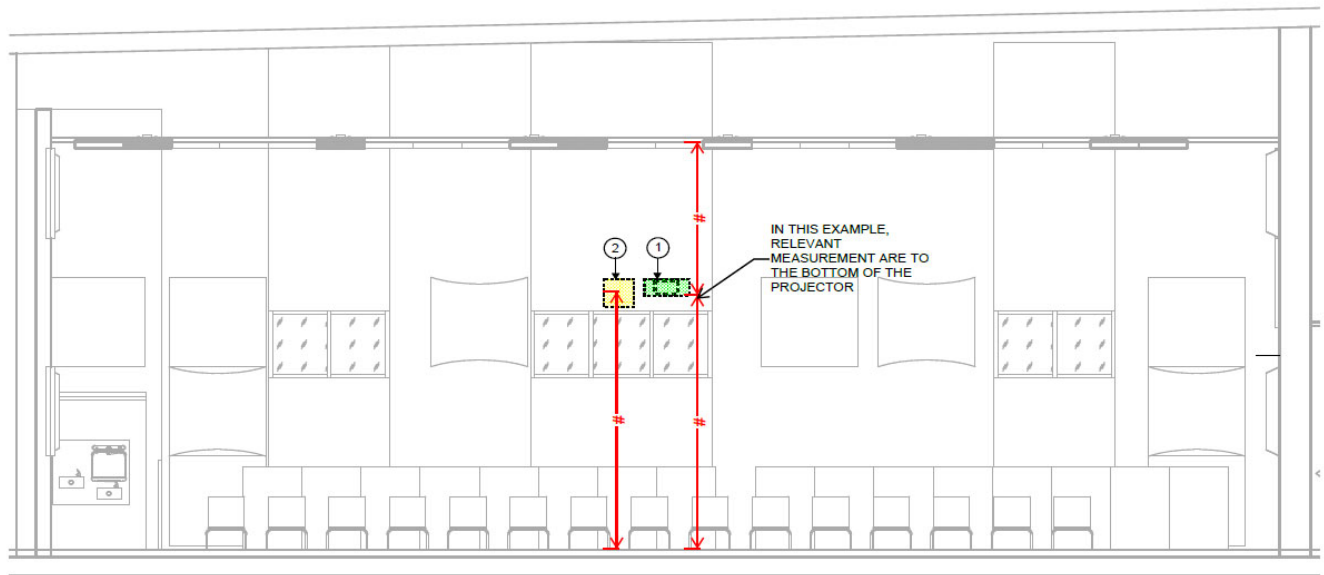
**Diagram 27\_14 (Refer to Division 27) – Typical Interior Digital Signage Elevation**

**KEYED NOTES:**

- ① LONG THROW WALL MOUNTED PROJECTOR.  
 ② RECESSED IN-WALL AV EQUIPMENT BOX

**NOTE:**

1. FLOOR PLANS WILL VARY. THE PURPOSE OF THIS SAMPLE ELEVATION IS TO ILLUSTRATE ROUGH-IN REQUIRED FOR AUDIOVISUAL, DATA, AND PROXIMITY TO ELECTRICAL DEVICES ON TEACHING WALL.
2. COORDINATE THE LOCATION OF THE PROJECTOR WITH ARCHITECT, FBISD D&C DESIGN MANAGER, AND FBISD IT DURING DESIGN. HEIGHT OF THE PROJECTOR INSTALLATION VARIES DEPENDANT ON THE BY ROOM TYPE, RISER HEIGHT, RISER USE (SIT VS STAND)) FOR EACH PARTICULAR FINE ARTS HALL
3. COORDINATE THE LOCATION OF THE OVERHEAD HANGING MICROPHONES WITH ARCHITECT, FBISD DESIGN MANAGER, AND FBISD IT DURING DESIGN.



**SAMPLE BAND, CHOIR, ORCHESTRA ROOM PROJECTOR WALL ELEVATION**

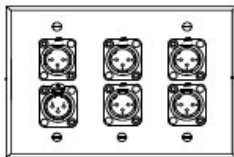
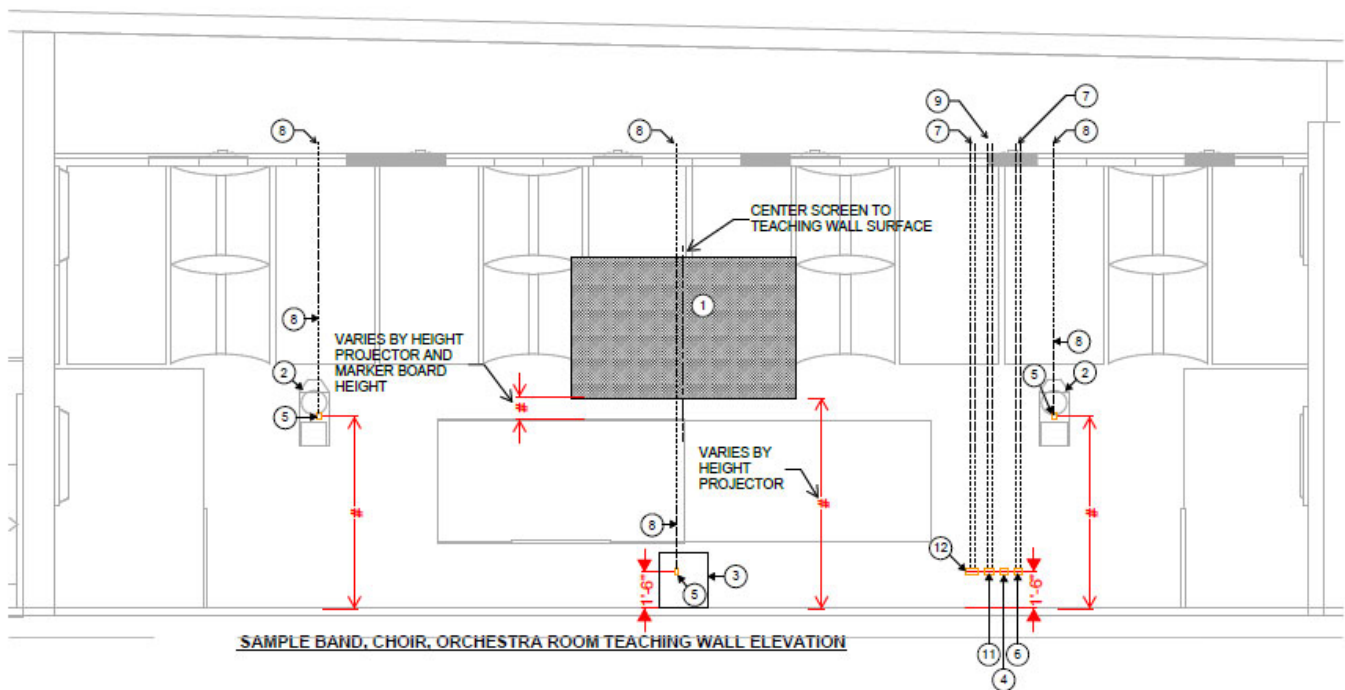
**Diagram 27\_15 (Refer to Division 27) – Typical Fine Arts Classroom – Projector Wall Elevation**

**KEYED NOTES:**

- ① FIXED WALL MOUNTED VIDEO PROJECTION SCREEN 16:10 ASPECT RATIO (69"H x 110"W - 130" DIAGONAL)
- ② SURFACE MOUNTED SPEAKERS (LEFT AND RIGHT)
- ③ MOBILE FLOOR MOUNTED SUB-WOOFER
- ④ QUAD ELECTRICAL RECEPTACLE 120VAC
- ⑤ AUDIO VISUAL ROUGH-IN WITH PASS-THROUGH PLATE
- ⑥ MULTIMEDIA INPUT FACE PLATE - HDMI, L&R RCA TO MONO, 3.5 MINI WALL PLATE. REFERENCE TYPICAL FINE ARTS INSTRUCTOR'S FACE PLATE DETAIL
- ⑦ (2) 1.25" EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING IF OPEN CEILING, STUB OUT TO NEAREST ACCESSIBLE CEILING (BY DIV 26)
- ⑧ (1) 1.25" EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING IF OPEN CEILING, STUB OUT TO NEAREST ACCESSIBLE CEILING (BY DIV 26)
- ⑨ (2) 1" EMT CONDUITS WITH 200 LB PULL STRINGS AND NYLON BUSHINGS STUBBED OUT ABOVE ACCESSIBLE CEILING IF OPEN CEILING, STUB OUT TO NEAREST ACCESSIBLE CEILING (BY DIV 26)
- ⑩ MARKER BOARD
- ⑪ DATA OUTLET WALL PLATE
- ⑫ CUSTOM I/O FACE PLATE - 5 X MALE (MIC A-D), 1 XLR FEMALE (MIX TO AMP) REFERENCE TYPICAL FINE ARTS INSTRUCTOR'S I/O FACE PLATE DETAIL

**NOTE:**

1. FLOOR PLANS WILL VARY. THE PURPOSE OF THIS SAMPLE ELEVATION IS TO ILLUSTRATE ROUGH-IN REQUIRED FOR AUDIOVISUAL, DATA, AND PROXIMITY TO ELECTRICAL DEVICES ON TEACHING WALL.
2. COORDINATE THE LOCATION OF THE SPEAKER WITH ARCHITECT, FBISD D&C DESIGN MANAGER, AND FBISD IT DURING DESIGN.
3. COORDINATE THE LOCATION OF THE PROJECTION SCREEN WITH ARCHITECT, FBISD D&C DESIGN MANAGER, AND FBISD IT DURING DESIGN.
4. DESIGN DOCUMENTS WILL SHOW THE LOCATION OF THE AUDIOVISUAL COMPONENTS ILLUSTRATED WITH DIMENSION TO ASSIST THE CONTRACTORS WITH INSTALLATION OF THE DEVICES, THE SUPPORTING ROUGH-INS, RELATIVE TO ONE ANOTHER IN THE DESIRED LOCATION FOR INSTRUCTION.



⑫ TYPICAL FINE ARTS INSTRUCTOR'S I/O FACE PLATE

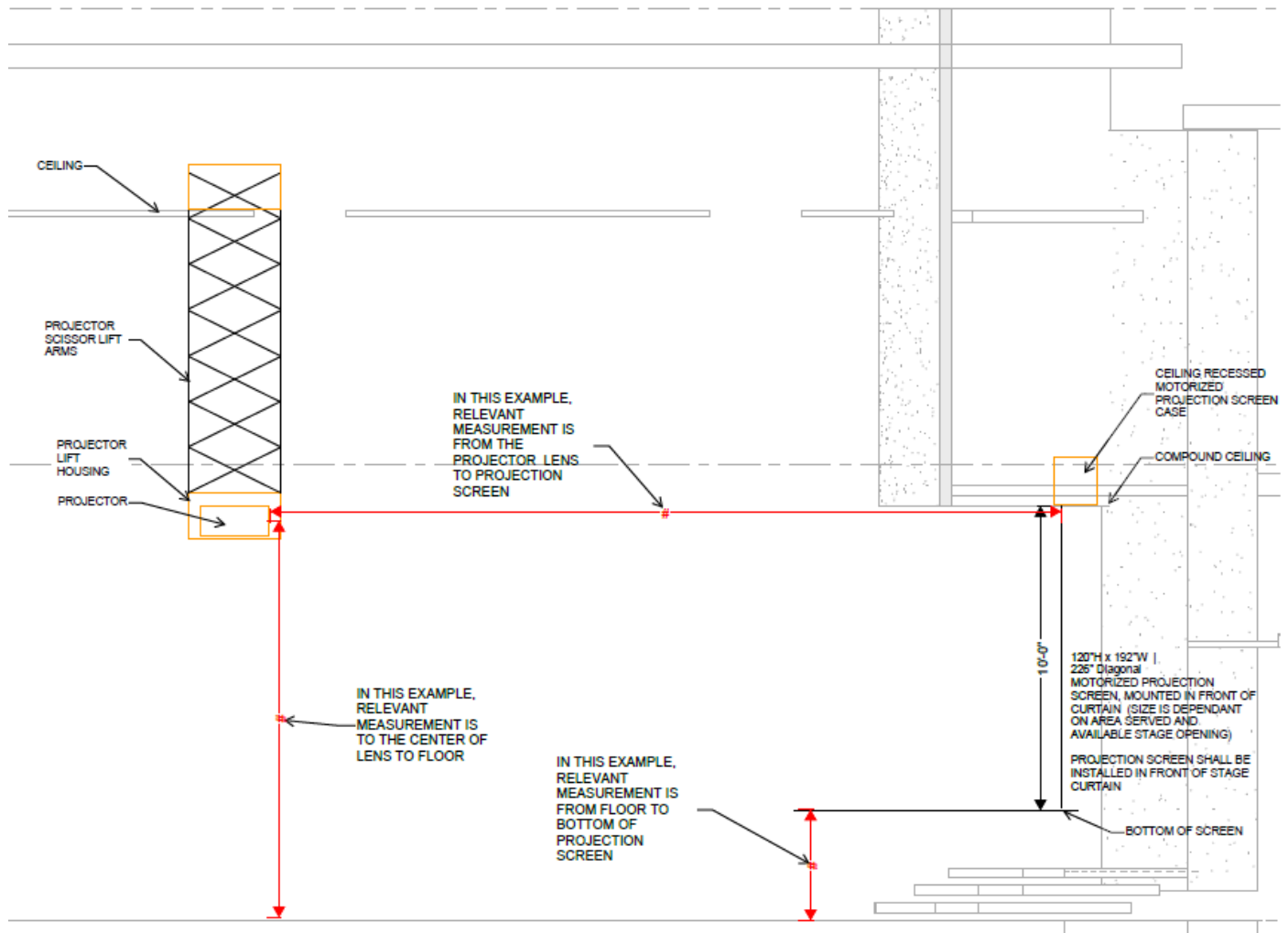


⑥ TYPICAL FINE ARTS INSTRUCTOR'S FACEPLATE MODULES

**Diagram 27\_16 (Refer to Division 27) – Typical Fine Arts Classroom – Teaching Wall Elevation**

**NOTE:**

1. FLOOR PLANS WILL VARY. THE PURPOSE OF THIS SAMPLE ELEVATION IS TO ILLUSTRATE ROUGH-IN REQUIRED FOR AUDIOVISUAL, DATA, AND PROXIMITY TO ELECTRICAL DEVICES ON TEACHING WALL.
2. COORDINATE THE LOCATION OF THE SPEAKER(S) WITH ARCHITECT, FBISD D&C DESIGN MANAGER, AND FBISD IT DURING DESIGN. SOME CAFETERIAS WILL BE BETTER SERVED WITH DISTRIBUTED SOUND OTHERS CAN BE SERVED BY WALL MOUNTED FORWARD FACING UNITS.
3. COORDINATE THE LOCATION OF THE PROJECTION SCREEN WITH ARCHITECT, FBISD D&C DESIGN MANAGER, AND FBISD IT DURING DESIGN.
4. COORDINATED PROJECTOR LIGHT PATH WITH ANY THEATRICAL LIGHTING
5. DESIGN DOCUMENTS WILL SHOW THE LOCATION OF THE AUDIOVISUAL COMPONENTS ILLUSTRATED WITH DIMENSION TO ASSIST THE CONTRACTORS WITH INSTALLATION OF THE DEVICES, THE SUPPORTING ROUGH-INS, RELATIVE TO ONE ANOTHER IN THE DESIRED LOCATION FOR INSTRUCTION

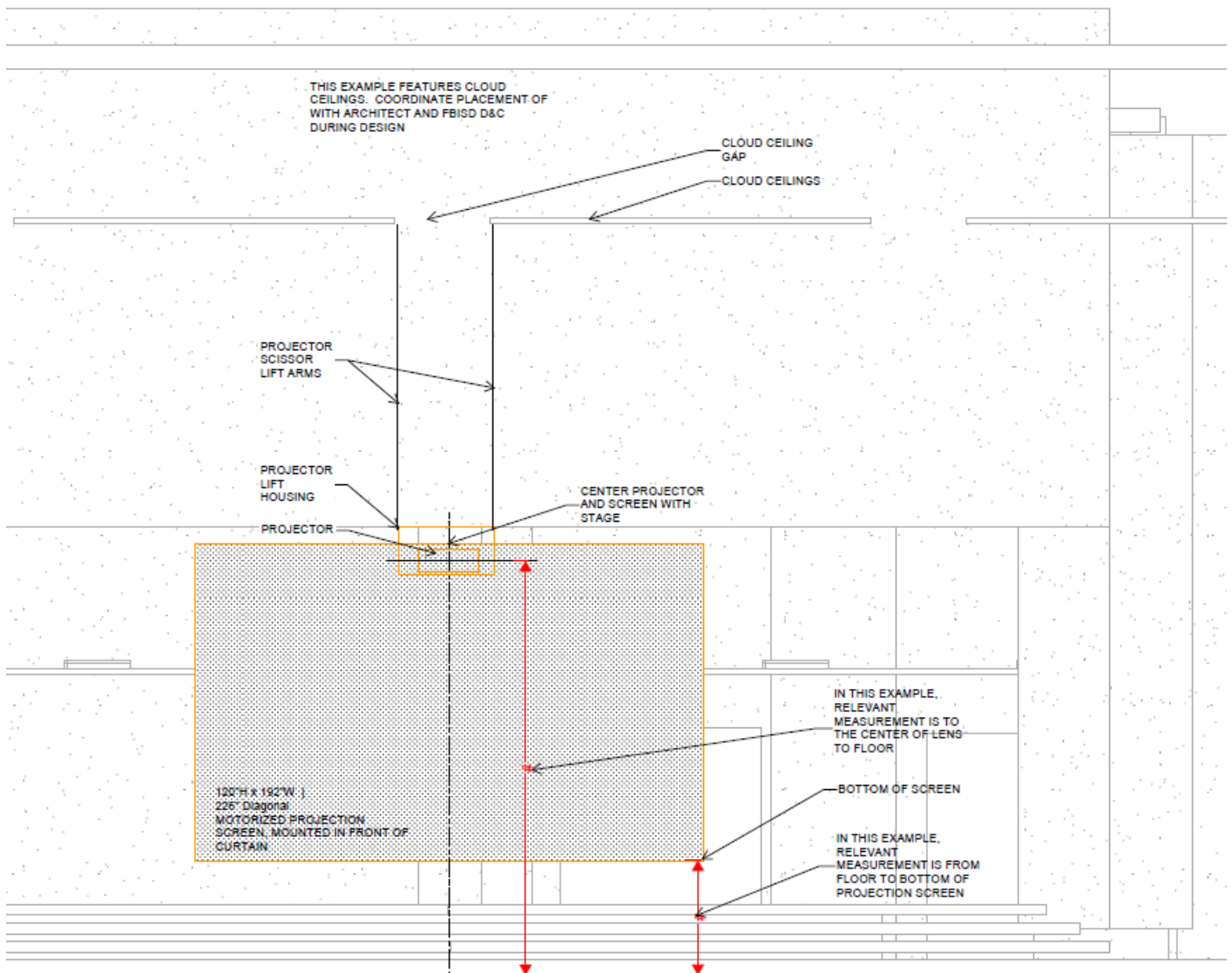


**Diagram 27\_17 (Refer to Division 27) – Cafeteria – Section**

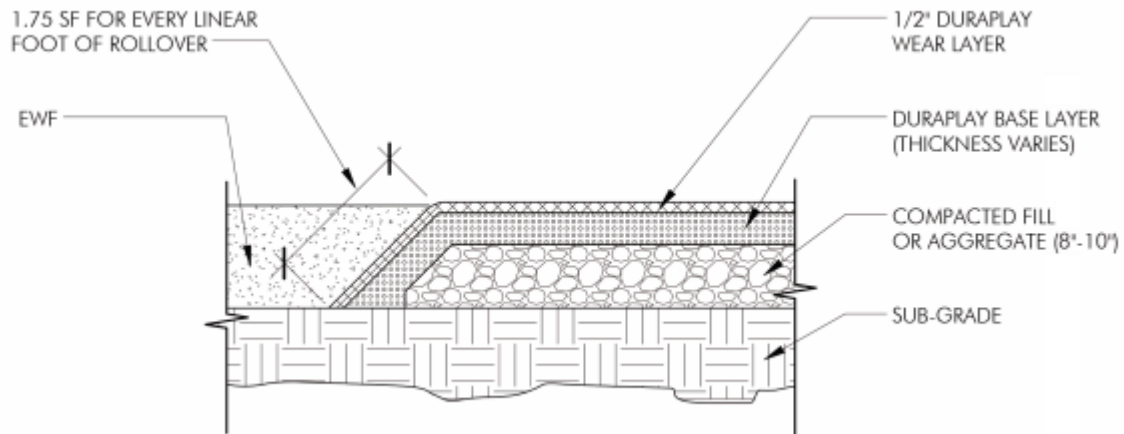
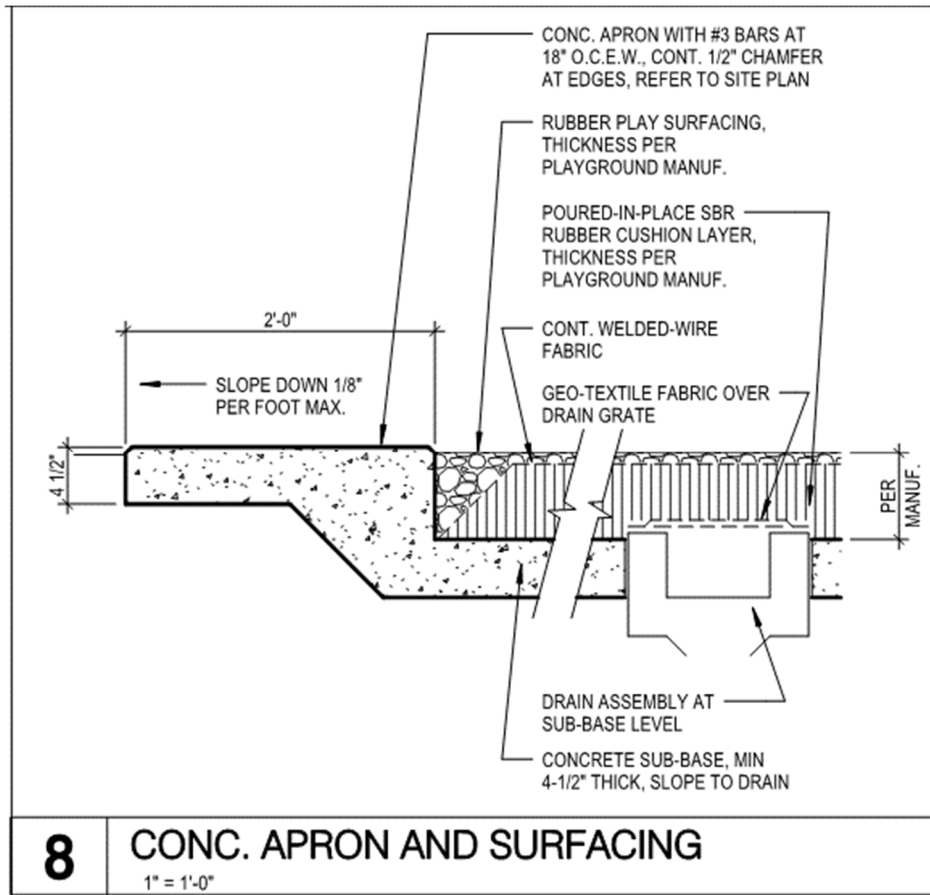


**NOTE:**

1. FLOOR PLANS WILL VARY. THE PURPOSE OF THIS SAMPLE ELEVATION IS TO ILLUSTRATE ROUGH-IN REQUIRED FOR AUDIOVISUAL, DATA, AND PROXIMITY TO ELECTRICAL DEVICES ON TEACHING WALL.
2. COORDINATE THE LOCATION OF THE SPEAKER(S) WITH ARCHITECT, FBISD D&C DESIGN MANAGER, AND FBISD IT DURING DESIGN. SOME CAFETERIAS WILL BE BETTER SERVED WITH DISTRIBUTED SOUND OTHERS CAN BE SERVED BY WALL MOUNTED FORWARD FACING UNITS.
3. COORDINATE THE LOCATION OF THE PROJECTION SCREEN WITH ARCHITECT, FBISD D&C DESIGN MANAGER, AND FBISD IT DURING DESIGN.
4. COORDINATED PROJECTOR LIGHT PATH WITH ANY THEATRICAL LIGHTING
5. DESIGN DOCUMENTS WILL SHOW THE LOCATION OF THE AUDIOVISUAL COMPONENTS ILLUSTRATED WITH DIMENSION TO ASSIST THE CONTRACTORS WITH INSTALLATION OF THE DEVICES, THE SUPPORTING ROUGH-INS, RELATIVE TO ONE ANOTHER IN THE DESIRED LOCATION FOR INSTRUCTION.



**Diagram 27\_18 (Refer to Division 27) – Cafeteria – Projection Screen**



**Diagram 32\_01 (Refer to Divisions 32) – Play Surfacing**

**END OF APPENDIX**