DESIGN GUIDELINES AND STANDARDS
SEQUOIA UNION HIGH SCHOOL DISTRICT
Maintenance Design and Construction

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INTRODUCTION AND GENERAL INFORMATION

Introduction

These District Guidelines and Standards ("the Guidelines" or "the District Standards" or "these Standards") are a coordinated effort by the Sequoia Union High School District, the District Director of Facilities, District Bond Program Manager, SUHSD Maintenance and Operations Department, outside consultants, and specialists in specific technological fields to articulate products, materials, procedures, and special requirements that architects, engineers and contractors must incorporate when designing and building projects for the Sequoia Union High School District.

The Guidelines are updated about once a year. Changes during the year will be documented in Addenda and distributed to those on the District Standards and Guidelines mailing list.

Contact the District Director of Facilities for the latest copy of the Guidelines and any Addenda that may have been issued.

General Information

These Guidelines and Standards include the products, materials, procedures, and special requirements that architects, engineers, and contractors shall follow when designing and building projects for the Sequoia Union High School District. Architects and engineers involved in the planning and design of District facilities must familiarize themselves with these Guidelines and adhere to them in all phases of their work with the District.

This document applies to modernization projects as well as to projects involving new buildings. However, the District recognizes that some requirements may not be achievable or appropriate for all projects. Where stated requirements in this document are not achievable, or seem inconsistent with the project scope and budget, the A/E should seek direction from the District Director of Facilities.

Standards defined in the Guidelines represent either a) established District requirements, or b) strong design recommendations.

District requirements fall into one of the following 3 categories:

1. Standards that list only one manufacturer and/or product and note that no substitutions are allowed. This is a District requirement, and substitutions or alternatives are not acceptable during either design or construction. District Standard specification section 01 31 00, titled "Sequoia Union High School District Design Standards," lists all such products and systems and is included with Division 01. It is to be included in the project manual for every project and revisions are not allowed on a project-by-project basis. District will provide A/E design teams with current versions of District Standard Specifications.
2. Standards listing single or multiple manufacturers, products, or systems for which substitutions may be allowed.

a. The listed manufacturers, products, or systems form the standard, and the Architect/Engineer is required to list these only. Approved equal products will be allowed only with the written authorization from the District's Director of Facilities.

b. When listing only one manufacturer and product in the project specifications, the A/E must include the clause “or approved equal,” per Public Contract Code Section 3400-3410

c. When listing two or more manufacturers and products, this language is not required.

d. The A/E is not allowed to substitute or add other manufacturers or products without prior written authorization from the District's Director of Facilities.

e. Contractors proposing substitutions during construction must follow the procedures outlined in District standard specification section 01 62 00 Product Substitution Procedures and submit on the District’s specification section 01 62 00 Substitution Guarantee Form. The contractor must demonstrate that the proposed products are equal in quality, performance, appearance, sustainability, and cost.

f. Requests for substitutions during bidding will be considered if received within 14 days prior to bid opening day. Contractors must follow the procedures outlined in District standard specification section 01 62 00 Product Substitution Procedures and submit on the District’s specification section 01 62 00 Substitution Guarantee Form. The contractor must demonstrate that the proposed products are equal in quality, performance, appearance, sustainability, and cost.

3. Standards that define the required performance: Any manufacturer and/or product that meet the performance criteria are acceptable. It is the responsibility of the Contractor to justify compliance with all requirements of the performance standard.

The wording "shall", "must", or "will" within a standard defines a standard that shall be complied with under all circumstances.

The phrase "or approved" within a standard defines a standard that allows the use of alternative manufacturers and/or products meeting established criteria or a basis of design. The Contractor must submit detailed product information and design criteria to the A/E and SUHSD Maintenance and Operations Department to evaluate the proposed alternate or substitution, following the procedures described above. Approval of manufacturers and/or products is at the sole discretion of the District.

Some standards include, or are solely, recommendations of sound professional practices and narratives that outline suggested procedures, practices, or design approaches. Every attempt shall be made by the A/E to comply with these standards in coordination with program, budget, and schedule priorities. However, these Guidelines shall not relieve the A/E from her/his professional, legal, and contractual responsibilities when providing services to the District.

The A/E should immediately alert the District Director of Facilities of any perceived conflicts or inconsistencies between what is described or required by these Guidelines and any code or legal requirements as well as any recommendations the A/E may find reasonable and advisable with respect to sound professional practice.

The District will issue the current edition of the District Guidelines and Standards, including all addenda, to the A/E during contract negotiations and prior to initiation of each respective project.

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DIVISION 01 – GENERAL REQUIREMENTS

A. Work Restrictions

1. System shutdowns and start-ups are to be coordinated in advance with the District Maintenance and Operations Department. Documentation of coordination in the form of written approval by the District Director of Facilities and the School Principal shall be maintained as part of the project records by the Contractor.
2. Weekend and after-hours work are to be approved by the District in writing.
3. The use of powder-driven anchors is not allowed during school hours. For after-hours work and weekend work, powder-driven anchors are allowed.

B. Demolition Requirements

1. Salvage
   a. The District encourages the recycling and reuse of used building materials and fixtures.
   b. SUHSD Maintenance and Operations Department can salvage parts no longer available, in scarce supply, or in good condition for use in other schools. Examples include water closets, flushometers, lockers, paper towel dispensers, clock and fire alarm parts, high-value architectural items, etc.
   c. The District shall be given adequate notice and the opportunity to salvage equipment and furnishings to be demolished. SUHSD Maintenance and Operations Department shall be given opportunity to salvage materials or the specifications shall direct contractor to salvage identified materials, including security alarm devices and systems.
   d. Items that are to be detached from the buildings and delivered to the District, ready for reuse, shall be clearly identified on the Architect's drawings and their handling specified.
   e. The Contractor is responsible for removing from the site all other items identified on the contract documents to be demolished.
2. Recycling
   a. Contractors are expected to divert a minimum of 75% of the waste removed from the project site.
   b. Identify a central location on the school campus with adequate area for collection recyclables generated during construction.
   c. Recycle concrete and asphalt surfaces. Contact an Industrial Resource Conservation Manager
   d. Recycle construction waste, including gypsum board and old carpet, as well as wood, metal and glass.
   e. Remove and/or manage all hazardous materials in accordance with project-specific requirements. Hazardous materials may include, but are not limited to asbestos containing materials, lead containing or lead based paints, fluorescent lights, fluorescent light ballasts, mercury vapor and/or high energy discharge lamps, and science classroom components such as sink drain traps or laboratory hood ductwork. SUHSD will be responsible for obtaining Hazardous Materials Report when required and as requested by the Architect. Abatement work will need to be included in contract work.
   f. Recycle spent fluorescent and HID lamps. A list of lamp recyclers is available at www.nema.org/lamprecycle/recyclers.html.

g. Mercury-containing components such as switches, lamps and thermostats, and old PCB-containing ballasts shall be removed from HVAC equipment and recycled. A list of mercury and hazardous materials recyclers in the state of California is available from the CA Dept. of Toxic Substances Control at http://www.dtsc.ca.gov/HazardousWaste/index.cfm

h. Mercury-containing thermostats can be recycled by contractors through the Thermostats Recycling Program (see www.nema.org/trc). All contractors for school construction and renovation projects should sign up to participate in the TRC mercury thermostat recycling program.

i. Request a waste manifest from the waste hauler to certify the diversion rate. The District recommends contracting with Recology for services to facilitate the reporting process.

j. All electrical wiring/cables shall be given to the SUHSD Maintenance electrical shop. All cables above 2/0 shall be cut in 10' lengths and given to SUHSD Maintenance electrical shop.

3. Demolition

a. Fire Extinguishers and Signage: To be replaced if removed during major renovation or painting.

b. Partial demolition of walls during plumbing improvements often lead to the finish of the entire wall being removed; floor to ceiling, corner to corner. It is more work, at times, to work around a "patch" than to remove the finish from the entire wall. Within reason, Architects should plan on removing the entire wall or wall finish.

c. Clean-Up before Re-occupancy: Where custodial services are required to cleanup before re-occupancy.

d. Dust control and Sound control must be considered. Contractors must submit a dust and indoor air quality maintenance plan for each project (in an occupied site). Temporary walls and standardized signage are needed for noise management and mitigation, as well as physical security, particulate (dust), and odor emission control. The plan and any containment walls are to be approved by the District prior to starting demolition.

e. Maintain negative pressure within the spaces where demolition work is being done.

f. Protect smoke alarms and sprinkler heads from dust intrusion.

g. Returns for ventilation systems which will remain in operations during demolition and construction activities shall be isolated through use of sheet metal covers or caps or polyethylene sheeting protected by plywood or particle board.

h. Supplies for ventilation systems which will remain in operations during demolition and construction activities shall be equipped with weighted polyethylene sheeting flaps or other means of protecting system components when the ventilation system is not operating. Alternately supplies may be capped as described in the ventilation system return element, above.

i. Temporary walls must be airtight.

j. Ventilation systems shall be temporarily rebalanced to compensate for changes created by the capping of returns and/or supplies. Prior to the release of final payment the ventilation system shall be rebalanced to normal operating standards.

k. Inactive ventilation systems shall be protected through use of polyethylene sheeting and/or hard barriers (sheet metal or plywood caps). Should visible evidence of damage to the protection (torn sheeting, dislodged caps, etc.) the contractor shall be responsible for the cleaning of ventilation ductwork and components prior to occupancy of the area or space

C. Special Closeout Procedures

Building pre-conditioning is to be done following the completion of any new construction project or a sizable renovation project to purge the buildings of any airborne contaminants (volatile organic compounds (VOC), construction-related particulates, etc. Refer to the current version of General Conditions, Closeout Procedures.

1. Pre-conditioning at Close-Out

a. Unless the District Director of Facilities authorizes an alternate procedure in writing in advance of the start of construction, continuously ventilate all construction work areas and spaces with 100% outdoor (fresh) air for at least 14 days prior to substantial completion of work. In areas which make use of natural ventilation such as windows install temporary fans sufficient to provide no less than three air changes per hour. In all cases make sure that air is exhausted from construction work areas directly to the outdoors; do not recirculate air or ventilate to other enclosed areas either within the occupied school or the construction area itself. Continuously operate ventilation systems and/or temporary fans 24 hours per day, 7 days per week, providing all measures necessary to allow the Operations of ventilation systems and fans while maintaining the security of the site.

b. When volatile organic compound, and/or odor generating activities are performed during the 30-day ventilation period provide temporary exhaust ventilation to capture emissions and exhaust them directly to the outdoors. Extend the building flush out for a minimum of four days after the completion of any such activities.

c. During ventilation, make necessary provisions to temper supply air or heat spaces sufficiently to prevent condensation, water damage, and/or mold growth. DO NOT attempt to speed the off-gassing of materials and/or curing of finishes by increasing room temperatures above normal levels ("baking" the building and/or components).

2. Additional Conditioning at Move-In

Continue to operate ventilation systems at 100% fresh air during occupant move-in and unpacking. Do not perform final balancing of the ventilation system until two weeks after the move-in.

3. Equipment Manuals

a. Refer to project closeout procedures and District standard General Conditions to the construction contract.

b. One copy of the Operations and Maintenance Manuals shall be delivered to SUHSD Maintenance and Operations Department one week prior to walk-through or training.

c. Submit hard copies of all NFPA Testing Documents to SUHSD Maintenance and Operations Department. These include sign-off sheets for fire sprinklers, emergency lighting and exit lighting.

4. Final Walk-Through

In addition to conditioning and other closeout procedures, contractor should flush out all sewer lines to get rid of any construction debris. For final walk-through and punch list preparation refer to project closeout procedures and District standard General Conditions to the construction contract (obtain the most current version from the District Director of Facilities)

D. Special Requirements

1. System Shut-downs and Start-ups

a. SUHSD Maintenance and Operations Department is to be notified at least one (1) week in advance and be present for shutdowns and start-ups of all utility systems.

b. All system shutdowns and start-ups are to have written approval from the District Director of Facilities.

c. Contractor shall coordinate and notify District Maintenance and Operations Department for the shut-off and start-up of all utility systems impacted by work, including coordination with other agencies and utility companies. See also the Mechanical, Plumbing, and Electrical Divisions.

2. Material Safety Data Sheets

a. Contractors are to submit 6 copies to District prior to installation of all items.

b. Must be maintained by the Contractor and available on site.

3. Security Services

a. If construction is to be undertaken outside of regular school hours, coordinate with the District Maintenance and Operations Department and School Plant Manager.

4. Submittals

a. For the most up-to-date information, refer to the current District standard specification section 01 33 00 Submittal Procedures and 01 70 00 Closeout Procedures.

1) Contractor shall provide all shop drawings and submittals in electronic format (pdf files) to the Architect for review. For shop drawings that have been reviewed without the requirement to resubmit, the contractor is responsible for making additional hardcopies that shall be distributed as follows:

2) District (2 copies)

3) Architect (1 copy)

4) Architect's sub consultants involved in discipline covered by shop drawings (1 copy each)

5) General Contractor (1 copy)

6) Subcontractors involved in discipline covered by shop drawings (1 copy each)

7) Field Office for As-Built Documentation (1 copy)

8) Inspector of Record (1 copy)

b. At the time of the Project Closeout, the following will be prepared. Submit to SUHSD Maintenance and Operations Department unless otherwise noted:

1) Contractor's Record Drawings

2) Contractor must submit as-built drawings and training manuals to SUHSD Maintenance and Operations Department 15 days prior to scheduling training

3) Contractor shall scan and provide PDFs of the as-built drawings on a CD or DVD to the Architect for preparation of the Architect's record drawings. The Architect will provide the District with record drawings, specifications, and all logs in AutoCAD and PDF format.

4) Warranties and Guarantees (7 copies)

5) Operations Manuals (7 copies)

6) Maintenance kits/spare parts. Contractor will provide a final list for all spare parts including the local store location, store contact information, model #, and serial #. Contractor to confirm with SUHSD Maintenance and Operations Department for the number of spare parts required for all items.

7) Pictures and videos to be taken before, during, and after the project. This should include underground applications, behind the wall applications, above ceiling applications, overall assistance with the progress of the various installations that may or may not be recorded or seen before, during, and / or after the field walk. All these should be included part of the closing documents that should be submitted to the district.

8) Electronic copies of the Design Team's drawings, specifications, and change orders (with actual costs) issued to contractor.

9) DSA-6 Verified Reports (Architect, Contractor, Engineers, Inspectors)

10) DSA approved Construction Change Directives (CCD's).

11) Badges and keys

12) Fire Alarm Certification from Contractor

13) Paint formulas

14) Material Safety Data Sheets

15) Upon completion of the project, Architect shall provide District with a copy of the entire finish schedule, including the district standard, items specified, and items installed by contractor.

16) Copy of backflow prevention device test report to be given to the SUHSD Maintenance and Operations Department.

5. Training

a. Contractor shall provide general training to site staff and in-depth training to the maintenance staff.

b. Training logs and attendance sheets are to be given to the District to substantiate training.

6. Warranty

a. Products and equipment shall be maintained by the contract at manufacturer's recommended levels during the warranty period and the first year after the warranty period. Special Extended Warranty Plan for certain products to be provided as indicated in these standards.

b. All maintenance service during this period shall be documented in writing by the Contractor on site (main office) with copies (not originals) sent to: SUHSD Maintenance and Operations Department at 480 James Avenue, Redwood City, CA. 94062

c. Specific coverage options shall be established prior to system acceptance.

d. Warranties for fire/life safety work such as fire alarm, sprinkler, emergency and exit lighting, and exiting pathway systems shall have specific language "in the event of our failure to respond within 3 hours after being notified in writing by the District, we collectively or separately, do hereby authorize the District to proceed to have said defects repaired or replaced and made whole, together with any other adjacent work which may be displaced or damaged by so doing, at our expense, and we will honor and pay the costs and charges therefore upon demand."

DIVISION 03 – CONCRETE

A. Cast in Place Concrete

Test slabs for moisture and alkaline content and include remediation procedures within specifications to prevent finish-flooring failures.

Concrete sealers need to be able to withstand urine.

Concrete ramps shall have a medium broom slip-resistive surface. Provide control joints minimum at 5'-0" on-centers.

Comply with DSA requirements for concrete mix designs rated at 3,000 psi and above.

DIVISION 04 – MASONRY

A. New brickwork Construction

1. Masonry products are discouraged for buildings because of graffiti and maintenance issues. If they need to be used to match existing conditions, they should be painted. Unpainted surfaces are not allowed without prior authorization by the SUHSD Maintenance and Operations Department**.** When masonry products are used, smooth precision cut or split-face finish is acceptable for planters and trash enclosures.
2. Proper anti-graffiti and masonry clear sealers from Prosoco or approved equal shall be used. Apply anti-graffiti coatings on surface areas up to 8'-0" in height.

B. Masonry Rehabilitation

1. Extending the useful life of masonry buildings has a positive environmental impact because the energy required to produce materials for new buildings and the landfill space needed to dispose of old building materials is saved.
2. Masonry restoration and cleaning involves many considerations. If the only reason is appearance and the structure is not of historic significance, the work requires less attention and economics may play a larger role in selecting cleaning procedures. If historical preservation is a reason, evaluate the long-term effects of the restoration and cleaning to ensure that no harm will be done. Other considerations include the causes for deterioration, the current condition of existing masonry materials and construction, the source and composition of original materials, the extent and nature of earlier restoration work (if any), the availability of suitable materials for replacement and repair, and the limitations imposed by the project location and the District.

C. Drawings

The drawings should be detailed enough to show types of work, such as crack repair, masonry unit replacement, special spot cleaning, and spot repointing. Quantity allowance with procedures for authorizing repairs are another way of including such work in the Contract without deciding exactly where or under what circumstances the work will be required. Unit prices are often used along with quantity allowances because the extent of work will usually vary from what is anticipated.

D. Hazardous Materials

1. Masonry cleaning, especially methods that use chemicals or abrasives, generate waste products that must be controlled, collected, and disposed of. Minimizing the negative environmental impact of these waste products should be a consideration in choosing a cleaning process.
2. Check the painting requirement for masonry substrate.

DIVISION 05 – METALS

A. Metal Fabrications

1. General:

a. All exterior steel should be galvanized

2. Handrails and Guardrails

a. In order to provide adequate construction tolerance and consistency among all installations, building code and ADA-compliant handrails shall be mounted 34" above the floor surface. Handrail diameter to be 1½" (1.5" OD)

b. Handrail distance from flat walls surface to be minimum of 1.5" and no greater than 2".

c. Code-required handrail extensions beyond the top and bottom tread nosings and ramp edges shall be straight and continuous before returning to an adjacent wall or to the floor. This means that the total distance from edge of nosing to end of the handrail termination, after accounting for the handrail return and required 1½" (1.5" OD) railing diameter, shall be a minimum of 1'-3" at the top of stairs (and top and bottom of ramps) and 1'-3" plus the tread width at the bottom. At the bottom of stairs, provide an actual fixed dimension on the drawings, not a note requiring the contractor to determine the tread width. In addition, dimensioning and detailing shall provide adequate construction tolerance.

d. New guardrails shall be designed to comply with CBC requirements regarding the maximum spacing of intermediate members. Existing guardrails shall be retrofitted to meet the code requirements for maximum spacing. In addition, for safety at both new and retrofitted guardrails, openings between intermediate members and in panels or mesh shall be limited in size and designed to inhibit climbing.

e. Guardrails designed as a series of horizontal railings or cables are not allowed unless otherwise approved by the SUHSD Maintenance and Operations Department.

f. Consider providing minimum 6'-high or full-height guardrails at upper-floor exterior walkways adjacent to lower roofs or covered walkways in order to prohibit unauthorized access to adjacent roofs. Review proposed solution with SUHSD Maintenance and Operations Department and school administration.

g. Guardrails provided at upper floor decks must not be more than 2" wide at the top to discourage students from sitting/ standing on it.

3. Exterior Balconies

a. Standalone structures are preferred (first option)

b. Hot-dip galvanized metal and powder-coated or Hot-dip galvanized with epoxy paint finish.

c. Flashing details at new wall openings leading out to new exterior balconies need to be detailed specific to existing building structure components. This pertains to door threshold, building expansion joints and other similar conditions.

d. See requirement for guardrail width above.

B. Miscellaneous Metal Fabrications

1. General

a. Provide safety guardrails (or safety cable system) around rooftop equipment that is within 6 feet of any roof edge. A cover, guardrail, or equivalent, on all open sides, shall guard every floor, roof op9ening or skylight.

b. Roof tie-backs (meeting Title 8, California Code of Regulations, section 3291 (f) or equivalent are required where edges of roofs and other architectural features (height changes, light wells, etc.) expose employees performing reasonably anticipated maintenance (example – clearing of gutters) activities to fall hazards. Safety lines and/or lanyards, secured to tie-backs for fall protection.

c. Removable bollards are to be flush with the ground, with contrasting colors, and lockable.

d. Also see Fencing and Gates section in Division 32 for additional information.

e. Perforated Metal panels, when used as a filler panel at utility pad enclosures or bike cages – consider safety concerns (min 60% visibility), 22 gauge galvanized steel with perforations in staggered pattern. Specify that perforations are cut prior to galvanizing.

f. Perforated aluminum panels in clear anodized finish can be considered an alternative product upon approval by SUHSD Maintenance and Operations Department.

g. Acceptable Manufacturer:

McNichols Co.; [T] 877-884-4653; [W] (www.mcnichols.com); or approved equal.

2. Finish

a. Exterior handrails and guardrails: Unpainted galvanized steel is the default for most exterior applications. Paint galvanized steel to match existing where required to provide a consistent appearance. Review with SUHSD Maintenance and Operations Department any conditions where stainless steel may be recommended due to extreme conditions of salt and humidity.

b. Interior handrails and guardrails: Painted galvanized steel is the default for most applications. Obtain prior approval for alternate materials or finishes, such as unpainted galvanized steel or stainless steel, from SUHSD Maintenance and Operations Department. Match existing railings wherever possible. Wooden handrails are not allowed under any circumstances.

c. Refer to Division 09 Painting for painting requirements and specific paint selection.

d. Shop prime all painted interior steel. Specifications shall require the contractor to remove any rust and re-prime steel that has oxidized during construction.

e. Aluminum finishes exposed to the weather and subject to excessive wear (such as top rails and handrails) should have heavy-duty coating, (0.018 mm thick anodic coating).

3. Galvanizing

a. Hot –dip galvanize all steel exposed to the weather or high moisture conditions, in contact with the ground or concrete, or where otherwise required by these Standards.

b. In designing metal fabrications for galvanizing after fabrication, avoid conditions that require field welding. Design items in segments that can be transported easily and that will fit into the galvanizing process dip tank where possible. Also remember; hollow shapes require vent and drain holes that allow the cleaning solution, air, and molten zinc to flow freely into and back out of the item. These holes can often be located so that they serve to drain the completed item of condensation and other water that might otherwise accumulate. Field welds should be covered by two coats of zinc paint.

06 – WOOD, PLASTICS, COMPOSITES

A. Carpentry

1. Rough Carpentry

a. The use of reconstituted wood products, such as parallel-strand lumber, OSB, particleboard, fiberboard, and hardboard, is encouraged.

b. The proper application of OSB products is necessary because it is highly prone to mold growth when exposed to water.

c. All composite wood products (particleboard, MDF, and hardwood plywood) must comply with new CARB limits on formaldehyde emissions.

d. Pressure-preservatives are to be used on all wood in contact with concrete or masonry, exposed to the weather, or prone to insect attack, in conjunction with roofing, under parapet caps, vapor barriers and waterproofing – sills, sleepers, furring, blocking, and stripping.

e. No wood products treated with (a) pentachlorophenol, (b) arsenic compounds, and/or (c) creosote shall be used in either interior occupied spaces or for exterior applications where there is a possibility of student contact. Borates are the preferred preservative if available.

f. For exterior applications where students contact is not possible, wood treated with (a) pentachlorophenol, (b) arsenic (e.g. CCA) and/or (c) creosote may only be used if less toxic alternative are not available on the market. Borates are preferred preservative if available.

g. Must be water-borne, inorganic type and comply with the CARB limit on volatile organic compounds (VOCs) for wood preservatives of 350 grams/liter using EPA Test Method 24.

h. Refer to Division 00, Hazardous Materials, for additional requirements

i. Use galvanized or stainless steel fasteners where wood is exposed to the weather.

j. Use stainless steel fasteners when using wood with preservatives.

k. Provide dry lumber with 15% maximum moisture content at time of dressing for 2-inch nominal thickness or less.

l. Provide fire retardant, ¾-inch A-B grade plywood (6-inches off the floor to 8-feet high) at all walls supporting electrical and telecommunication equipment.

m. Mount the plywood so the manufacturer's stamps remain visible from the front side.

n. Fasten plywood backboards to the structural members of the building using only approved fasteners. Plywood backboards shall not be anchored to gypsum wallboard.

o. Refer to Division 09 – Finishes: Painting.

2. Finish Carpentry

a. Back prime all finished carpentry (interior and exterior).

b. Prime or otherwise seal cut ends.

B. Casework

1. General

a. Furnish a Woodwork Institute (WI) certified compliance label on each cabinet elevation.

b. Only manufacturers and model numbers listed in the Architectural Woodwork Standards, Edition 1, under the approved listing for cabinet hardware will be acceptable.

c. Casework shall be, Custom Grade, Style A (Frameless), Type I or Type II Construction Type as listed in the Architectural Woodwork Standards

d. Core material for plastic laminates: 45# density particleboard, medium density fiberboard or industrial grade strawboard.

e. Plastic laminate edge treatment: 3 millimeter solid non-PVC edging.

f. Replace entire countertop when lowering or raising existing casework and/or sinks. Implement proper cabinet face corrections or renovations as a result of countertop adjustment

g. Back splash at sinks to be a minimum of 4".

h. Classroom sink locations (excluding Science Lab casework): Provide fully formed, no edge drip, rolled counter tops over marine grade plywood.

~~i.~~ Science Lab or Classroom Casework: Custom Grade with solid epoxy resin tops or solid phenolic resin tops

j. Inside face of casework (with doors), semi-exposed conditions should be melamine

k. Provide stainless steel countertops in kitchens.

l. Library Casework: Premium Grade; open casework is to be treated as "all exposed surfaces". These surfaces shall be covered with plastic laminate.

m. Art Rooms: Custom Grade with solid surface laminate tops or phenolic resin tops. (It is acceptable to install plastic laminate tops at this location if they are installed over marine grade plywood.)

n. Verify any fire code issues when installing casework in the corridors. Specify proper fire rated material.

2. Shelves

a. 14 inches deep minimum; (measured front of shelf to back of shelf). Blocking is not to intrude into this space.

b. Construction for shelves up to 36" long: 3/4 inch veneer core plywood.

c. Construction for shelves from 36" to 48" long: 1" veneer core plywood with a 1 inch x 3/4-inch front rail.

3. Shelf Standards

a. Knape & Vogt 255 Series recessed steel pilaster standards with 256 Series steel shelf supports, or approved equal.

b. Provide seismic restraints for open shelf supports.

4. Casework Hinges

a. Grade 1. European semi concealed hinges with built in door catches.

b. Do not "let-in" hinges into the door.

5. Casework Drawer Slides

a. Pencil and Thin Drawers: Accuride, or approved equal, full extension and minimum load rating of 100 lbs.

b. Standard Drawers: Accuride or approved equal, full extension and minimum load rating of 100 lbs.

c. File Drawers: Accuride Full Extension, or approved equal and minimum load rating of 200 lbs.

6. Casework Locks

a. Provide locks at all cabinets and drawers, keyed alike per room. Contractor to provide the district with 5 sets of keys only for each room, irrespective of the number of locks in the room.

c. Drawer and Cabinet Locks: Cylindrical type' 5-pin tumbler and dead bolt, round cylinder only exposed

d. Acceptable Manufacturers: Olympus, National

e. Show locations on architectural cabinet elevation drawings.

7. Casework Pulls

a. 4" long, "wire" pull, zinc alloy, anodized aluminum or brushed stainless steel finish.

b. Show locations on architectural cabinet elevation drawings.

8. Casework Door Silencers

Provide door silencers at the tops and bottoms of all doors.

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

A. Roofing

1. General Requirements

a. This section does not apply to portable, modular or pre-manufactured buildings which have the manufacturer's standard metal roofing provided and installed as part of the building.

f. Roof system designs shall incorporate all aspects of roof waterproofing, including parapet walls, skylights, flashings, drains, scuppers, gutters, downspouts, etc. Comply with current NRCA and SMACNA standards.

g. New low-slope roofs, roof alterations, and roof replacements must comply with Title 24 Part 6 Non-residential Energy Efficiency Standards. Compliance can be achieved using a performance approach or the prescriptive approach. For roof alterations and roof replacements, confirm that sufficient insulation exists to eliminate the need for a vapor barrier. Refer to CRRC's rated product directory on the CRRC website (www.coolroofs.org)

h. Roofing systems shall be designed for a minimum 30-year non-prorated, no-dollar-limit, labor-and-materials guarantee. The roofing membrane, base flashings, liquid applied flashing, roofing membrane accessories, roof insulation, fasteners, cover board, walkway products, and other single-source components of the roofing system must be marketed by the manufacturer and covered under the guarantee.

i. Consider including expansion joints, copings and edge metal systems marketed by the manufacturer of the roof system and included in the guarantee.

j. Roofing membrane, base flashings, liquid applied flashing, roofing membrane accessories, roof insulation, adhesives, coatings, mastics, fasteners, cover board, walkway products, and other single-source materials should all carry the same manufacturer label. If the Contractor decides to use and mix other roofing components from another manufacturer, the Contractor shall secure a letter from the other manufacturer that such component will not void the warranty of the intended roofing system for the job

k. Contractors are required to comply with public contract code regulations and California Assembly Bill AB635 (passed August 27, 2010). To that end, they must review and follow the requirements stipulated in District standard Division 1, which shall be provided by the District for inclusion in the contract documents for all projects. Contractors proposing substitutions to any roofing products or systems must submit a completed form. Written approval of substitutions by the SUHSD Maintenance and Operations Department is required for all substitutions of specified roofing products and systems.

l. The contractor are required to complete and sign separate copies of the Roofing Affidavit provided in Division 1.

m. The new roof system shall comply with all mandatory requirements under The California Green Building Standards as listed under Title 24 Part 11.

2. Roofing Contractor Qualifications

Roofing installer must have minimum 5 consecutive years' experience with the specified product. The installer must submit a manufacturer's list of 3 roofs they have installed, located within 50 miles of Redwood City, of equal size and degree of difficulty, which have been in place for a period of 5 years and have performed to the owners' satisfaction for that period. The installer must submit project details and reference contact information including the owner name and telephone number for each listed project.

3. Contractor Guarantee

a. Contractor shall provide the District with a 2 year guarantee covering labor and materials for any defective workmanship, system failure, or premature deterioration of the roofing system.

b. The guarantee shall not require the purchase of a manufacturer's maintenance program, or be voided by SUHSD personnel conducting routine maintenance tasks such as cleaning debris and unclogging drains.

4. Fire Rating and Safety

a. Contractor shall obtain fire permits when using open flames and equipment fueled by propane tanks. Contractor shall provide evidence of CERTA training for any installer of torch-applied membrane.

b. Salvage copper flashing and trim materials that are in good condition. Surrender such items to the SUHSD Maintenance and Operations Department.

c. Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency as follows:

1) Exterior Fire-Test Exposure: Class A ASTM E 108, for application and roof slopes indicated.

2) Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

d. Roof systems must meet Class A fire-resistive, and UL Class A standards. It should be noted that when a roof is rated with a Class A Fire-Resistive Rating, it is the entire assembly that is rated, not just the roofing membrane.

5. Wind Resistance

a. Roofs shall be designed for wind exposures in accordance Building Code designations for specific building locations.

b. The architect shall design a roof in accordance with Title 24 Part 2 Chapter 15 Section 1504. Wind loads shall be calculated by a licensed engineer using the ASCE 7 guidelines as outlined in Title 24 Part 2 Chapter 16. Low-slope membrane roof system metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with ANSI/SPRI ES 1.

6. Roofing Replacement Preparation

a. Support roof mounted mechanical, plumbing and electrical equipment, ductwork, piping, conduit and lines in such way as to permit roof replacement without their removal.

b. Solar panels and their piping or wiring that conflicts with roofing that is replaced shall be removed, stored and re-installed by a contractor recommended by the solar panel manufacturer.

c. Completely tear-off and remove all existing roofing, including fasteners, flashing, rooftop insulation and other appurtenances, prior to re-roofing.

7. Roofing Installation

a. The roofing system manufacturer shall provide a technical inspector to perform a thorough inspection of the roof installation a minimum of three times a week during the course of construction to confirm compliance with the manufacturer's requirements.

b. Hold a pre-roofing conference with manufacturer's representative, installer, General Contractor, Inspector, Architect, and District representative.

c. The Contractor shall test all drains, and inform the District of any drain not fully functioning, prior to start of roofing work.

8. Safety

a. Roofing contractors shall abide by all safety regulations provided for by California Code of Regulations Title 8 and OSHA. Failure to comply is unacceptable and grounds for stopping work. Before beginning the project, the contractor shall submit a roofing project safety plan that complies with CCR Title 8.

b. Provide a safety barrier consisting of guardrails or a cable system around rooftop equipment that is within 6 feet of any roof edge. The barrier shall be 42" high and comply with OSHA requirements. Every floor or roof opening is to be guarded by a cover, guardrail, or equivalent on all open sides. Install toeboards around the edges of openings where people are able to be present below. Mount guardrails to the face of a parapet (or curb) wherever possible to avoid additional roof penetrations.

c. Roof tie-backs shall be used at concrete decks where safety lines and/or lanyards are used for fall protection and for suspended scaffolding, and shall comply with CCR Title 8. Provide anchor points at 12-foot intervals where activities are required to be cleaned at least annually. The spacing will depend primarily on the availability of structural support of sufficient strength to safely carry the loading. The design criteria for the tie-backs are as follows:

1) Drop-forged eyebolts or other component of equivalent strength having at least a 2-inch inside diameter closed eye.

2) Tie-back assembly to be hot dip galvanized or provide equivalent corrosion resistance.

3) Assembly and anchorage provisions adequate to sustain a 5400-pound tensile load applied in any direction.

4) Roof tie-backs or other devices shall not be installed in a wood roof framing system.

5) Mark tie-backs with a high-contrast color so that they're readily identifiable by crews that are sent to the roof to perform maintenance.

B. Low-Slope Roofs – Modified Built-Up Roofing System

a. All new low-slope roofs, roof alterations, and roof replacements must comply with Title 24 Part 6 Non-residential Energy Efficiency Standards. Compliance can be achieved using a performance approach or the prescriptive approach. For roof alterations and roof replacements, confirm that sufficient insulation exists to eliminate the need for a vapor barrier. Refer to CRRC's rated product directory on the CRRC website (www.coolroofs.org).

b. Basis of Design: On low-sloped roofs (½" in 12" to 3" in 12") Garland "Stressply EUVFR Mineral" modified bitumen roofing or approved equal by SUHSD Maintenance and Operations Department.

C. Modified Bitumen Roofing

1. General

a. Provide an unconditional 2-year installation warranty commencing on recordation date of the Notice of Substantial Completion in addition to a 30-year manufacturer's warranty.

b. The roofing contractor shall meet with the SUHSD Maintenance and Operations Department to review the roof at the site within 60 days of the expiration of the warranty. This shall be a condition to end the installation warranty period.

c. Reference the latest editions of all applicable codes.

d. Include requirements for submission of all material proposed for use.

e. Require shop drawings.

f. Require O&M data.

g. Manufacturer to have minimum of 10-years experience and ISO certified.

h. Installer to have minimum of 5-years experience with modified bituminous roofing and certified by manufacturer.

2. Roofing Material

a. Garland, "Stressply EUVFR Mineral is used as the basis of design. Acceptable equal as approved by SUHSD Maintenance and Operations Department.

b. Two-plies, ASTM D-2178, Type IV glass fiber roofing felt bonded to the prepared substrate with ASTM D-312, Type III hot steep asphalt.

c. One-ply specified SBS/SIS modified cap sheet in steep asphalt.

d. Two-ply modified base flashing set in steep asphalt.

3. Insulation

a. R-30 Polyisocyanurate insulation and ½" Perlite insulation board above all conditioned areas and tapered insulation as required to create roof slopes to drain at low slope conditions. Specify insulated subsurface to meet required fire ratings where decks are diagonally wood sheathed or are concrete.

b. Install tapered insulation in a manner to avoid any standing water.

4. Mechanical Fasteners

a. Nails: galvanized steel with 1" cap.

b. Metal Disks: 28 gauge, zinc-coated, sheet metal caps.

D. High-Slope Roofs — Standing Seam Metal

1. General

a. Basis of Design: On sloped roofs (3" in 12" or greater) use Garland, R-mer Span, metal roofing or approved equal by SUHSD Maintenance and Operations Department.

b. Warranty: Require the following warranties:

c. Unconditional 2-year installation warranty commencing on recordation date of the Notice of Completion.

d. A 20-year manufacturer warranty for finish.

e. A 30-year warranty for water-tightness.

f. Require a site review with the designated District representative prior to expiration of warranty as a condition to end installation warranty period.

g. Codes and Standards: Reference the latest editions of all applicable codes.

2. Submittals

a. Shop drawings.

b. O&M data.

3. Products

a. Basis of Design: Garland, “R-mer Span”, “Mesa” pattern, or acceptable equal as approved by SUHSD Maintenance and Operations Department.

b. Panel material: 22 ga., Galvalume steel, type AZ-55, grade 50 B, smooth as per ASTM A792-96.

c. Panel Finish: Two-coat coil applied, baked-on full-strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), and applied by manufacturer's approved applicator.

d. Underlayment: Aqua Shield By Garland or approved equal

e. Concealed fasteners: Corrosion resistant steel screws designed to meet structural loading requirements. The normal minimum screw size shall be #14.

f. Exposed fasteners: Corrosion resistant steel screws (cadmium or zinc coatings are not acceptable) of R-MER SPAN series stainless steel with neoprene sealing washer, or 3/16" diameter waterproof rivets.

g. Coordinate installation requirements with manufacturer.

4. Additional Roofing System Options

In the event that a new building, addition or renovation has architectural or aesthetic factors that require matching an existing roof system, exceptions to the standards can be made (example: match Spanish tile at Sequoia High School). Coordinate with the SUHSD Maintenance and Operations Department during the design phase.

E. Metal Wall Panel Systems and Air Barriers

Basis of Design: On walls and Site Sceens where applicable, use Garland, R-mer Guard, metal wall panels or equal. For Air Barriers, use Aero Block SA by Garland or equal.

F. Sheet Metal Flashing and Trim

1. Comply with SMACNA and NRCA.
2. Use 22 gauge (.0299 in.) galvanized sheet metal
3. Copings: 22 gauge (.0299 in.). Slope ½” inch per foot minimum. No simple lap joints. Use butt plates or standing seam joints. Reference current edition of SMACNA Architectural Sheet Metal Manual, Table 3-1 Coping Design.
4. Corners are to be mitered and shop fabricated (no field fabrication).
5. Lap joints against the weather.
6. Lap metal edge flashings 6” under (into) the finished roof membrane.

7. Gutters shall be sized to accommodate the amount of rainwater collected per the State Plumbing Code, SMACNA and NRCA standards. Refer to Sheet Metal Roofing guidelines in determining the type of sheet metal material for gutters. Use only copper gutters if necessary to match existing conditions. Gutters shall be properly braced and strapped along the roof fascia edge. Gutter joints shall be riveted. Gutter corners shall be welded and riveted.
8. Provide waterproof coating and screens at gutters exposed to leaf debris.

G. Roof Accessories

1. Provide guardrails, removable screens, or glazing systems adequate to withstand required structural loads (as required by DSA) for fall protection at all skylights and roof edges.
2. Project specifications shall require the contractor to perform 40 lb./sf load test on all skylights or as required by DSA.
3. Screen openings cannot exceed 4"x 4". Refer to Title 8, CCR, Subchapter 7, Group 1, Article 2, and Section 3212.
4. Ladders are to be installed where there is a difference of more than 3 feet between one roof level and the next. Ladders shall be aluminum and OSHA compliant.
5. Roof hatches and roof access ladders shall have telescoping safety ladder posts, and shall conform to CAL OSHA standards (3212) for roof hatches, Floor Openings, Floor Holes and Roofs. Refer to http://www.dir.ca.gov/title8/3212.html
6. See also Safety section in this chapter.
7. Overhanging roofs, eaves, or other equivalent measures shall be included in the design for all new exterior doorways to prevent rainwater from entering buildings. Consideration shall be given to adding similar features to existing exterior doorways.

H. Roof Drains

1. All existing drains shall be cleared of debris and water-tested before work commences and both existing and new drains shall be water-tested after work is complete to ensure all drain lines are free-flowing.
2. All surface grades and drainage systems shall be designed to prevent the accumulation of water under, in, or near buildings.
3. Provide sumps (24" x 24" x 2" deep minimum) at all new drains. Reinforce the bottom of the sump with a 4 lb. lead sheet. Solder joints and round corners (no sharp points) to avoid puncturing the overlaying membranes.
4. Drains that do not have proper bolts or attachments shall be replaced.
5. Install overflow drains adjacent to roof drains where missing. Building code requires overflow drain scuppers through walls to be 2-inches (max.) higher than adjacent drain opening and to be sized three times the volume of the adjacent drain line. Provide proper weather tight sheet metal flashing for through-wall scuppers.
6. All roof drains and overflows shall be routed to the outside face of the building. Overflow roof drain lines shall not be connected to the plumbing lines of the roof drains.

I. Rainwater Leaders

1. G-90 galvanized schedule 40 pipe with 1/4 inch steel plate supports welded to pipe. Straps are acceptable. Galvanize after fabrication.
2. Downspouts shall have galvanized wire strainer at gutter openings.
3. Provide at-grade cleanouts in all downspouts.
4. No copper downspouts allowed.

J. Insulation

1. Rigid Roof Insulation
    a. Match slope at existing construction, except as needed to re-slope for adequate drainage. Minimum slope for existing roofs should be ¼" per foot.
    b. Slope min. ½" per foot slope at new construction.
    c. The construction documents shall specify insulation that is appropriate to the selected roofing system and application method and that complies with the fire rating for the entire roofing assembly.
    d. Top layer: Use material recommended by roofing system manufacturer. Perlite board, wood fiber and Densdeck are acceptable
    e. Bottom layers: Polyisocyanurate (rigid foam) insulation, thickness to provide required R-value. Use tapered insulation to provide slope to drain. Expanded (EPS) and extruded (XPS) polystyrene are not allowed.
    f. Stagger joints of insulation boards when laying them out on the roof deck.
2. Batt/Blanket Insulation

    Flexible, faced and unfaced blankets made of inorganic glass fibers, complying with ASTM C665, compliant, and with glass fiber portion classified as noncombustible when tested in accordance with ASTM C136.

K. Spray Foam

1. Only WATER-BLOWN spray polyurethane foam should be used when specified

DIVISION 08 – OPENINGS

A. Doors - General Requirements

1. Provide self-adhered bituthene membrane at all exterior door heads, jambs and sills.
2. Provide metal head flashing at all exterior door and storefront frames.
3. Provide sill pans with fully welded seams at all exterior doors and storefront systems.
4. Water test (ASTM E1105.00) all exterior doors upon completion of the door installation (prior to project closeout).

B. Exterior Steel Doors and Frames - Utility Doors

1. Exterior steel doors and frames shall be galvanized and prime painted.
2. Removable mullions at double doors are to be provided. Provide keyed removal.
3. Provide Level 4 (maximum duty) and Physical Performance Level A doors and frames, as classified in ANSI A250.8. Refer to Steel Door Institute (SDI) report #SDI-108.
4. Minimum door thickness: 1-3/4" with 14 gauge (0.067 inches, uncoated steel) thick face sheets.
5. Fully welded hollow metal frames only. Knock-down frames are not allowed.
6. Provide insulation or grout filled frames at all locations. Specify plaster guards if frames are grouted.

C. Fiberglass Reinforced Polyester (FRP) Doors

1. Provide fiberglass reinforced polyester (FRP) doors at high traffic, high abuse, and weather-prone exterior locations, and at all exterior building entry doors. Use galvanized hollow metal doors at exterior utility rooms and where appropriate. See section above.
2. Factory-install door-associated vision lites and louvers, where applicable.
3. Class I anodized finish
4. Poured-in-place urethane core
5. Stiles and rails shall be manufactured of extruded 6063-T5 aluminum alloy
6. 0.120 – inch thick FRP face sheets
7. Use continuous hinges and factory-installed adjustable door bottom brush
8. 10-year warranty covering parts and labor
9. Refer above for other guidelines for exterior doors.
10. For door glazing see Glazing Section below.
11. Model #SL-20 for non-fire rated doors and SL-23 for fire-rated doors. Sandstone texture and custom color to match campus colors.
12. Manufacturer: District standard is:

    Special-Lite, Inc.

    [T] 800-821-6531
    [W] www.special-lite.com

D. Interior Flush Wood Doors

1. Interior wood doors: 5-ply doors per Architectural Woodwork Standards with Birch Veneer Staved Lumber Core for painted doors or Select Maple Veneer Staved Lumber Core for clear finish doors.
2. Furnish a Woodwork Institute (WI) certified compliance label on each door.
3. Seal the tops and bottoms of all wood doors.
4. Furnish Environmentally Certified Doors.
5. Environmentally certified doors carry a certification authorized under a recognized authority.
6. Provide fire rated door label for rated door and frame.

E. Gates

See Division 32– Exterior Improvements.

F. Door Glazing

1. Minimize glazing at exterior doors.
2. Use glass vision door lites where possible. When glass door lites are used, use narrow vision lites. Cut-outs for vision lites shall be 8-inches from top of door and from strike-side edge of door to allow mounting space for door hardware such as door closers, panic devices and lever handles.
3. Use manufacturer's vision lite kits and louvers wherever possible.
4. Acceptable manufacturer: Anemostat "Lo-Pro" or equal.
5. No glass less than 36" above the floor. Full height glazing for doors is discouraged, unless replacement doors are matching existing conditions or as part of a storefront or curtain wall system.
6. In general for non-rated doors with vision lites, use 7/32" laminated safety glass. Provide etched label on the glass.
7. For fire-rated doors with vision panels, use fire and safety-rated glass products complying with the fire resistance and impact requirements of CBC section 715 and Chapter 24. Provide etched label on the glass. Wired glass is not allowed.
8. Acceptable Manufacturer as listed below; or approved equal

    - Firelite Glass

      Distributed by Technical Glass Products, Kirkland Washington
      [T] 800-426-0279
      [W] www.fireglass.com

    - Anemostat

      Distributed by R.E. Edwards, Dublin, California
      [T] 925-829-2942

    - Vetrotech Saint Gobain

      www.vetrotechusa.com
      [T] 888-803-9533

G. Overhead Coiling Doors

1. All keyed overhead coiling doors are to be keyed the same and be connected to the fire alarm system, where required, in a dedicated zone. Contact SUHSD Maintenance and Operations Department for the keyway (cross reference this requirement to the fire alarm system)
2. Acceptable Manufacturers:
    - R&S Erection of Concord, www.rsdoor.com
    - The Cookson Company, Inc., www.cooksondoor.com
    - Cornell Iron Works, Inc., www.cornelliron.com
    - Overhead Door Corporation, www.overheaddoor.com
    - Bullzeye Installation, www.bullzeyedoors.com

H. Overhead Doors

1. Use of sectional overhead doors may be appropriate at multi-purpose rooms and cafeterias where the design calls for opening the interior space to the adjacent outdoor areas for assembly or dining. When using this type of door, special care should be taken with regard to weather and water intrusion. Though individual site conditions will vary, at minimum there should be a positive slope away from the opening away from the interior (within ADA slope requirements), and use of trench drains at the opening should be considered. In addition, consider the impacts of wind driven rain and investigate the need for a canopy or other device to provide weather protection above the top of the sectional overhead door opening.
2. Acceptable manufacturers:
    - Raynor AlumaView OPTIMA
    - Amarr
    - C.H.I. Overhead Doors

I. Door Hardware

1. Introduction

a. Design of the school hardware systems can be broken into three categories; new schools where all the hardware is new, existing schools where all the hardware is being upgraded, and existing schools where some (not all) of the hardware is being upgraded.

b. Inventory all the existing hardware for each door that is being upgraded. As part of the inventory process, it is suggested that each door be photographed from both sides to show all hardware, hardware functions, and latch side clearances.

c. For existing schools where a partial upgrade is being done, match the existing finish, existing functions, and existing keying for each door. When most hardware of a specific type, such as locksets, is required to be replaced, consideration should be given to replacing all hardware of that specific type in order to provide consistency throughout the school. The Architect shall review the proposed approach with the SUHSD Maintenance and Operations Department as early as possible in the design process. It is strongly recommended that each Architect retain a reputable hardware consultant for this work.

d. Existing hardware to be salvaged. Coordinate salvage of all hardware with the SUHSD Maintenance and Operations Department. The SUHSD Maintenance and Operations Department is the only entity with salvage rights to door locks and hardware.

e. ALL HARDWARE: Exposed fasteners shall be tamper resistant type.

f. Provide recessed pulls where applicable and where allowed.

g. 'Z' shaped pulls are NOT ALLOWED in "Accessible" areas.

h. Round shaped, surface mounted, pulls are preferred.

i. Avoid wall door stops as much as possible. District preference is floor stops. When providing wall stops, blocking in walls at these locations must be provided.

j. Architect to consider providing power operated doors at rooms/ spaces that will be used by the larger public – especially in Administration Buildings, Conference Rooms, Multi-Purpose Rooms, Theaters, etc. Architect to coordinate with SUHSD Maintenance and Operations Department and the School Administration to determine the need during the design phase.

k. Provide special wrenches and tools applicable for installation to the District.

l. Provide maintenance tools and accessories supplied by the hardware manufacturer to the District.

m. See Fencing and Gates section in Division 32 for gate hardware information.

n. Follow the hardware types below. For information and assistance regarding products from the Ingersoll Rand family of companies, contact:

Jeff Silveira
Allegion, Pleasanton, California
[T] 925-462-4777
[E] jJeff.Silveira@allegion.com

2. Hanging Devices

Opening Type	Description	Manufacturer(s)	Model / Series *
FRP Exterior Doors	Continuous Hinges (Lifetime Warranty)	Select, Ives	224HD UL
Other Exterior Doors	Heavy Duty, Ball Bearing Butt Hinges – Non Ferrous, 4.5 x 4.5 NRP	Hager, Ives, Stanley	BB1199NRP
Interior Doors	Heavy Duty, Ball Bearing Butt Hinges, 4.5 x 4.5 NRP	Hager, Ives, Stanley	BB1168NRP

* Model / Series for first listed manufacturer. Where no other manufacturer is listed, product listed must be furnished per District Standards - NO SUBSTITUTIONS PERMITTED.

a. All hinges shall be non-removable pin (NRP) type.

b. Finish at existing campuses (some, but not all hardware is being replaced): Match existing.

3. Securing Devices:

Opening Type	Description	Manufacturer(s)	Model / Series *
Exterior Pair Entrances and Exits	Rim Exit Devices x Mullion	Von Duprin	CD99NL (unrated) or 99L-F-2 (fire-rated) x 98EO Series x VR 900 Series Trim x KR4954/9954 Mullion
Exterior Single Entrances and Exits	Rim Exit Device	Von Duprin	CD99NL (unrated) or 99L-F-2 (fire-rated) x VR 900 Series Trim
Other Exterior (non-exit) Doors	Cylindrical Lockset	Schlage	ND Vandlgard Series; ND95D; Rhodes Trim
Interior Single Doors without Exit Devices (Classrooms, Offices, Staff Lounge, Multi-Purpose or other occupied Rooms).	Cylindrical Lockset	Schlage	ND Vandlgard Series; ND95PD Rhodes Trim
Interior Single Doors with Exit Devices (Classrooms, Offices, Staff Lounge, Multi-Purpose or other occupied Rooms).	Rim Exit Device	Von Duprin	99L-2 (unrated) or 99L-F-2 (fire-rated) w/ Rim Cylinder 20-057
Interior Pair Doors with Exit Devices (equal or unequal pairs)	Rim Exit Devices x Mullion	Von Duprin	99L-2 (unrated) or 99L-F-2 (fire-rated)x KR4954/ 9954 Mullion & Rim Cylinder 26-091/20-057
Interior Doors – Adult/Staff Single-Occupant Restrooms	Privacy Lockset	Schlage	L9496 x 06 Trim (Admin/Staff areas) LV9486 x 06 Trim (Student/Corridor areas)

***** Model / Series for first listed manufacturer. Where no other manufacturer is listed, product listed must be furnished per District Standards – NO SUBSTITUTIONS PERMITTED.

a. Levers/locksets at all rooms with an occupant load of 5 or more persons shall allow the outside lever to be locked from the inside with the inside lever always remaining unlocked, in compliance with California Assembly Bill 211 (AB211) and emergency egress requirements.

b. Finish at existing campuses (some, but not all hardware is being replaced): Match existing.

c. Vertical rod devices must be replaced at existing doors, to comply with State of California AB211. Provide rim exit devices and replace doors if necessary at double door conditions (whether equal or unequal pairs) to suit new door hardware configuration. Provide removable door mullion. INTERNAL VERTICAL RODS ARE NOT ALLOWED.

d. Exit devices shall be thru-bolted.

e. No mortise locks allowed.

f. Provide interchangeable cores for all Schlage cylinders except for ND levers.

g. Keying at New Campuses – Assa Abloy at Carlmont HS, and Menlo Atherton HS; Schlage Primus at all other campuses - NO SUBSTITUTIONS. Keying schedules will be provided by the SUHSD Maintenance and Operations Department.

h. Keying at Existing Campuses - Match Existing Manufacturer and System unless all locks on campus are to be replaced, then provide Schlage or Assa as above. Keying schedules will be provided by the SUHSD Maintenance and Operations Department.

i. Contractor shall provide a method independent of the final keying system for securing the building during construction and shall provide the SUHSD Maintenance and Operations Department with construction keys and IC control keys.

j. ASSA cylinders should be 9 bitted and Primus cylinders should be 0 bitted. When contractor is ready for installing the cylinders, the SUHSD Maintenance and Operations Department will pin them according to their keying schedule. Contractor will then install the pinned cylinders.

k. KEYING SYSTEM: Provide keyed cylinders to provide master and grand master keying system. Design system to provide highest possible security consistent with type of system being used.

4. Provide keys as follows:

Provide 3 key blanks per cylinder.

5. Closing Devices

Opening Type	Description	Manufacturer(s)	Model / Series *
Automatic Door Openers	Heavy Duty, overhead concealed parallel arm door mounted track	Norton	6000 Series
Other Exterior Doors	Heavy Duty Surface Closer	Norton	7500/ 7700 x PR
Interior Doors	Heavy Duty Surface Closer	Norton	7500/ 7700 x PR

* Model / Series for first listed manufacturer. Where no other manufacturer is listed, product listed must be furnished per District Standards - NO SUBSTITUTIONS PERMITTED.

a. Finish at existing campuses. Match existing.

b. All surface closers shall be thru bolted to doors.

6. Stops and Holders

Opening Type	Description	Manufacturer(s)	Model / Series *
Non Hold-Open Doors	Imbedded Floor Stop	Ives, Trimco, Hager	FS18S
Non-Rated Hold-Open Doors	Floor Stop/Holder	Ives, Trimco, Hager	FS40 Series
Rated Hold-Open Doors	Electromagnetic Holder	LCN	SEM 7800 Series

* Model / Series for first listed manufacturer. Where no other manufacturer is listed, product listed must be furnished per District Standards - NO SUBSTITUTIONS PERMITTED.

a. Finish at existing campuses: Match existing.

b. Holders thru-bolted to door.

c. Kick-down door holders are NOT ALLOWED.

d. Provide electromagnetic holders on all interior stair doors.

7. Accessories

Opening Type	Description	Manufacturer(s)	Model / Series *
Janitor Closet, Toilet Room, Classroom, and Kitchen Doors	Stainless Steel Kick Plate - 10 inch height	Ives, Trimco, Hager	8400 Series B4E
Multi-Occupant Toilet Rooms (non-rated)	Stainless Steel Push and Pull Plates	Ives, Trimco, Hager	8200 4" x 16" 8303-8 4" x 16"
Exterior and Rated Doors	Perimeter Gasket	Pemko, Reese, National Guard	303APK
Interior Non-Rated Doors	Silencers	Ives, Trimco, Hager	SR64 / SR65

* Model / Series for first listed manufacturer. Where no other manufacturer is listed, product listed must be furnished per District Standards - NO SUBSTITUTIONS PERMITTED.

Refer to sample hardware group listing for various door conditions:

A. Typical Exterior Main Entry FRP Flush Doors

Hinges	Continuous	Select
Panic Devices	99L-2	VON
	996L-06	VON
Mullion	KR4954 x 154 with MT54	VON
Rim Cylinders	20-057	VON
Closer	7500 PR	NOR
Kickplate	8400 x 10" 2"LDW B4E	IVE
Gasket	S88D	PEM
Door Bottom	By door manufacturer	
Threshold	Per detail	PEM
Floor Stop	FS41	IVE

B. Typical Interior Classroom Door

Hinges	BB1168 NRP (size)	HAG

Lockset	ND95PD x Rhodes	SCH
Closer	7500	NOR
Kickplate	8400 x 10" 2"LDW	IVE
Gasket	S88D	PEM
Silencers	SR64	IVE

C. Typical Interior Student Restroom Door (non-rated)

Hinges	BB1168 NRP (size)	HAG
Push/Pull	8200 4" x 16"	IVE
	8303 4" x 16"	IVE
Closer	7500	NOR
Kickplate	8400 x 10" 2" LDW	IVE
Silencers	SR64	IVE

Threshold or Floor Transition Molding (depending on the type of floor finish)

D. Typical Interior Staff Restroom Door (non-rated, within administrative offices)

Hinges	BB1168 NRP (size)	HAG
Lockset	L9496 x 06	SCH
Closer	7500	NOR
Kickplate	8400 x 10" 2" LDW	IVE
Silencers	SR64	IVE

Threshold or Floor Transition Molding (depending on the type of floor finish)

E. Typical Interior Multi-Purpose Room Doors

Hinges	BB1168 NRP (size)	HAG
Panic Devices	99L-F-2 996L-06	VON
	99EO-F	VON
Removable Mullion	9954 x 154	VON
Rim Cylinder	20-057	VON
Closer	7500 PR	NOR
Kickplate	8400 x 10" 2"LDW	IVE
Gasket	S88D	PEM

Legend:

HAG	Hager
IVE	Ives

LCN	LCN
NOR	Norton
PEM	Pemko
SCH	Schlage
VON	Von Duprin

NOTE: Hardware items listed above are for reference only. Architect shall verify field conditions whether these hardware group items are appropriate. Finishes have to be specified. Hollow metal door frames are assumed for the conditions stated above.

J. Windows

1. General Requirements

a. Provide Fortiflash "High Performance Window Flashing System", waterproof flashing membranes with Moistop Corner Shields (or approved) around all exterior flanged window openings.

b. Provide operable windows in all new classrooms and existing classrooms with window replacement projects. 90% of all classrooms' operable windows must be of sufficient size to comply with the natural ventilation requirements of Title 24, Part 6, 121 (b). All exterior glazing to be double pane. Style of windows to match existing windows at the specific campus.

c. Provide operable windows at non-classroom spaces such as multi-purpose rooms, gymnasiums, libraries, cafeterias, circulation, and accessory spaces as required to comply with the natural ventilation requirements of Title 24, Part 6, 121 (b)

~~d.~~ Provide direct line-of-sight glazing (clear glazing equal to or above 2.5 ft and below 7.5 ft) equal to or greater than 7% of the floor area for 90% of new classrooms, library reading areas, and administration areas, unless approved otherwise by SUHSD Maintenance and Operations Department.

e. For new construction, provide a minimum of 2% daylight factor in 75% of classrooms or a minimum 60% average daylight saturation percentage for all classroom space. Consider conducting a baseline daylight analysis to determine the potential for achieving either approach for modernizations.

f. For windows and skylights exposed to the sun, especially southern and western orientations, the first priority shall be given to exterior shading via overhangs, side fins, vegetation, or other devices to prevent overheating and reduce glare. If exterior shading is not feasible, the window solar heat gain coefficient (SHGC) shall be no greater than 0.40 and visible light transmittance no less than 0.50 (may be lower if necessary to control glare and provide visual comfort). Where laminated safety glass is required, the inner PVB layer shall be spectrally selective (tinted bronze or grey colors are acceptable) to minimize solar heat gain while retaining good visible light transmission. All skylights shall have diffusing glazing.

g. Provide etched label on the glass.

h. Consider the shading effect of security grills over windows and skylights.

i. To ensure thermal comfort during cold weather, glass with low-e coating shall be used wherever occupants are seated within about ten feet of large windows. The SHGC and visible light transmittance for the glazing shall be determined as appropriate for the solar exposure.

j. Windows with spans over 10'-0" in any direction (window walls and storefronts) require structural calculations at the time the project documents are submitted to DSA or they shall be noted clearly on the drawings as a deferred submittal, for which calculations shall be provided by the window manufacturer for approval by DSA prior to fabrication and installation. The use of deferred submittals to DSA must be approved by the District.

k. Limit the weight of any one single glass lite to 75 pounds.

l. Windows that swing open and whose bottom edge is 6'-8" or less above the interior finished floor or exterior finished grade shall not project more than 4" into a path of travel. Provide opening restrictors (stops) where required.

m. Provide opening restrictors on windows at the ground floor where security may be an issue and provide access into the building from the exterior. Above the ground floor, provide opening restrictors where children may be subject to falling out of the opening.

n. Internal gutters and weeps to the outside are required for all individual glazed fixed windows and ventilating windows.

o. Check STC requirements for the windows and compare them against the acoustical requirements for the site indicated in Division 1 documents.

p. All windows installed in compensation channels should be bedded in sealant upon installation into compensation channel framing. Follow manufacturer's written instructions.

q. Remove old sash only when new windows are on-site, verified to fit, and ready to be installed.

r. Spare parts amounting to 10% of the job shall be supplied by the sash installer for use by SUHSD Maintenance and Operations Department.

s. Salvage old hinges and operating hardware and turn over to the SUHSD Maintenance and Operations Department.

t. Provide small working sample window (12" x 12" with specified glass and hardware) for review by SUHSD Maintenance and Operations Department, prior to any installation with all specified hardware attached.

u. SUHSD Maintenance and Operations Department shall review the architectural drawings prior to construction, submittals during construction, and in-place testing of windows prior to Contract Closeout. Provide one AAMA-certified tester who reports to SUHSD Maintenance and Operations Department, for all in-place testing. Test is contractor performed and District directed.

v. District is to approve an AAMA-certified testing agency or laboratory. Installers shall be qualified by a minimum of 5 years' experience in similar applications.

w. Provide sample installation (mock-up) window test before proceeding with window installation job.

x. Test further, after successful completion at 50% and 90% of work completion.

y. Windows are to be field tested per ASTM E-1105.00 prior to accepting work. Perform ASTM E-1105.00 tests on finished installed products only. 8 ½ pounds minimum pressure per square foot required per testing.

z. No uncontrolled water, penetrating the glazing or the framing system, is to appear on normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to the exterior and water that cannot damage adjacent materials or finishes.

aa. No water allowed at 80% of design load.

bb. Use splice plates with bond breaker tape applied at exposed portion of splice plate prior to sealant application.

cc. All windows are to have metal head flashing unless the frames are flanged.

dd. All windows shall have a continuous bead of sealant applied after frames are inserted on panning sills, at heads, and jambs. Follow manufacturer's written instructions.

ee. Use end dams at all corners of pan flashing and compensation panels.

ff. Provide maintenance manuals and parts lists to the SUHSD Maintenance and Operations Department

2. Window Design

a. Windows shall be designed to incorporate either compensation channel (receptor) at head, sill, and jambs or full panning (flashing) system.

b. Provide metal window head drip flashing at all exterior openings that do not have integral flanges.

c. Provide Fortiflash "High Performance Window Flashing System", waterproof flashing membranes with Moistop Corner Shields (or approved) around all exterior flanged window openings. (This work is to be done by non-glazers.)

d. All window components, sash, frame, compensation channel, or panning (flashing) systems shall be from the same manufacturer and designed to function as an integrated system to prevent water and air infiltration.

e. All windows (operable or fixed) should comprise a system whereby through compensation channels or panning any uncontrolled water leakage will be weeped (diverted to escape) completely outside window at exterior wall.

f. If using compensation channels, use starter sills along with head and jamb components. Allow for weepage to sill and weepage outside sill. Follow manufacturer's written instructions. Drill weep holes as necessary.

g. If using compensation channels install sealant on to channels prior to installation of window frames. Bed compensation channels with sealant prior to inserting windows.

3. Configuration

a. Provide operable windows that project out, except operable vents above 6'-8" AFF may be inward projecting hoppers.

b. Sliding windows are not allowed.

c. Casement windows are not allowed except where required to provide emergency egress.

d. All fasteners, blocking, etc. securing the sash to the frame perimeter must be non-magnetic stainless steel (18-8).

e. Any substitutions of windows or window parts must be in writing and subject to approval by SUHSD Maintenance and Operations Department.

4. Warranty

a. All windows, both steel and aluminum shall have a 10-year manufacturer's warranty against defects in materials and workmanship including installation against water leakage.

b. References:

c. Glass Association of North America of Topeka, Kansas

d. GANA Glazing Manual current edition

e. GANA Sealant Manual current edition

f. American National Standard for Voluntary Specifications of Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

g. American Society of Testing Materials ASTM E-1105-00 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Air Pressure Difference

5. Screws

All sash hardware must be installed with non-magnetic stainless steel round, Phillips head screws.

6. Anchorage

As designed by structural engineer and approved by Division of the State Architect.

7. Window Glass

a. Laminated, annealed glass shall be specified for all exterior windows and shall be as consistent as possible for each building. Selections and specifications, including proposed variations due to solar orientation (use of Low-E Glass, shading, fire rating requirements, impact resistance requirements, and compliance with the California Building Energy Efficiency Standards (CCR Title 24, Part 6), shall be reviewed with the SUHSD Maintenance and Operations Department.

b. Glass shall be 7/32" thick with interlayer of .030 Poly-Vinyl Butryl (PVB).

c. Use clear glass wherever possible. Tinted glass can be used to match existing conditions or as requested by the school and as approved by the SUHSD Maintenance and Operations Department.

d. Provide etched identifying labels on the glass.

e. Wired glazing is not allowed at any openings including transoms required to be fire-rated and impact-resistant. Comply with the requirements of CBC section 715 and Chapter 24.

f. Privacy glazing where needed at toilet rooms shall be translucent, white, laminated glass.

K. Window Hardware

1. General Requirements

a. Provide restrictor blocks on each hinge to limit lower operable light opening dimension to 4" from face of building.

b. Ventilating windows over 6'-0" above the floor are to have ring handles with poles for operations.

c. Clerestory sash operating hardware is to be non-motorized, surface mounted cables on walls. Handles to be removable.

d. Replacement parts for all window hardware must be available locally (within 25 miles of driving distance from Redwood City). Contractor should provide a list of stores, locations, and serial number for all parts in the closeout documents.

e. Deviation on hardware must be approved by SUHSD Maintenance and Operations Department.

2. Handles

a. Each operable window shall have two handles so that if one is damaged or otherwise becomes inoperable the window can still be secured using the remaining handle until SUHSD Maintenance and Operations Department can repair the hardware.

b. Aluminum-bronze alloy (C95500) with polished-satin finish to be used with aluminum sash.

c. Red-bronze alloy (C83600) with polished-satin finish (red bronze US10) to be used with steel sash.

d. On project-out vent (awning type), use the following handles in conjunction with #282 series strikes (aluminum-bronze alloy).

- Hand-Operated Handles: Bronze Craft #162-001-4504 (right-handed handle) or 162-003-4504 (left-handed handle)
- On project-in vent, (hopper type), use the following handles in conjunction with #210 series keepers (aluminum-bronze alloy).
- Hand-Operated Handles: Bronze Craft #156-001-4504 (right-handed handle) 156-003-4504 (left-handed handle)
- Pole-Operated Handles: Bronze Craft #158-001-4504 (right-handed handle) 158-003-4504 (left-handed handle)

e. Consideration of handle operations in conjunction with shade hardware is essential.

3. Hinges

a. Storm hinges, manufactured from 304 stainless steel 4 bar hinge with stainless steel slide mechanism and integral adjustable limit stop (restraining block), with a concealed non-structural delrin sleeve for smoothness of operations and application of friction.

b. Storm Hinges adjustable limit stop (restrictor block) setting to be 4" where applicable for access compliance (to avoid excessive encroachment into a path of travel) or safety (to prevent falls).

c. All operable windows whose bottom edge is 72" or more above the interior finished floor shall allow for pole operations, using specified pole, pole tip, pole hanger, and pole ring.

d. Pole ring shall be used on projecting - in windows. Locate on middle of top rail of ventilator and indicate on shop drawings. If such location is not possible due to design of window opening, or conflict with window shade, consult SUHSD Maintenance and Operations Department for appropriate design.

4. Operating Poles

a. It shall be the responsibility of the sash installer to install the pole and pole hanger in each classroom and office. Pole hook assembly to be Aluminum tube with rubber end, (7 feet long)

b. No mounting of pole ring on glass allowed.

5. Security Screens

a. Perforated metal screen (per Division 5, Item B.1.e) or 2"x 2" wire mesh such as those provided by:

- Exeter Crime Shield, Wyoming, PA
  [T] 888-972-2478
  [W] www.securityshield.net/doors.html
- Western Wire Screen, Sacramento CA
  [T] 800-234-6331

[W] www.thewesterngroup.com

- Howard Wire Cloth Co, Hayward, CA
  [T] 510-887-8787
  [W] www.howardwire.com

b. Only use stainless steel metal fasteners.

L. Aluminum Windows

1. General Requirements

a. Protect against galvanic action.

b. Aluminum finishes exposed to the weather shall have heavy-duty coating, suitable for salt environments (0.018-mm-thick anodic coating).

c. A letter certifying / guaranteeing the above anodizing must be furnished by the window manufacturer or anodizer to the District.

d. Testing firm to be contractor provided and approved by District.

e. Window testing must be AAMA-certified and approved by District before actual testing occurs. District will provide AAMA-certified testing laboratories if requested.

f. Window standards are based on AAMA AW60 grade as a minimum.

g. Acceptable manufacturers:

h. OldCastle, Kawneer, EFCO, SAFTIFire (for fire-rated windows)

i. Awning and hopper type vents must be AAMA-AW rated, AP-AW 60 or higher. Awnings and hoppers may occur in some unit.

j. Caulking: Use silicone or one-part polyurethane sealant on aluminum windows and frames, with associated sealant primer where manufacturer recommends on custom-painted walls and window frames. For example, for one-part polyurethane sealant use sealant primer when caulking fluorocarbon or Kynar-painted finished aluminum frames. For painted stucco or concrete walls use sealant primer as recommended by supplier.

2. Aluminum Sash

a. All wall thickness shall be a nominal one-eighth inch (1/8") thick, including sill covers.

b. Provide window maintenance manual from supplier that is required for an architectural weight (AW) rated window.

3. Glazing

a. Neoprene setting blocks shall be used on all glazing.

b. Glazing tape shall be used on the outside facing side of the sash opening. The butyl tape shall be kept at 3/16" to 1/8" below the sight line. A bed of clear silicone shall be applied to this outer face to insure a water tight installation.

c. Neoprene weather-stripping glazing gaskets are preferred. Weather stripping shall be integral type no push in type of weather stripping shall be used.

d. Glazing bead to be square extruded stops.

e. All aluminum windows shall be factory glazed to ensure adequate quality control. Field glazing shall be used only when absolutely necessary.

f. No putty glazing.

g. Inside glazing mandatory.

M. Aluminum Storefronts

1. Acceptable manufacturers: OldCastle Building Envelope, Kawneer, Special-Lite, US Aluminum
2. Submittals to DSA for deferred approvals are required for window wall and storefront systems over 10' tall or 10' wide and shall include structural calculations.
3. Protect against galvanic action.
4. Detail for seismic movement.

N. Steel Sash Windows

1. Finishes

a. Steel sash and stops are to be properly cleaned, hot dipped galvanized, phosphate treated, prime painted, and factory finished in a color selected by the Architect and approved by the District.

b. A letter guaranteeing the above galvanizing shall be furnished by the steel sash manufacturer to the Architect and approved by the District.

2. Hardware

~~a.~~ All vent arms, nuts, bolts, clips, screws, etc. shall be of non-magnetic stainless steel (18-8). Rivets securing the vent arm hinges shall be made of brass.

b. All hardware is to be the same as for aluminum windows.

3. Glass Stops

a. Glass stops shall be extruded steel stops, drilled and tapped for installation with non-magnetic stainless steel (18-8) Phillips head machine screws. Stops shall be galvanized.

b. All sash to be inside glazed.

O. Shades

See Division 12 Furnishings.

DIVISION 09 – FINISHES

A. Material/Finish Considerations

The following criteria shall be used to evaluate whether a material or finish is appropriate for inclusion in a project:

a. Durability
b. Non-toxicity throughout life span from production through end of life
c. Impact on indoor air quality, off-gassing
d. Recycled content and recyclability – post-consumer preferable to pre-consumer/post-industrial
e. Reused/salvaged material, ability to refurbish, reuse, or salvage in the future
f. Made from rapidly renewable resources
g. Chain of custody and life-cycle assessment of impact on environment
h. Packaging
i. Proximity of manufacturing and distribution to the Project.
j. Maintainability.
k. Utility.
l. Appropriate aesthetics.

B. Finish Schedule

Architects shall select materials and finishes from the following list for the associated spaces and uses. The options listed are not in order of preference. See Finish Schedule Note 1 for the extent of ALL wall, floor and ceiling finishes related to Modernization Projects.

Type of Space	Floors	Walls	Base	Ceilings
Classrooms	Polished Concrete[13] VCT[11]	Paint[4] Wall Surface[14] Acoustical Wall Panel[8, 10]	Rubber Base[12]	Acoustical Tile[9]
Multi-Purpose Rooms, Auditoriums, and Cafeterias	Polished Concrete[13] VCT[11] Carpet Linoleum[3] Wood Rubber[2]	Paint[4] Acoustical Wall Panel[8,10]	Rubber Base[12]	Acoustical Tile[9] Acoustical Deck
Gymnasiums	Wood	Paint[4] Acoustical Wall Panel[8,10]	Vented Rubber Base	Paint[4] Acoustical Deck

Type of Space	Floors	Walls	Base	Ceilings
Kitchen/Food Service	Epoxy Flooring	Ceramic Tile[5], FRP, or Stainless Steel Wainscot *(6'-0" min.)* with Paint[4] above	Epoxy	Epoxy Paint[4] Suspended
Staff Toilet Rooms *(see notes)*	Ceramic Tile	Ceramic Tile Wainscot[6] with Paint[4] above	Ceramic Tile[5]	Epoxy Paint[4]
Student Toilet Rooms	Epoxy Flooring	Ceramic Tile[5]	Epoxy	Epoxy Paint[4]
Offices / Administration / and Conference Rooms	Linoleum[3] Carpet VCT[11]	Paint[4] Wall Surface[14]	Rubber Base[12]	Acoustical Tile[9]
Teachers' Lounge	Linoleum[3] VCT[11]	Paint[4]	Rubber Base[12]	Acoustical Tile[9]
Libraries	Linoleum[3] Carpet VCT[11] Polished Concrete[13]	Paint[4] Acoustical Wall Panel[8,10]	Rubber Base[12]	Acoustical Tile[9]
Corridors	Linoleum[3] Polished Concrete[13] VCT[11]	*Koroseal*[14] Wainscot[6] with Paint[4] above	Rubber Base[12]	Acoustical Tile[9]
Locker Rooms *(see note)*	Terrazzo Epoxy Flooring Polished Concrete[13]	Paint[4, 7]	Terrazzo Epoxy Rubber Base	Epoxy Paint[4]
Showers	Epoxy Flooring	Ceramic Tile[5]	Epoxy	Epoxy Paint[4]
Nurse's Office / Sick Room	VCT[11] Polished Concrete[13] Linoleum[3] Ceramic Tile[5]	Paint[4]	Rubber Base[12] Ceramic Tile[5]	Paint[4]
Closets / Copy Rooms	VCT[11] Linoleum[3]	Paint[4]	Rubber Base[12]	Paint[4]

Type of Space	Floors	Walls	Base	Ceilings
	Sealed Concrete			
Janitor Closets	Sealed Concrete	Stainless Steel or FRP Wainscot with Paint[4, 6] above	Rubber Base[12]	Paint[4]
Utility Rooms	Sealed Concrete	Paint[4]	Rubber Base[12]	Paint[4]

Finish Schedule Notes:

1. Modernizations: When refinishing wall, floor, and ceiling surfaces, avoid creating a patchwork appearance. Determine suitable limits for finish material replacement to ensure a consistent appearance and, when appropriate, replace entire wall, floor, and ceiling materials. Paint entire walls, corner to corner, floor to ceiling.

2. Resilient Flooring: Rubber is acceptable only when patching limited quantities into existing conditions.

3. Slip resistant flooring is required at interior ramps and sloped floors to provide additional slip resistance.

4. Painted Walls: Paint is over gypsum board or gypsum plaster walls. Do not paint over pre-finished materials (acoustic wall tile, ceramic tile, etc.).

   Where plywood backer panels are installed in electrical equipment rooms (and telecommunication closets): Paint the face of the plywood with (2) coats of off-white, semi-gloss, fire-retardant paint. Manufacturer's stamps are to be masked to painting so they remain visible.

5. At all multi-accommodation restrooms and both single- and multi- accommodation student restrooms, ceramic tile is allowed only as wainscot above epoxy or terrazzo wall base. At such conditions, the architect shall provide a detail for the transition from wall base material to ceramic tile wainscot.

6. Wainscots shall be minimum 6'-0" high in kitchen/food service areas, 4'-0" high in staff restrooms, 4'-0" high at floor mop sink locations, minimum 4'-0" high in corridors and entrances, and full-height to the ceiling at showers. New wainscots at existing hallways should match existing type and design. At wet areas such as toilet rooms, locker rooms, and showers, ceramic tile wainscot shall be installed over minimum 5/8" cement backer board. Design stud deflection not to exceed L/360 – spacing 16" o.c. maximum. Painted wall areas above the wainscot shall be:

   - Moisture-resistant high impact gypsum board; or
   - Standard moisture-resistant gypsum board installed over 1/2 inch plywood; or
   - 2-coat veneer plaster over 5/8-inch cement board, or
   - 7/8 inch thick cement plaster.

7. Locker Rooms: Wall studs are to be designed for a deflection not to exceed L/360 and spaced at 16" o.c. max. Painted wall areas are to be any of the 4 systems mentioned in Note 6, above.

8. Gymnasiums and Multi-Purpose Rooms: When sound control is needed, provide impact-resistant acoustical tile ceilings and wall panels mounted 8'-0" above the floor or higher. Use vandal-resistant faces (metal or wood). Fabric-faced panels are not allowed.

9. Acoustical Ceiling Tile: When installing acoustical tile ceilings, check the floor areas above for leaks and have them fixed before installing the new ceiling.

- Reinstallation of existing ceiling tile is NOT ALLOWED.
- Ceiling tile should have a minimum NRC (noise reduction coefficient) of 0.70.

10. Acoustical panels shall be used made from perlite or mineralized wood fiber (formaldehyde free) and other nontoxic materials and recommend to promote good indoor quality. Panels with reflective surfaces are recommended to improve daylighting and electrical light distribution in darker rooms.

11. VCT tiles have to be scuff resistant, and minimum 12" x 12" size tiles.

12. 4" base at new construction.

13. Polished Concrete Finish in accordance with HTC Superfloor™ concept for interior concrete flatwork. Certified applicators: Colour; Chris Swanson; 530-409-9232; 530-409-5979.

14. See section M in this division for vinyl faced wall panels.

C. Portland Cement Plaster

1. 7/8 inch thick 3-Coat Cement Plaster System (scratch, brown, finish) with metal lath, over 2 layers of building paper (grade D, Style 2), Fortifiber or approved equal, shall be used
2. Metal lath is to be held 3/8 inch off the face of the building paper. Use ribbed metal lath. The lath should be installed with attachment to the edges of the control and expansion joints, so the lath is not continuous or tied across the control joints, reveals or expansion joints.
3. For exterior cement plaster walls, install control joints to create panels no larger than 144 sq. ft. with no dimension exceeding 18 feet or a length to width ratio of 2-1/2 to 1.
4. For ceilings, the maximum size of panels should not exceed 100 sq. ft.
5. Install control joints at all locations where panel sizes or dimensions change. Joints shall extend the full width or height of the plaster membrane. For example, use them at the outside corners of windows.
6. Where control joints are placed parallel to framing members, install joints so that none is more than 4 inches away from a framing member.
7. Use horizontal control joints with weep flashing at the exterior of the building at the floor lines.
8. Slip or cushioning joints should be provided at beams so loads will not be transferred to the plaster.
9. Use expansion joints to cover building movement locations and where there is a difference in the wall construction behind the plaster (i.e. transition from CMU to wood frame construction).
10. Use control joints where framing changes direction (ceilings).
11. Use screeds at the perimeter of the plaster finish, where it meets dissimilar materials.
12. Use weep screeds at the bottom of all plaster walls to prevent moisture build-up at the bottom of the cement plaster panels.

D. Gypsum Board Assemblies

1. Gypsum Board Control Joint Locations

a. In ceiling areas exceeding 2,500 sq. ft.

b. Space them not more than 50 feet on center.

c. Where ceiling framing or furring changes direction.

d. Partition and Furring Control Joint Locations

e. In partitions and wall furring runs exceeding 30 feet

f. Space control joints not more than 30 feet on center.

g. In furred assemblies where control joints occur in the exterior wall (beyond).

h. Use non-vinyl (non-V.I.P.) patching compound: Lime compound, all-purpose joint and texturing compound containing inert fillers and natural binders rather than vinyl

2. High Impact Gypsum Board Panels

a. Corridors, locker rooms, and wall areas above ceramic tile wainscots in student used toilet rooms need added impact protection.

b. Studs must be sized for L/360 deflection. Spacing is not to exceed 16" o.c.

c. High impact gypsum board panels by National Gypsum Wallboard Products or United States Gypsum over wire mesh.

d. Standard weight gypsum board over ½" plywood can also be used.

E. Ceramic Tile

1. The use of asbestos-containing flooring products is NOT ALLOWED.
2. Lead glazing is NOT ALLOWED.
3. Re-use of existing tile is NOT ALLOWED.
4. At student restrooms and locker rooms, all wall-applied ceramic tiles shall be installed over 3/4" mortar bed over 5/8" cement board or 7/8" cement plaster with studs at 16" on center, maximum. Design stud deflection not to exceed L/360. Thinset application over water-resistant gypsum board sheathing at walls is acceptable only at staff restrooms.
5. Ceramic tile is not allowed for floors at any multi-accommodation restrooms or at any student restrooms (single or multi-accommodation) except where matching existing. Use epoxy flooring and base. Ceramic tile is allowed for wainscot. See Finish Schedule earlier in this section for allowable materials at all rooms.
6. Minimum tile size for flooring is 12" x 12" (except at restrooms where floor is sloped to drain) and maximum wall tile size is 4 ¼" x 4 ¼" nominal, except where matching existing tile. Deviations shall be reviewed and approved by SUHSD Maintenance and Operations Department.
7. Use epoxy grout at all toilet room walls and floors. Colored grout and minimum-size joints are preferred to minimize appearance of stains and graffiti. White grout is not allowed at floors. Seal all wall and floor tile grout joints with a product resistant to chemicals and urine.
8. Floor tile shall have non-slip texture and finish.
9. Provide preformed inside and outside corners for walls and bases.
10. Tile patterns shall be limited to four colors. Intricate patterns are discouraged for ease of installation and repair.
11. Dal-Tile products are acceptable and provide the basis of quality for both quarry and ceramic tile.

F. Acoustic Ceiling Tiles/Panels

1. General

a. For the majority of ceilings in modernization and new construction projects, the use of a 2-ftx 4-ft foot suspended grid system with integral recessed 2-ftx 4-ft lighting is the standard for the District (Refer to Division 26 for lighting fixture standards). Ceilings where these systems are typically used include classrooms, corridors, administrative spaces, labs, and libraries. Some areas where use of suspended acoustical ceiling systems may be appropriate include cafeterias and multi-purpose areas, though this should be considered on a case by case basis and reviewed with the SUHSD Maintenance and Operations Department. Kitchens and restrooms should avoid the use of suspended acoustical ceilings, as these spaces typically are a hard ceiling (gypsum or plaster) system.

b. In laying out the ceiling grids, the system should be centered on the space such that the edge conditions are consistent, though this may vary if special lighting conditions exist. In classrooms, the lighting fixtures (and ceiling grid) should be laid out such that the long dimension of the 2 X 4 grid and associated lighting fixtures are parallel to the windows.

c. Use of 2 X 2 grids and lighting fixtures should be limited to special conditions where a 2 X 4 lights or ceiling panel will not work with the space. Customized grid systems are allowed only as authorized by SUHSD Maintenance and Operations Department.

2. Adhesive-Applied Acoustical Ceiling Tiles

a. Thickness: 5/8-inch

b. Size: 12-inches x 12-inches

c. Color/Texture: White/Fine fissured

d. Material: Mineral fiber; resistant to sag, mold/mildew and bacteria growth

e. Acceptable Product: Armstrong 746 or 741

3. Suspended Ceiling Systems

a. Provide acoustical panel units and grid components by a single manufacturer.

b. Panels shall comply per ASTM E84, and ASTM E1264

c. Flame Spread: 25 or less

d. Smoke developed: 50 or less

e. Suspended grid system shall comply with California Building Code and DSA requirements. Refer to DSA Interpretation of Regulations IR 25-1 and 25-2.10., specifically for seismic restraints.

f. Grid: White baked enamel, direct hung, square regular with 9/16 grid

g. Wall molding: nominal 7/8-inch x 7/8-inch hemmed, pre-finished angle molding

h. Ceiling Panel retaining clips and hanger wire shall be hot-dipped galvanized steel

i. Ceiling Struts: Place maximum 12'-0" on center in both directions and within 6'-0" of each wall

~~j.~~ Acceptable Manufacturers: Armstrong, Chicago Metallic, USG.

4. Ceiling Panels

a. Surface Texture: Medium or fine where appropriate

b. Composition: Mineral Fiber or Fiberglass where appropriate
c. Color: White
d. Size: 24-inch x 48-inch x ¾-inch (at hallways and classrooms; Use "Second Illusion 2" only in offices and conference rooms)
e. Edge Profile: Square Lay-in
f. At Kitchen and Food Service areas, use "clean room panels."
g. Acceptable Manufacturer: Armstrong and USG

G. Wood Flooring

1. General

Clear finish for stage floor

2. Athletic Wood Flooring

a. Maple flooring shall be 25/32 inch thick Northern Hard Maple, "2nd and better" grade, 2 ¼" wide, tongue and grooved, end matched.
b. Sub floor components: PVC shock resilient pads to be 3/8" thick by 2 ¼" wide by 3" long with six fully enclosed air channels. Sleepers shall be Northern Pine or Eastern Hemlock nominal size two inches by 3 inches by four feet, over continuous, un-penetrated waterproof membrane.
c. Must have perimeter gap for ventilation and expansion.
d. Finish shall be as follows:
e. First and second coats: Bona Sport Supersport Seal
f. Third through seventh coats: Bona Sport Supersport One, gloss finish
g. Acceptable Manufacturers:
    - Conner
    - Southern
    - AACER
h. Basis of Design: Conner Retroflex System

3. Wall Base

a. Resilient wall base shall be heavy-duty molded rubber vented base. Vinyl is not acceptable.
b. Provide pre-formed corners at inside and outside corners.
c. Select water-based adhesives.

H. Resilient Flooring

1. General

a. The use of asbestos-containing flooring products is NOT ALLOWED.

b. Linoleum tile and sheet linoleum products are acceptable for general use at level floors: Homogeneous linoleum comprised primarily of natural materials consisting of linseed oil, wood flour, rosin binders, and pigments calendared in a two-stage process to ensure optimal dimensional stability.

c. Slip resistant flooring is required for interior ramps and sloping floors in order to provide additional slip resistance.

d. Slip resistance:

   1) 0.6 min. coefficient of friction at level floors

   2) 0.8 nominal coefficient of friction at ramps and sloping floors

e. The A/E is encouraged to avoid light and solid flooring colors that exhibit scratch and scuff marks more readily than darker colors. Marbled and other pattern types are encouraged for this reason. Review proposed selections with SUHSD Maintenance and Operations Department prior to presenting to the school site.

f. The A/E shall include colored floor pattern drawings and color samples for major spaces, including the auditorium/multi-purpose room, offices, circulation spaces, and typical classrooms, with the color and material presentation boards submitted to the District for review during the design process.

2. Quality Assurance/Flooring Contractor's Qualifications

a. The flooring specifications shall include language requiring that:

b. Prior to being authorized to commence work, the flooring contractor/installer must submit a list of three (3) projects they have installed, located within 50 miles of Redwood City, of similar size, material, and use, which have been in place and performed to the owners' satisfaction for a period of not less than five (5) years. The installer must submit project details and reference contact information including the owner name and telephone number for each listed project.

c. Flooring contractor shall be an installer certified by the flooring manufacturer. Proof of certification shall be required prior to start of work.

d. Flooring contractor shall be an established firm, experienced in the installation of the specified product, and shall have access to all manufacturer's technical maintenance specifications and related documents.

e. Flooring contractor shall have completed master mechanics class in installation of linoleum and shall have a factory-trained master mechanic on site to supervise the entire installation.

f. Warranty: The flooring specifications shall include language requiring the contractor to submit joint manufacturers/applicator's warranty covering labor and materials for a period of not less than two (2) years.

g. The contractor must have the manufacturers or sales technical representative on site to give approval of start area before contractor is to proceed.

3. Flooring Preparation

a. Contractor shall verify, in writing, 30 days prior to scheduled resilient flooring installation.

b. The general contractor shall be responsible for the acceptability of moisture emission levels of concrete slabs as well as job site conditions as required in the flooring manufacturer's specifications.

c. Maximum moisture content of concrete slabs shall be less than 5 lbs. of water per 1000 sq. ft. of slab in a 24-hour period, as tested with a calcium chloride test kit per ASTM F1869-89.

d. Maximum alkalinity level of concrete slabs shall be 9.9 pH.

e. Use flooring manufacturer's recommended moisture limiter coating if moisture mitigation is required. Costs for the coating are to be borne by the Contractor if the moisture and/or alkalinity levels exceed the above amount.

f. Removal of old flooring shall be performed by mechanical means only. Do not use solvents to remove old flooring because solvent residue will act to prevent proper adhesion of new flooring.

g. After the old flooring is removed, the floor should be bead blasted then sealed with a moisture limiter coating acceptable to the flooring manufacturer. This should be done before the installation of patching and leveling compounds.

h. Use multiple coats of leveling compounds (3-coats) which are compatible with the flooring manufacturer's adhesive.

i. The flooring contractor shall install a pre-determined (mock-up) area for approval of workmanship by the Architect prior to proceeding with the remaining work.

4. Adhesives

Use the flooring manufacturer's approved adhesive. Flooring adhesives must be compatible with all concrete sealers.

5. Sheet Linoleum

a. Flooring shall meet or exceed Federal Specification SS-T-312B and ASTM F1700, Static Load Limit 450 psi (ASTM F970 standard test), ASTM E-682/NFPA 258 – 450 or less. ASTM E_648/NFPA 253 – Class -1.

b. Gauge: 2.5 mm min. thickness – consider heavier gauge for athletic/gymnasium floors.

c. Jute backing.

d. Heat weld all seams with matching solid color welding rod.

e. Flooring edges that abut walls, door casings, pipes, etc. must be sealed with an acrylic latex silicone caulk sealant. Top-set rubber or wood base must be installed to all applicable areas after caulking.

f. Cove strips are needed to form a radius at the joint between the floor and the wall surface to support the floor covering as it turns up the wall.

g. Provide preformed metal cove base corners at inside and outside corners for additional support of the cove base.

h. Provide cove base cap strips (metal or rubber) to conceal the edge of floor covering that is turned up the wall.

i. The following manufacturers are acceptable:

   1) Armstrong

   2) Forbo Marmoleum

   3) Johnsonite

j. Standard of quality for installation: Specifications shall include language requiring that the flooring contractor shall, for the purpose of evaluating the quality of the workmanship, provide a mock- up installation of the specified floor covering in an area designated by the architect. Upon approval, this test installation shall then be considered the standard of quality and basis of comparison for the balance of the project. The mock up area can then be incorporated into the finished project upon

approval. Areas found to be deficient by specification standards or application procedures shall be repaired or replaced at the contractor's expense.

6. Linoleum Tile

a. Gauge: 2.5mm min. thickness

b. Polyester backing required for tile only to provide dimensional stability.

c. Acceptable manufacturers: See above listing for sheet linoleum.

7. Rubber Flooring

a. Rubber flooring to be used only as authorized by SUHSD Maintenance and Operations Department for science classrooms or any other specialized spaces.

b. Textured rubber flooring is not allowed. Use only smooth tile.

c. Gauge: 3mm min. thickness

d. Green Guard-certified

e. Acceptable manufacturer: Burke Flooring.

f. Avoid Mondo rubber flooring unless matching existing conditions and as approved by SUHSD Maintenance and Operations Department.

8. VCT

a. Acceptable Manufacturer/ Product: Armstrong, Mannington, Safewalks or Touchtone series.

b. Prior to finalizing the VCT product, Architect shall work with the manufacturer in selecting the appropriate series for maximum scuff resistance and minimal maintenance issues. Architect should get approval from SUHSD Maintenance and Maintenance Department during the design phase on the proposed system.

c. Architect should include all manufacturer's recommended final cleaning and waxing instructions for Contractor to perform.

9. Wall Base

a. Existing Schools: If there is an existing intricate milled wood base design, it is not necessary to provide an exact match. Select from stock wood shapes where possible to avoid special milling costs (especially in small quantities).

b. In existing conditions, confirm 4 or 6-inch base requirement for replacement.

c. Resilient wall base shall be rubber. Vinyl is not acceptable.

d. Provide pre-formed corners at inside and outside corners.

e. Select water-based adhesives.

10. Maintenance

First cleaning, waxing, and polish shall be included in the base bid of any work and performed per manufacturer's instructions.

I. Terrazzo Flooring

1. This is the most durable floor finish and easiest for custodial maintenance. Consider using when budget allows, especially for locker rooms and showers but also, when appropriate, for entrance lobbies, etc. If desired or recommended, propose its use to SUHSD Maintenance and Operations Department early in the design process to ensure its acceptability for each individual application and accounting for in early cost estimates.
2. Specify non-slip finish.

J. Epoxy Mosaic Composition Flooring

1. General

a. Epoxy mosaic composition flooring is required at kitchens, multi-accommodation restrooms, and all student restrooms (single and multi-accommodation).

b. Provide a pre-mixed (broadcast aggregate is not allowed), trowel-applied, seamless floor and cove base system, containing colored epoxy resin and decorative embedded aggregates and finished with a clear epoxy sealer top coat (having a low odor level). Colored granular systems are not acceptable. The flooring must include a high-wear quartz aggregate with a minimum value of 7 on the Mohs hardness scale.

c. Thickness to be 3/8" for heavy-duty applications, such as at kitchens; ¼" for all other applications.

d. The supporting floor system should have minimal deflection to avoid surface cracking. Where needed, specify installation of a crack isolation membrane to reduce the possibility of cracking. Over wood substrates, use metal lathing, heavily stapled and filled with the manufacturer's recommended underlayment, under the epoxy flooring and show a waterproof/anti-fracture membrane on top of the underlayment.

e. If curing compounds are used on concrete substrates, they must be compatible with the flooring system. Water cured concrete is recommended.

f. Remove existing floor tile. Shot blast, acid etch or power scarify the substrate to obtain the optimum bond for the flooring to concrete.

g. Infill voids and depressions with products recommended and produced by the manufacturer.

h. Maintain the required flooring thickness at thresholds and around drains and clean-outs by removing concrete (1/2" deep) below the leading edge of the flooring.

i. Floor drains, clean-outs, etc. should be "floor-flange" type for use with composition floors.

j. Specify a vapor control primer (min. 10 lbs.) to be applied over all concrete substrates where the moisture vapor transmission of the substrate for all types of applications exceeds the manufacturer's recommendation. Contact the Owner and flooring manufacturer if emissions exceed 10 lbs.

k. HVAC system serving areas where new epoxy mosaic composition flooring is applied shall be fully functional before, during, and 7 days after the installation of the flooring system.

l. Flooring shall include an EPA-licensed anti-microbial/anti-bacterial biocide system to protect against algae growth, bacteria, fungi, mold, and mildew. Applicator must submit EPA licensing information from the base manufacturer showing that the system is effective for the long term in the cured materials and is not simply an "in-can preservative."

m. Specify a waterproof membrane produced by the manufacturer of the flooring system where occupied spaces occur below. Areas receiving the waterproof membrane should be clearly shown on the architectural drawings.

n. Provide multiple top coats (seal coats) incorporating moppable non-slip aggregate.

o. In shower areas, more aggressive, non-moppable non-slip aggregate will be necessary due to future buildup of soap scum residue.

p. Single-Source Responsibility: Flooring materials, underlayments, crack control systems, vapor dissipation and control systems, primers, resins, hardening agents, waterproof membranes, fillers, aggregates, and finish or sealing coats are to be from a single manufacturer.

q. Acceptable Products – Heavy-Duty Applications (including kitchens – 3/8" thickness):

- Dex-O-Tex 'Tekcrete' (or equal)
- Dex-O-Tex Composition Flooring

r. Acceptable Products – Standard Applications (1/4" thickness):

- Dex-O-Tex 'Cheminert Terracolor'
- Dex-O-Tex Composition Flooring (see above)
- Sika 'Versacolor'

2. Quality Assurance/Flooring Contractor's Qualifications

a. The flooring specifications shall include language requiring that the contractor be required to submit a plan to ensure that the manufacturer's required environment is maintained for the duration of the installation, with an emphasis on the critical curing phase of the epoxy. This plan will be tailored to the specific conditions of the site and must show that the correct environmental conditions will be maintained on a 24 hour basis. The general contractor shall maintain continuous floor temperatures of 60-degrees F or above before, during and 7 days after placement of resinous flooring. Depending on the availability of heating at the site, this MAY include the need to have continuous supervision of the environmental controls/systems to be utilized for the duration. Work may not proceed on installation of the flooring system until such time as this plan has been submitted and approved by SUHSD Maintenance and Operations Department.

b. No resinous flooring installation may take place when temperatures fall – or are anticipated to fall within 5-degrees of the dew point.

c. Prior to being authorized to commence work, the flooring contractor/installer must submit a list of three (3) projects where they have installed the same exact system they propose to use on subject project, located within 50 miles of Redwood City, of similar size, material, and use, which have been in place and performed to the owners' satisfaction for a period of not less than five (5) years. The installer must submit project details and reference contact information including the owner name and telephone number for each listed project.

d. The flooring contractor shall be an installer certified by the flooring manufacturer. Proof of certification shall be required prior to start of work.

e. The flooring contractor shall be an established firm, experienced in the installation of the specified product, and shall have access to all manufacturer's technical maintenance specifications and related documents.

f. The completed resinous flooring is not to be exposed to moisture, spills or cleaning 7 days after installation. Failure to observe this restriction by the Contractor may cause the floor to blemish or discolor and shall be reason for removal and replacement of the floor at Contractor's expense.

g. Warranty: The flooring specifications shall include language requiring the contractor to submit joint manufacturer's/applicator's warranty for the specific project (not a generic warranty) covering labor and materials for a period of not less than two (2) years.

h. Vapor Control System: Prior to installation of this material, the applicator shall:

1) Close off all shared exhaust ventilation systems (i.e. systems providing ventilation to more than the area in which the application is being made) using a hard (cardboard, plywood, sheet metal or equivalent) barrier, covered by polyethylene sheeting, and perimeter sealed with duct tape. Close off other penetrations to the work area in a similar fashion.

2) Equip all doorways leading from the work area to other interior portions of the building with T or Z pattern flap doorways constructed from 6 mil or greater polyethylene sheeting.

i. The A/E shall include language in the contract documents that clearly specify that the general contractor shall be responsible for installing temporary exhaust ventilation:

j. Submit layout drawings and equipment specifications for the temporary ventilation system for approval by the District IN ADVANCE of equipment staging or installation. Following ventilation system installation and prior to material installation, the District and/or its representatives reserve the right to verify the operations of the system. Verification may include the measurement of pressure differential and/or use of ventilation tracer smoke to assess airflow patterns.

k. The temporary ventilation system must exhaust potentially contaminated air to the outside of the building.

l. The system must be capable of providing a minimum of 10 air changes per hour in the room in which the applications will be made.

m. The air exhaust must be situated no closer than 10 feet from any building air intake, operable window, doorway, or other vapor/odor entry point into the building, and no less than 20 feet from any area where children play.

n. The temporary ventilation system must be capable of generating a minimum of 0.025" WG pressure differential between the application room and any adjoining room occupied by SUHSD students, staff, or parents, with the application room being at a lower pressure than the adjoining room.

o. The temporary ventilation system is to be operated continually (i.e. 24 hours per day, 7 days per week) from the initial mixing of the materials to a period of 7 days AFTER the final application of the materials. The general contractor shall account for this in the project schedule so that the District does not incur additional unanticipated labor charges from the flooring subcontractor.

K. Carpet

1. Carpet is generally unacceptable and shall not be included in any designs unless specifically approved in advance by the SUHSD Maintenance and Operations Department.
2. If carpet is approved, provide the following carpet material, use only no/low volatile organic compound emission products. Use only carpet tile and adhesives that meet NSF/ANSI 140 rated, and/or Carpet and Rug Institute (CRI) Green Label Plus qualified products. (NOTE – CRI Green Label qualified products are NOT ALLOWED)
3. Acceptable Manufacturers:
    a. Collins and Aikman
    b. Interface
    c. PATCRAFT
4. Minimum Product Specs::
    a. Tufted, textured loop
    b. Dye Method: 100% solution dyed

c. Pile height: average: 0.110 in.
d. Gauge stitch: min. 1/12
e. Stitches: 8/in.
f. Yarn weight: 18-20 oz./sq. yd.
g. Yarn: 100% nylon with static control
h. Density factor: 7,000
i. Backing: Closed cell vinyl cushion
j. Weight: 35.5 oz. /sq.yd.
k. Density: 18.5 lbs. /cu ft.
l. Thickness: .156”
m. Self-adhesive glue-down system
n. Total weight (backing and face weight): 84.70 oz./sq.yd. +/- 5%
o. 100% PVC-free
p. Recycled Content (RC) min. 50% post-consumer recycled content (PVB/PC Glass)
q. Warranties: 15-year wear, delamination, edge ravel, static, zippering, loss of resiliency.

5. Check for alkalinity and moisture of concrete slabs. A pH range of 5 to 9 is generally satisfactory. A moisture emission rate of 5 lbs./1000 sq. ft. per 24 hours or less for direct glue-down carpets is generally acceptable. A moisture emission rate of 5 lbs./1000 sq. ft. per 24 hours or less for carpet tiles is acceptable. Consult the carpet manufacturer to determine acceptable moisture emission rates and adhesives that will be compatible with sealers (if they are used).
6. Install carpeting during school break to provide time when building is vacant for VOCs to be ventilated out of the building. Allow 14 days for building flushout.
7. Qualified Installers are required. Carpets shall be installed in strict accordance with the CRI's "Guidelines for Maintaining Indoor Air Quality during Carpet Installation", which is incorporated into the CRI's "Standard for Installation Specification of Commercial Carpet", CRI-104/2002. Specifically:
8. Carpeting should be unrolled (if rolled) and pre-aired in a well-ventilated area for no less than 24 hours prior to installation,
9. Areas where carpet is being installed are to be ventilated with fresh (outdoor) air during the installation.
10. Fresh air ventilation as well as the opening of available doors and windows should continue following installation; fresh air ventilation should be continued for 14 days
11. Flooring contractor must be certified by the carpet manufacturer prior to bid.
12. If carpet tile is deemed unsuitable for the floor being considered, carpet sheet goods, minimum 6-feet wide, are acceptable meeting the similar technical specifications noted above. Consult SUHSD Maintenance and Operations Department prior to final carpet selection.
13. Flooring contractor must provide Owner a written recycling warranty that guarantees the old carpet to be 100% recycled. Flooring Contractor shall provide a certificate of recycling during closeout phase submittal of the project.

L. Painting

1. General Procedures

a. It is recommended that the Architect, SUHSD Bond Program Manager, representative from SUHSD Maintenance and Operations Department, and a representative of a major paint manufacturer meet at the project site to review existing conditions.

b. The Architect and SUHSD Bond Program Manager and/or SUHSD Maintenance and Operations Department shall collaborate in preparing color boards (maximum 24" x 36") indicating choice of paint systems for specific surfaces, colors and where such colors will be applied on the interior and/or exterior elevations to be approved by the District and the School. In addition to paint colors, these boards shall fully convey the entire design color scheme and show other key finishes including tile, flooring, baseboard, and all other key finishes.

c. Color boards are to be developed in two steps. During schematics the Architect shall submit to the district samples of proposed finish materials and conceptual sketches of color schemes being considered. In the Design Development phase, fully developed color boards are to be submitted to the district and all revisions resubmitted and color boards approved no later than 75% Construction Documents phase.

d. Based on visual inspection, the paint manufacturer will recommend specific paint systems and surface preparation appropriate to the conditions. This approach is designed to keep abreast of manufacturer's product changes, specify products appropriate to the specific condition, and to avoid specifying products that are no longer available.

e. Architect to examine conditions of existing painted surfaces to determine if outside testing agency is required.

f. Several sealed gallons of each color, primer, etc. shall be provided to SUHSD upon completion of project.

2. Contractor Submittals

a. After colors are selected, send color schedule and brush-outs to District for review and approval.

b. Submit paint color formulas and floor plan locations for each to the District Paint Shop as part of the Project Closeout procedures.

3. Hazardous Materials

a. Paints and surface preparation agents such as epoxy paint removers containing methylene chloride (dichloromethane, CAS 75-09-2) are a health hazard and are NOT ALLOWED.

b. Substitution of materials not meeting the criteria in this section and products containing 1/10th of 1% (0.1%) or more of any [a] OSHA or Cal/OSHA, [b] NTP, or [c] IARC-listed carcinogens shall be clearly identified during the submittal process and require written approval by: SUHSD Maintenance and Operations Department.

c. In order to obtain this approval submit a detailed written justification for the substitution, including complete information (technical data sheet (TDS) and materials safety data sheet (MSDS)) regarding the proposed alternate material to the SUHSD Maintenance and Operations Department no less than 10 working days in advance of the planned use of the non-complying material. Failure to provide written justification for the substitution (i.e. submission of TDS and MSDS without further explanation) will be grounds for rejection of the request without further comment or evaluation.

d. The use of two-component polyurethane paint systems in occupied school sites is NOT ALLOWED.

e. All paints and coatings must meet the California Air Resources Board (CARB) and Bay Area Air Quality Management District current standards and regulations.

f. Recycled paints are NOT ALLOWED.

g. EPA Method 24 VOC testing is standard for all paints. Results can be found on the product's Technical Data Sheets and/or labels. Architects and project designers may easily verify the Volatile Organic Compound test results by consulting with the paint or coating manufacturer's technical representative. Similarly the presence of "exempt" VOCs can best be identified by asking the technical representative if a product or products "contains 0.1% or greater of and non-photoreactive (i.e. exempt) VOCs".

h. If an architectural coating is recommended for more than one use, the most restrictive VOC limit shall apply.

4. SUHSD acceptable paint manufacturers include:

a. Benjamin Moore Co. – typical for exterior use. Can be used for interior upon approval by SUHSD Maintenance and Operations Department

b. Kelly Moore Paint Co. – typical for interior use. Can be used for exterior upon approval by SUHSD Maintenance and Operations Department.

5. Interior Painting

a. Interior primers, paints, finishes, and similar coatings:

1) Must NOT contain greater than 50 grams/liter of Volatile Organic Compounds (VOCs) as determined by EPA Method 24. Zero (0) VOC content paints, or paints with VOC contents significantly lower than the 50 gram/liter limit are strongly preferred.

2) Must NOT contain 0.1% (volume/volume) or greater of any "Exempt" (non-photoreactive) VOC as listed in 40 CFR 51.100(s)(1).

3) Must meet or exceed the requirements of the current edition of Green Seal Standard GS-11.

b. Painted ceilings are to have a reflectivity of 80% or higher to improve lighting distribution. Flat ceiling finishes should be specified with indirect lighting to minimize glare highlights. Specify flat paints to be "washable."

c. Use standard manufacturer tinted colors. Custom mixed colors are NOT ALLOWED unless existing colors are being matched.

d. Color-tint sealers and undercoats to correspond with finish color. Vary color of successive coats sufficiently to distinguish between coats.

e. Undercoat/Primer (acrylic latex, enamel undercoat)

f. Confer with Paint Manufacturer for a suitable primer. Pigmented shellac primer can be problematic.

g. Toilet Rooms: Acrylic latex, industrial maintenance coatings.

1) Walls/Ceilings: 1 full coat primer and 2 full coat gloss finish.

2) Accents: 1 full coat primer and 2 full coat high gloss finish.

h. Interior Corridors/Stairs: Acrylic latex

1) Walls: 1 full coat primer and 2 full coat semi-gloss finish.

2) Accents: 1 full coat primer and 2 full coat semi-gloss finish.

3) Ceilings: 1 full coat primer and 2 full coat flat finish.
4) Doors: 1 full coat primer and 2 full coat gloss finish.

i. Offices: Acrylic latex
1) Walls: 1 full coat primer and 2 full coat eggshell finish
2) Accents: 1 full coat primer and 2 full coat eggshell finish
3) Ceilings: 1 full coat primer and 2 full coat flat finish
4) Doors: 1 full coat primer and 2 full coat gloss finish

j. Classrooms: Acrylic latex.
1) Walls: 1 full coat primer and 2 full coat semi-gloss finish.
2) Trim: 1 full coat primer and 2 full coat gloss finish.
3) Ceiling: 1 full coat primer and 2 full coat flat finish.

k. Interior metal handrails:
1) 1 full coat Acrylic Metal Primer and 2 full coats Semi-Gloss Enamel,

6. Exterior Painting

a. For maintenance purposes, logical and easily maintained color schemes should be developed.

b. Avoid complex multi-color patterns, and create color transitions at logical break points such as inside or outside corners, existing reveals, or other logical color transition points.

c. Avoid excessive amounts of colors, including subtle differences in the same shade of color.

d. Special attention should be given to areas most subject to wear or graffiti. In these areas a single color should be utilized to allow for ease of repainting which will occur more frequently than non-accessible areas of the building.

e. Walls: 1 full coat primer and 2 full coats of a non-flat finish such as low sheen or an equivalent to low sheen.

l. Exposed galvanized metal (i.e., guardrails, handrails, fencing): 1 full coat Acrylic Metal Primer and 2 full coats Semi-Gloss Enamel. Clean and prime per manufacturer's approved procedures.

m. Exterior Stucco & Concrete walls: 1 full coat Masonry Primer and 2 full coat Elastomeric Eggshell Sheen

n. Mold and mildew retardant to be included in paint – to be specified by SUHSD Maintenance and Operations Department.

o. The only use allowed for anti-graffiti is at concrete planters and at exterior brick locations.

p. Exterior doors: to be water bourne gloss enamel.

q. Use custom colors to match existing campus colors.

r. At exterior steel structures such as stairs, select a high-performance paint resistant to protect against corrosion.

s. Acceptable manufacturers. Benjamin Moore and Kelly Moore. Pratt and Lambert colors for Sequoia High School and Carlmont High School.

t. No graffiti coating for painted surfaces.

7. Painting Preparations

a. Specifications shall include removal and reinstallation of any signage required for painting, such as room numbers, fire life safety equipment, boiler room, switchplate covers, outlet covers, etc.

b. Building detail accessories shall be removed or masked off before painting (signage, grills, electrical cover plates, etc.).

c. Note areas that require special attention or preparation prior to painting. Cracks shall be filled, window surrounds re-caulked and sealed, loose window glazing compound removed and replaced, rust removed from metal elements scheduled for painting, etc.

d. Use flexible patching compound (preferably Clark's Patching Compound or Kelly Moore Patching Compound) on walls.

e. Use primer designed for new wood. Apply patching or filler materials after primer is applied. Sand after primer and patching is applied to smooth raised grain. Apply primer over patched and filled area.

f. Confer with Paint Manufacturer for a suitable cleaning and primer instructions. Pigmented shellac primer can be problematic.

g. On glossy surfaces, de-gloss surface for maximum adhesion by chemical and or mechanical means, using Jasco products that are odorless and biodegradable, such as Jasco 'Liquid Sander Paint Etch and 'TSP No Rinse Substitute,' or by power sanding.

h. Use primer designed for metals on clean, rust-free metal surfaces. New galvanized metal must be etched with a material that is designed for etching new-galvanized metal. Iron surfaces must have a rust inhibitor primer and/or rust converter.

i. Undercoat/Primer (acrylic latex enamel undercoat or acrylic multi-prime) for maximum adhesion for all surfaces except stucco.

j. Remove rust before painting. Removal of rust from roof vents and mechanical housings can be included in roof replacement/repair contract.

k. Adjacent planting alongside buildings, retaining walls, etc. are to be protected by trimming or wrapping in tarps.

M. Vinyl Covered Wall Panels

1. All panel components to meet Class A flame spread rating as determined by ASTM E84 Tunnel Test.
2. Vinyl covering shall be bonded directly to the core to prevent sag or distortion and returned at all edges to the back of the panel. Manufacturer must insure flat, wrinkle free surface and tailored corners. No seams permitted in the covering.
3. Provide clear anodized aluminum trims at the tops, bottoms, and sides of all panels. At the joint lines between two panels, there is no need for a trim.
4. Finish fabric: To be completely adhered to the face of the panel and returned to the back for a full finished edge. All corners to be fully tailored. Minimum NRC rating of 0.80 (ASTM C423).
5. All panels shall be pre-sized in the manufacturer's plant from exact field dimensions provided by the installing contractor, to a tolerance of 1/8 inch.
6. Mounting Type 'A'; Square edges and wrapped; Square corners
7. Panel type: ½" thick mineral fiberboard core, non-sound rated, decorative tack panel; Color: Crosstown or Spellbound

8. Acceptable Manufacturer for Vinyl Covering (District Standard – NO SUBSTITUTIONS):
    a. Koroseal Wall Protection Systems Fairlawn, OH, 44333 (phone: 1-800-628-0449)
9. Acceptable Manufacturer for Panel: Golterman & Sabo, Inc. or acceptable equal.

DIVISION 10 – SPECIALTIES

A. Visual Display Surfaces

1. Porcelain enamel marker boards with 4' x 16' x 24 gauge (0.0209-inch, uncoated thickness) face sheets with porcelain-enamel coating fused to steel face finish, 3/8-inch particleboard cores, and .015-inch aluminum backing sheets. The porcelain coated boards with steel substrate shall have magnetic properties to allow use of magnet for attaching postings.
2. Provide display rails, marker trays, map hooks, and flag holders.
3. Provide 1/4-inch thick natural cork-surfaced tack boards with 3/8-inch thick fiberboard backing.
4. If tack boards are covered with fabric, provide 100% polyester, soil and stain resistant fabric, as supplied by the marker board company, meeting ASTM-E 84 Flame Tunnel Test Class "A" rating.
5. When using tackable panels on the wall, indicate installation height so as to protect walls from damage from back of chairs.
6. Acceptable manufacturers:
    - Forbo Bulletin Board
    - Claridge Cork
    - Tacwall or equal
    - Koroseal Crosstown or Spellbound for fabric covered tackable panel. This is SUHSD standard.
7. Provide permanent stenciled horizontal lines or horizontal/vertical grid lines on marker boards per school request. Coordinate with school principal.
8. Marker board resurfacing is not allowed.

B. Operable Partitions

1. Manually operated, top supported operable partitions with retractable seals. Provide structural steel support system connected to the building structure at appropriate points.
2. Products to be UL listed or similar independent laboratory. Flame spread to meet code requirements for maximum 25 flame spread and maximum 450 smoke density; Class A ASTM E84
3. Provide minimum three field sound transmission rating tests on previous projects of similar scope indicating system to be provided has minimum STC rating of 40.
4. Installers shall have a minimum of five years successful experience in installing operable partitions and accessories on comparable projects.
5. Basis of Design: Modernfold
6. Additional acceptable manufacturers:
    - Hufcor, Inc
    - Industrial Acoustics Co. Inc.

C. Toilet Compartments

1. General Requirements

a. Partitions shall meet NFPA 101 flame spread and smoke developed requirements.

b. Provide backing within walls and ceilings to withstand partition loading, including weight of children climbing on partitions. Destructive testing is recommended at existing walls to confirm wall framing and approach for providing adequate backing. See Division 00 for destructive testing guidelines and Division 5 for alterations to existing metal-framed walls.

c. Partitions suspended from ceilings are not allowed.

d. Provide 10-year guarantee against breakage, de-lamination, and rusting of partitions and hardware.

e. Recycled content partitions are encouraged subject to approval by SUHSD.

2. Products

a. Overhead-Braced floor mounted Bobrick 1082.67 Duraline Series. Bobrick Sierra line can be used upon approval by SUHSD Maintenance and Operations Department.

b. Solid phenolic material constructed of solidly fused plastic laminate with matte- finish melamine surfaces, colored face sheets, and black phenolic-resin core that are integrally bonded. Edges shall be black. Brown edges shall not be acceptable. Solid phenolic material shall meet National Fire Protection Association Class B, Uniform Building Code Class II, ASTM E-84 Fire Resistance Standards: flame spread 69, smoke density 93.

c. Provide ¾" thick doors and stiles along with ½" side panels and benches.

3. Hardware

a. Institutional hardware is required.

b. Provide stainless steel saddle leveling plates with lips to seat stile and stainless steel bolt, nut, and washer.

c. Use pin-in-head type tamper-proof screws and through-bolts.

d. Provide full-length bracket for stiles adjacent to walls.

e. Provide overhead braces with sloped and contoured profile that makes them difficult to grip in order to avoid students hanging from partitions.

f. Provide barrel-type hinges on compartment doors.

g. At accessible stalls provide self-closing out-swing door with pull handles on both faces.

D. Toilet Accessories

1. General Comments

a. A/E shall review with the SUHSD Maintenance and Operations Department before indicating on the construction documents that the contractor is to salvage accessories either for reinstallation or pickup and storage by the District. In many cases this is neither feasible nor practical.

b. A/E shall indicate all accessories on both floor plans and interior elevations.

c. All accessories shall be mounted in compliance with applicable CBC and ADA requirements. When the code-required mounting dimension is a minimum or maximum, the A/E should locate the accessory and indicate a dimension so as to provide for appropriate construction tolerance.

2. Mirrors

a. 18 gauge (1.2mm) Type 430 stainless steel mirror with bright polished finish and frame, except use mirrored glass surface with satin stainless steel frame at administrators' and teachers' restrooms - by Bobrick (www.bobrick.com). Glass mirrors are not allowed at student restrooms unless otherwise approved by SUHSD Maintenance and Operations Department.

b. Mirrors shall have frames on all four sides. Frames shall be theft-proof type.

c. The code-required mounting height for mirrors is from the bottom of the mirrored surface, not the frame.

3. Grab Bars

a. Grab bars shall be Bobrick model B-5806, 18 gauge, type 304 satin finish stainless steel tubing, 1-1/4" in diameter with concealed mounting flanges.

b. Provide wall backing for all grab bar anchors and fasteners. Structural strength of grab bars and their mounting devices shall withstand more than 250 pounds of force.

c. Grab bars shall be sized complying with CBC and ADA dimensional requirements:

4. Paper Towel Dispensers

a. The District uses roll paper towel goods as well as electric dryers.

b. Locate paper towel dispensers so that they are out of the path of travel. However, avoid custom wall pockets for towel dispensers if other surface mount options exist. The placement should protect the dispensers from accidental contact by a sight-impaired person and meet barrier free accessibility guidelines.

c. Ensure any conflicts with material changes or wainscot heights are coordinated with the dispenser mounting height.

d. Locate paper towel dispensers at all Classroom sinks. District will provide these surface mount units (only at classroom and lab sinks) and contractor to install them. Architect shall show the locations on the drawings.

e. Recessed paper towel dispensers at restrooms will be contractor furnished and installed.

f. Acceptable Products: Bobrick

5. Soap Dispensers

a. Locate one soap dispenser between each pair of lavatories in multi-accommodation restrooms (one dispenser per pair of lavatories).

b. Locate soap dispensers at all classroom sinks (one soap dispenser may be shared by a pair of side-by-side sinks, where they occur).

c. Acceptable products are Bobrick models B-2111 (vertical orientation) and B-2112 (horizontal orientation) surface-mounted (with concealed, vandal-resistant mounting), stainless steel (type 304, satin finish), 40-oz. capacity liquid soap dispenser with lockable hinged stainless steel lid. NO SUBSTITUTIONS ARE ALLOWED during either design or construction

6. Toilet Paper Dispensers

a. District shall provide toilet paper dispensers for standard ("non-accessible") toilet stall locations. Contractor shall be responsible for installation of these units.

b. Wall-mounted, recessed multi-roll toilet paper dispensers shall be used whenever possible in accessible toilet stalls.

c. Acceptable manufacturer: Bobrick recessed models with reserve roll above available roll.

7. Surface-Mounted Seat Cover Dispensers

a. Acceptable product is Bobrick B-221 Classic Series surface-mounted seat cover dispenser.

b. Dispensers are to be installed at all restrooms – one per stall.

8. Sanitary Napkin Disposal Units

a. Provide one sanitary napkin disposal at all adult/staff women's and unisex restrooms and one at each stall in student girls' restrooms. Mount to comply with accessibility requirements.

b. Surface-Mounted: Bobrick B-270 (3-13/16" projection from wall)

c. Recess-Mounted: Bobrick B-35303

E. Fire Protection Specialties

1. Fire Hose Cabinets

a. Minimize glass area on cabinet doors.

b. Check and repair or replace valves as needed.

c. Institutional weight: 22 gauge steel for cabinet.

2. Fire Extinguisher Cabinets

a. Steel cabinet with continuous hinge,

- Manufacturer: Larsen's, Architectural Series; http://www.larsensmfg.com/fire_extinguishers/fire_extinguisher_cabinets_architectural_series.html.

b. Vertical Duo Panel with Tempered Glass

c. Stainless steel finish or painted steel to match existing conditions.

d. Semi-recessed in hallways with sign at the top that projects out of the wall surface.

e. Acceptable Manufacturers: Larsen's, J.L. Industries.

F. Lockers

1. All welded construction with 17-gauge (.0528-inch) thick sides, backs, tops, and bottoms with 15-gauge (.0677-inch) thick, steel door panels.
2. Continuous door strikes. Attachment between door and hinge and between hinge and door frame to be bolted for ease of door replacement.
3. Stiffeners mounted on the inside face of the single and double tier doors for sound reduction.
4. Nylon-covered latching mechanisms.
5. Single-point lock to eliminate springs and latches (needs double-walled door).
6. Enamel baked finish or electrostatic powder coating.
7. Ventilate lockers.
8. Coordinate the number of keys required with SUHSD Maintenance and Operations Department.

9. Provide the required number of accessible lockers per CBC, with special needs latches and accessible locking mechanisms.
10. Show accessible lockers on floor plans and interior elevations.
11. Book shelf and coat hook shall be mounted no higher than 48" above the finish floor.
12. One additional shelf shall be mounted near the bottom of the locker but no lower than 9" above the finish floor.
13. Where appropriate, two-tier locker arrangements allow the lower locker to be used as the accessible locker.
14. Handles shall have a handle that is easy to grasp with one hand and does not require tight grasping, pinching, or twisting of the wrist to operate.
15. Locker doors shall require no more than 5 lbs. of force to operate.
16. Lock shall be ADA-compliant, Digilock, one-touch access. Lock shall unlock by using button key and provide audio and visual indicators.
17. Acceptable manufactures:
    a. Lyon Work Space Products, www.lyonworkspace.com
    a. Republic Storage Systems, www.republicstorage.com
    b. PENCO Products, www.pencoproducts.com

G. Louvers and Vents

1. Locate air intake louvers at least ten (10) feet above the ground; do not locate intake louvers near large concentrations of vehicle exhaust (i.e. next to freeways, idling vehicles, and loading docks), or facing southwest.
2. Provide formed copper, formed stainless steel or extruded aluminum louver blades, with high-performance, powder coated, suitable for a high salt atmosphere.
3. Provide storm resistant, drainable-blade louvers at air intake locations. Comply with the performance requirements established by the Air Movement and Control Association International Inc. (AMCA), Publication 3: AMCA Certified Ratings. Arlington Heights, IL: AMCA, 2000; www.amca.org.
4. Provide storm resistant bird screens.
5. Use insect screens with caution and only if other means of insect exclusion, such as filters in air-handling equipment, are absent; the small openings between the wires become easily clogged, causing the screens to become damaged and optimum airflow to be obstructed.

H. Bird Deterrents

1. For modernization projects consideration should be given to the use of bird deterrent devices to discourage the congregation of pigeons and other birds. Use of stainless steel spikes is a preferred solution as opposed to netting.
2. At new construction, Architect to avoid certain design elements that encourage congregation of birds. Review this with the SUHSD Maintenance and Operations Department.
3. Acceptable Manufacturers:
    - Bird B Gone

      www.birdbgone.com

- Nixalite

  www.nixalite.com

4. If netting is more appropriate use black knotted polyethylene fiber having 6 individual strands of 12 denier wound together. Acceptable Manufacture: Hot Foot Invisinet

I. Impact Resistant Wall Protection

1. Corner guards

Flush-mounted (fire rated where required) stainless steel, 0.028 and 0.040-inch thick, medium duty or better, satin finish.

2. Wall Covering

b. Class 'A', 0.040 inch thick low VOC adhesives approved by wall covering manufacturer with matching accessory molding.

c. Acceptable Manufacture:

- Koroseal Apollo Series Spellbound is the district standard. No substitutions allowed.

J. Signage

1. General Requirements

a. Signage is to meet current CBC and DSA requirements.

b. Individually label each room and stairway.

c. Self-illuminating signage (commonly called emergency exit indicators) that makes use of tritium or other radioactive elements is NOT ALLOWED.

d. Applied copy signage is NOT ALLOWED.

e. Ensure any conflicts with material changes, trim work or wainscot heights are coordinated with the signage to allow for a flush installation.

f. Demolition plans shall indicate that existing signs shall be removed when replaced with new ADA compliant signs.

g. Architect should be aware of different sign types such as room signs for interior and exterior applications.

2. All Signage Criteria

a. Character and symbol size for all signs as follows:

1) On visual signs, size characters and symbols according to viewing distance. Sign mounted 80" or more AFF must have 3" high (minimum) characters.

2) Pictograms (pictorial symbols) and ISAs (International Symbol of Accessibility) on interior signs at eye level should be 3" (minimum) high or twice as high as height of largest text on sign, whichever is greater. On signs where the bottom is 72" or more AFF, (minimum) pictograms or ISAs should be 6" high or twice as height as height of largest text on sign, whichever is greater. NOTE: Pictograms and other symbols, such as ISAs, which are included on signs with raised characters and Braille, are not required to be raised. The ISA,

when included on a tactile sign, does not require any accompanying text, either visual or tactile.

3) On tactile signs, raised characters must be 5/8" minimum and 2" maximum in height.

4) Pictograms that identify rooms and spaces, such as gender pictograms for restrooms must be in a 6" (minimum) height field directly above accompanying raised text and California Braille. No characters or Braille in field.

b. Use the following criteria for signage:

1) Except for reflective parking and traffic signs, all identification, informational and directional signs must have non-glare backgrounds and characters. "Matte," "satin" or brushed metals are rarely appropriate. These and other shiny or reflective materials are only appropriate for frames or other strictly decorative elements, which don't intrude into the area of the sign.

2) Contrast between characters and background must be 70% (minimum).

3) Geometric symbol door signs for restrooms must color contrast with the door.

4) Character width 100 percent (maximum) and 60 percent (minimum) of height, measured by width of uppercase "X" at base; or by width of uppercase "O" (whichever is more narrow). Stroke width must be 10 percent (minimum) to 20 percent (maximum) of character height, measured by stroke, width, and height of uppercase "I."

5) Script, italic or oblique typestyles are NOT ALLOWED.

6) Cut vinyl letters or applied copy signage is NOT ALLOWED.

7) Ease all edges and corners of signs. On signs installed on poles, provide radius corners and eased edges.

8) Signs mounted on glazing are to have a same size blank backer sign on the opposite side to cover adhesive spots on the glazing.

9) Concealed mounting system. Epoxy attachment is preferred. Double-sided tape is not allowed.

c. For exterior signs, and where epoxy mounted signage is not practical, provide tamper resistant screw mounting

3. Room and Exit Signage

a. All rooms and areas within a building shall be identified with a number. This includes stairs, restrooms, storage and mechanical rooms, etc. Elevators and wheelchair lifts are also required to be numbered. Rooms and areas that open directly onto a corridor shall be given a number designation (no letters) irrespective of whether or not they also have a room name. Rooms within other rooms (i.e., rooms without direct access from a corridor) shall have a letter designation following the room number (example: 214A, 214B, etc.) so that in an emergency fire department personnel can more easily locate these rooms. Room labeling for special use rooms or rooms with hazardous materials shall include any precautions needed for the room.

b. <u>For renovation work, DO NOT change the room numbers which are already in place</u>. Existing room numbers need to be confirmed so they agree with the plans. Any new numbering shall be coordinated with SUHSD Maintenance and Operations Department and the school site.

c. Confirm final room numbers for all new schools with the District. After the room numbers are established, they should NOT be changed because they are tied to the addressable systems (fire alarm, energy management systems, etc.) and tracked by DSA.

d. Mount restroom door symbol on the door, 5'-0" above finished floor and centered on the door, left to right. Colored plastic sign, 0.25-inch thick.

e. Unisex restroom signs shall comply with CBC Section 1115B.6.3. The male triangle symbol shall be of a color that is different from and contrasts with the background female circular symbol. In addition, the language on the sign shall read “RESTROOM” or “STAFF” as applicable and avoid the term “UNISEX.”

f. Room Identification signage must be installed adjacent to the specific door they identify. Mount the sign 60” from the centerline of the sign to the top of the finished floor. The sign must not be installed behind an obstruction, and the reader must be able to approach the sign within 3” without being hit by the swing of the door. Specify colored plastic signs, 0.125-inch thick.

g. At outdoor installations, provide signs with tough laminated polycarbonate face adhered to 1/8” acrylic back plate for added stability.

4. Tactile Signage

a. Raised characters must use Sans Serif font, in all uppercase characters. NO Serif fonts of any kind are allowed. Use 1/8” (minimum) between the two closest points of adjacent tactile characters, measured at top surface of characters. Use beveled or rounded characters.

b. Braille should be directly below the text, separated by 3/8” (minimum) from the bottom of text to top of Braille, either flush left with text or centered below it, depending on layout. Keep tactile messages very brief.

c. California Grade 2 Braille must accompany raised text characters. NOTE: Most Braille signs that are identified by manufacturers to be ADA compliant do not comply with California’s requirement.

d. Use rounded or domed California Braille dots, each distinct and separate.

e. California Braille dots within cells must be 1/10” apart o.c. Cells must be 2/10” apart. Measure cell distance from the center of top dot location of column two of the first cell to the center of top dot location of column one of the next cell on right, within the same word. Dots must be 1/40” high at dot apex

5. Informational and Directional Signage

a. Firefighter Stairwell Informational and Directional Signage are to be placed at decision points at the locations most visible from the primary direction of approach. Align the top of the sign panel with the tops of adjacent room identification signs.

b. Directional signage to be coordinated with floor plan layout. Contact LOCAL FIRE DEPARTMENT for directional signage requirements.

c. For exterior sign applications, exposed to the various weather conditions, refer to sign types for parking lots as noted below. Vinyl adhesive-applied signage is not allowed.

6. Parking Lot Signage

a. Engineer-grade reflective recycled aluminum 0.63 thick; porcelain enamel with beaded text and symbols, min. size 12” x 18”. Mount signs where applicable on galvanized steel post embedded into concrete footings, minimum 12-inches in diameter and in depth

b. Mount Tow-Away sign per CBC and ADA requirements at entry gate or driveway approach to school parking lot. Confirm with SUHSD Maintenance and Operations Department for the Tow Away Sign phone number.

c. Include “NO SKATEBOARDING – NO ROLLER SKATING – NO BIKE RIDING” signage at parking lots and other locations where designated by the District.

DIVISION 11 – EQUIPMENT

A. Energy Efficiency Requirements

1. All equipment shall comply with the highest Consortium for Energy Efficiency (www.cee1.org) tier available for that product category. Where no CEE rating is available, equipment should meet Energy Star criteria. All equipment should be cross-referenced with available PG&E rebates and the Project Manager should be alerted to their existence where applicable.
2. Any proposed equipment that is not eligible for either standard above must be approved in advance by the District.

B. Assisted Listening Devices

1. Provide frequency modulated radio frequency type assistive listening system complete with all required transmitters, receivers, earphones, and accessories. All electrical components shall be listed and approved by Underwriters Laboratories. All broadcasting/receiving components and system shall be approved by the Federal Commission (FCC)
2. Suggested Suppliers:
    a. www.gentnerals.com
    b. www.centrum sound.com (408) 736 6500
    c. www.audiogear.com (800) 959 4252

C. Kitchen Equipment

1. See energy efficiency requirements listed above. Selected equipment shall qualify for PG&E Food Service Technology Center (www.fishnick.com) rebates unless exempted.
2. All appliances to be electric models only. Gas appliances can be used only with written authorization from SUHSD Maintenance and Operations Department.
3. Contact the SUHSD Maintenance and Operations Department to discuss equipment selections and additional requirements for each project.

D. Laundry Equipment

1. Contact the SUHSD Maintenance and Operations Department to discuss equipment selections and additional requirements for each project.
2. All appliances to be electric models only. Gas appliances can be used only with written authorization from SUHSD Maintenance and Operations Department.
3. Coordinate location of such equipment with custodial services of school site. Location shall have water supply and drain line available, in addition to the electrical power, preferably at the custodial room or boiler/mechanical room.
4. Preferably washing machine should be near a service utility sink.

E. Audio Visual Equipment

1. Projectors

a. Contact the SUHSD Maintenance and Operations Department to discuss equipment selections and additional requirements for each project.

2. Interactive Projection Boards ("Smart Boards")

a. Contact the SUHSD Maintenance and Operations Department to discuss interactive board selections and additional requirements for each project

F. Laboratory Fume Hoods

1. Laboratory fume hoods are to meet or exceed Cal/OSHA requirements per section 8 CCR 5154.1.
2. Provide ONLY ducted laboratory hoods exhausting air to the exterior of the building. Ducting shall be negatively pressurized inside the building envelope. Re-circulating or "ductless" (filter-equipped) hoods are NOT ALLOWED.
3. Do not incorporate demonstration (two-sided) laboratory hoods into any designs.
4. Position laboratory hoods away from doors, operable windows, and other air sources that can create turbulence and/or contaminant re-entrainment from the hood.

G. Kilns

1. Regardless as to whether fired by gas, electricity, or other means, kilns can emit potentially hazardous air contaminants including carbon monoxide, oxides of nitrogen, metal fumes, and halogen gases (chlorine and fluorine as examples).
2. All kilns must be purchased with the manufacturer-designed mechanical (fan-powered) ventilation ("venting") kit. Care should be taken in preparing the order for the kiln as manufacturers may sell the venting kit as an optional added-cost accessory rather than as part of the basic kiln assembly.
3. Ventilation must be exhausted directly to the exterior of the building at a location away from foot traffic, play areas, windows, or building air intakes.
4. The exhaust system is to have a separate electrical circuit.
5. Through the use of the venting kit, points where firing and combustion products may escape from the kiln's firing chamber and into the room must have air flowing into the firing chamber, unless the kiln itself is housed inside of an exhaust hood or ventilated enclosure. Such exhaust hoods or ventilated enclosures must have air flowing into them from the surrounding room in sufficient volume and velocities to capture firing and combustion products emitted from the kiln and prevent their escape into the room.
6. During kiln operation, fans in venting kits must be operated in strict accordance with the manufacturer's recommendations. Kilns housed in exhaust hoods or ventilated enclosures must be equipped with electrical interlocks to prevent the kiln from firing unless the fans are operating.
7. Tie the room heat detector into the shunt-trip beaker of the kiln.
8. Pottery rooms need clay traps in sinks and storage for the work.
9. Anchor kilns securely to their working surface.
10. High temperature sprinkler heads required at kiln rooms.

DIVISION 12 – FURNISHINGS

A. Window Shades

1. General Requirements

a. Provide layout drawings for shade installation showing elevations and sections through the shades and operating (cam) handles. Shade configuration drawings shall include the sill, jamb, and head window details, showing how the shades are positioned in relation to the handles. Architects must consider both operability and ventilation in laying out window shade configurations. In some cases in order to address operability and provide adequate ventilation two rows of brackets with shades on a given window may be required. Review with the SUHSD Maintenance and Operations Department options to best meet the needs and requirements of the particular site and orientation of the windows on that site. As orientation of the windows vary, it is likely that multiple options may be required to address the particular conditions of the school.

b. Install with clearance, for window operations level and plumb, secure for unencumbered operation.

c. Provide maintenance manual showing shade repair guidelines and replacement with parts diagrams from manufacturer.

d. Prior to fabrication, vendor/contractor shall contact the SUHSD Maintenance and Operations Department to arrange sample installation for review and acceptance by the Architect and District.

e. Provide spare parts amounting to 10% of the job to SUHSD Maintenance and Operations Department.

f. Coordinate the window hardware, such as handles, with shade hardware.

g. Mounting brackets for shades shall not be installed on window stops.

h. Warranty: 2 years from manufacturer and 2 years from installers.

i. Recessed ceiling shade pockets at suspended acoustical ceiling or dropped drywall ceilings are discouraged. However because of pre-existing or new building conditions, such feature has to be implemented, consult SUHSD Maintenance and Operations Department for further evaluation.

j. Side and Sill Channels: For room darkening shades or blackout shades, provide 2-piece extruded aluminum side and sill channels to eliminate left, right and bottom edge light gaps. One-piece side channels will not be acceptable.

2. Acceptable Manufacturers:

a. Draper, Inc.

b. MechoShade Systems, Inc. only if approved by SUHSD Maintenance and Operations Department.

3. Manually Operated Shades

a. Manual Techmatic FlexShade by Draper unless otherwise approved by SUHSD Maintenance and Operations Department.

b. Provide at all windows including transom above doors.

4. Motorized Shades

a. Motorized FlexShade by Draper unless otherwise approved by SUHSD Maintenance and Operations Department.

b. Provide at all floor-to-ceiling height curtain wall systems.

5. Shade Cloth Material

a. All curtains and drapes shall be made of interwoven non-combustible fiber, inherently flame-retardant and permanently flame-resistant. Material shall pass tests per NFPA 701, Test Methods 1 and 2. Fire rating: NFPA Class A.

b. Shades shall be hemmed top and bottom, with both hems double needle stitched and backstitched at edges. Hems must be turned so that stitching passes through three thicknesses of fabric.

c. Sufficient length of material to allow two complete wraps around roller when shade is fully extended Roller in hem construction prevents fabric from being pulled of roller. Fabric is to be attached by double wide staples. No adhesive is allowed.

d. Material for general and blackout shading shall be Phifer SheerWeave Performance Plus Interior Sun Control Fabric Style 2500, or approved equal. Greenguard certified

e. Classrooms – Color as selected, 0% openness factor if required for blackout shades

f. Offices – Color as selected, 1% openness factor

6. Rollers

a. Clutch mechanism: Provide a heavy-duty single spring that creates a positive mechanical relationship between the roller shade tube unit and the universal installation bracket to ensure stationary positioning in the static state. When activated the wrap spring shall release and permit the clutch to turn while reducing friction on the clutch. Clutch mechanisms with multiple springs are not acceptable.

b. Clutch bracket: The clutch shall be fixed to the installation bracket with tech screws. It must be removable without having to remove the installation brackets from the wall. Clutch mechanism shall be fastened with screws and not riveted to the brackets.

c. Spring loaded and retractable idle end cap – with retractable pin end to provide secure anchorage into end bracket and to provide for simple and easy installation.

d. Spring roller diameter length and material as needed to support shade length, width and material weight 1-1/2"diameter min. x width needed to cover window.

e. Use steel rollers for all shades exceeding 45” in width; heavy-duty springs and positive locking mechanisms.

7. Mounting Brackets

a. Diameter to match roller, closed end projection adequate to clear all hardware galvanized steel finish, compatible with aluminum if aluminum sash, isolate if necessary.

b. Brackets must have nylon insert on pin side. Mount brackets with ¼” hex head screws.

c. Installation brackets are not universal in design. They shall support 150 percent of the full weight of the shade. Specify brackets either for ceiling mount, right wall mount and/or left hand wall mount installation. Clutch mechanism shall be screwed to the clutch side of the installation brackets for superior durability.

d. Idler End Mounting Bracket: The idler end installation shall include a ball bearing idler socket for quiet and ultra-smooth rotation. It shall also include a built-in height leveling adjustment to minimize shade telescoping.

8. Pulleys

a. Tolerances are critical to performance.

b. Spacing between pulley roller and pulley roller bracket arm holding the pulley roller must not allow shade cord to catch.

c. Closed end stop pulleys on all shades.

d. All metal roller catches mounted with ¼" hex head screws.

9. Cord

a. Shall be stainless steel chain. Nickel plated steel chain not acceptable. Include cord clasp to be mounted at appropriate height above window sill side wall.

b. Braided fabric cord is not acceptable.

c. Chain shall be rated for 90 lbs. breaking strength.

10. Fascia

a. Continuous extruded aluminum "L"-shaped profile to conceal the roller shade tube mechanism. It shall be attached to the tube mounting brackets by snapping it in place on a hinge rib clip, without the use of adhesives, magnetic strips, or exposed fasteners. It shall be able to be installed across two or more shade bands in one piece as specified.

b. Fascia minimum thickness of 5/16-inch with paint finish in color as selected.

c. Provide bracket/fascia end caps where mounting conditions expose outside of roller shade brackets.

d. Notching of fascia for manual drive chain shall not be acceptable.

11. Hem Bar/Slat

a. Kiln dried hard maple, mahogany, or poplar, size as required but none less than 1-1/4" x 5/16". Length to equal width of shade material across window.

b. Hem (sew) ends of hem bar or slat to shade material.

12. Screw Eyes

a. Brass screw eyes: Screw eyes shall not be oversized. Any splitting of slats caused by screw eye installation shall be rejected.

DIVISION 13 – SPECIAL CONSTRUCTION

A. Pre-Fabricated Structures

1. The use of pre-fabricated structures must be approved by the District prior to incorporation into a design. Common pre-fabricated structures include: Covered Lunch Shelters, Metal Ramps/Stairs, and Bleachers.
2. Aluminum metal ramp/stair systems are acceptable in certain applications where a concrete ramp/stair may not be appropriate.
3. Any pre-fabricated structures need to be reviewed by SUHSD Maintenance and Operations Department prior to incorporation in the project. The construction document set must include a valid PC approval set of drawings of the complete pre-fabricated structure.

B. Modular Buildings

The use of modular classroom buildings is discouraged and will only be considered if time constraints are an issue on the project. If modular classroom buildings are approved, the buildings components must comply with and follow the District Standards.

C. Temporary Classroom Buildings

1. The use of temporary classroom buildings may be required in a project to allow for needed swing space for the continued operation of a school during construction. The number of buildings and layout must be approved by SUHSD Maintenance and Operations Department prior to finalizing the construction drawings.
2. Utilities for temporary buildings should be routed in rigid conduit or overhead whenever possible. Underground utility installation for temporary utilities is discouraged.
3. Downspouts should surface drain. Drain pipes through asphalt berms may be required to avoid ponding.
4. Spot elevations at each corner of each temporary classroom should be taken and included on the drawings. Any elevation change greater than 12” will require asphalt berms to be installed prior to setting the portable classroom.
5. Include the removal and patching of any temporary asphalt berms required at foundations and ramp landings.
6. Verify power requirements early in the design as temporary transformer installations are sometimes required and the installation process through PG&E can take +6 months.
7. Power & Data Requirements in Classrooms: (4) data & (2) quad outlet for Students, (2) data & (1) quad outlet for Teacher. Locate each set of data/power at far opposite corners of the temporary classroom.
8. Power & Data Requirements in Temporary Computer Labs: (8) sets of (4) data & (2) quad outlets equally spaced at perimeter walls.
9. Power & Data Requirements in Temporary Library Buildings: (4) data & (2) quad outlet for Students, (2) data & (1) quad outlet for Teacher. Locate each set of data/power at far opposite corners of the temporary classroom.
10. IDF cabinet should be wall mounted and located in the temporary Computer Lab building if one is being included in the project.

11. Motion activated security lighting should be surface mounted at back areas not easily supervised or illuminated by existing exterior lights.
12. A security keypad is to be provided in each temporary classroom. The security system is to comply with the District Standards and be tied into the main security monitoring system either through a direct dedicated phone line connection or a dialer.

DIVISION 14 – CONVEYING EQUIPMENT

EQUIPMENT

A. Elevators

1. FOB readers shall be added to all elevators as a security measure to restrict usage of the elevator. The FOB reader shall be located at the door of the elevator except when there is an elevator vestibule door. When there is a vestibule door, the FOB reader shall be located at the vestibule door and coordinated with electrified hardware for the door. In addition, a phone or data line needs to be connected to the Reader hardware located elsewhere for programming purposes. This scope of work must be fully coordinated with electrical, door hardware and elevator consultants.
2. Elevators, hoist way shafts, and machine rooms shall comply with CBC Chapter 30, including all standards referenced therein.
3. Per ASME A17.1, article 8.4.11.1, where buildings are designed with expansion joints, the machine room and the hoist way shall be located on the same side of an expansion joint.
4. Isolate pumping plant and piping from building structure.
5. Provide dry sumps with steel cover plates at each elevator pit. Sump pump, drain lines and holding tanks are not permitted. Contractor shall include the first and second year of elevator monitoring in the construction contract. Extended maintenance agreement beyond the first two years to be included as requested by SUHSD Maintenance and Operations Department. Cancellation of service shall be received in writing 3 weeks prior to end of the two year period and addressed to SUHSD Maintenance and Operations Department.
6. Airborne Noise: Maximum acoustical output levels shall not exceed 70 dBA measured in Machine Room, 55 dBA measured in elevator car during operation, and 45 dBA measured in elevator lobbies.
7. Provide emergency operated lighting in each car.
8. Per CBC 3006.5, where elevator hoist ways or machine rooms contain automatic fire sprinklers, provide a shunt trip to automatically disconnect the power prior to activation of the sprinklers. Locate pit sprinklers within 24 inches of pit floor.
9. Require a letter from the elevator manufacturer as part of the Contractor's submittal to attest to the manufacturer's responsibility for the 'agent' and installation as well as all other tasks outlined under 1.03 QUALITY ASSURANCE: Bidder's Qualifications.
10. Submittals are to be reviewed by the Project Architect and SUHSD Maintenance and Operations Department.
11. Contractor shall provide maintenance/operation manuals (three copies: SUHSD Maintenance and Operations Department and Project Site) and initial operating permit of new or repaired elevator (three copies: SUHSD Maintenance and Operations Department, Project Site, and Elevator Cab).
12. Emergency telephone shall ring the main site office and after four rings shall roll over to the emergency repair line (weekdays 7:30 to 4:00) and (after hours and weekends).
13. Provide telephones and have them identified at the main telephone board with a durable, permanently marked tag with assigned phone number and "Elevator Emergency Telephone."
14. Keys for elevators, elevator machine room, and elevator fire recall are to be standardized; check with SUHSD Maintenance and Operations Department prior to bid.

15. For accessibility, DSA does not allow elevator cabs to have keyed secure access because keying requires grasping and twisting that is difficult for persons with certain disabilities. Provide a Keri proximity card (fob) reader system for securing elevators.
16. Install smoke/heat detector on an access door at top of the shaft if sprinkler are installed overhead in the hoist way.
17. Refer to Division 28.C for additional requirements.

B. Wheelchair Lifts

1. General

1. Ensure compliance with CBC, State Elevator Code, and ADA requirements.
2. Vertical platform lifts are the preferred product for most applications. Acceptable manufacturers and products are:
   - Garaventa, Genesis series
3. Convertible stair/wheelchair lifts are acceptable at auditoriums and similar assembly areas with stages with prior approval by the District. Ensure that product provides code and ADA-compliant stair treads and risers, handrails – including top and bottom extensions, and top and bottom landings. The basis of design is:
   - Lift-U 'AccesStair' as manufactured by Hogan Manufacturing
4. Incline lifts mounted along existing stairs are discouraged and acceptable only in extreme hardship situations with prior approval by SUHSD Maintenance and Operations Department. If used, select option for manufacturer-provided handrail. Design layout so that when lift platform folds up and stores away it does not infringe upon required exit width or create an obstruction or hazard at either top or bottom of stairs for people entering or exiting.
5. Provide appropriate signs related to ADA and State Elevator Code. For type of signs, mounting heights and other related information, refer to Division 10 for signage.
6. Proposed substitutions for approved equal products must be approved by the SUHSD Maintenance and Operations Department.
7. Review each individual application and product selection with SUHSD Maintenance and Operations Department.
8. See Division 28.D for additional requirements.

2. Additional Requirements

1. Provide emergency power back-up and same maintenance/operation and certification submittals as required for elevators.
2. Evacuation plan shall include wheelchair lift. Coordinate with SUHSD Maintenance and Operations Department for Fire Department review.
3. Avoid exterior lifts.
4. Vertical platform lifts shall be pit mounted.
5. Paint a "keep clear" zone on the floor, adjacent to the top and bottom landings. The "keep clear" zone includes the floor area needed to access the lift controls.
6. Provide vandal-proof light fixtures at both the top and bottom landings of each lift.

7. Proximity card or fob reader secure access system is not allowed by the State Elevator Code. Wheelchair lifts must remain operational and unlocked during business hours.
8. The first two years of lift maintenance are to be included in the Construction Contract. Contact telephone numbers and maintenance records must be made available to the District. A final service and inspection is required three weeks before the expiration of the two year warranty maintenance.

DIVISION 21 – FIRE SUPRESSION

FIRE SUPPRESSION

A. Fire Protection / Suppression Systems

1. The SUHSD Maintenance and Operations Department prefer fully sprinkled buildings rather than smoke/heat detectors to address concealed conditions and/or combustible materials.
2. In accordance with California State Certification CCR Title 19, certification test to be performed before acceptance of work by District and DSA.
3. ~~3.~~ All new fire sprinkler and new fire hose mains need back flow devices
4. Backflow devices must be tested and certified after installation by an approved Certification Company.
5. Domestic water system must be protected by an approved backflow device. (Reduced Pressure Principal Device)
6. OS&Y (outside stem and yolk) valves are required. Butterfly valves are NOT ALLOWED on the outside of the building.
7. Building Fire Department Connections are to be within 100 feet of a low pressure hydrant.
8. Any upgrade of the fire sprinkler systems shall include provisions for the future extension if work cannot be done for the entire building in one phase. The hydraulic calculations shall include provision for the future work.
9. Provide all fire sprinkler systems with an air relief valve at all high points and end of the system for air purging.

B. Sprinkler Systems

1. Provide complete and operative Automatic Sprinkler System as required providing full coverage, including connection to existing mains and new piping and new heads to suit partitioning arrangements.
2. The sprinkler system shall be coordinated with electrical engineering for connections to the Fire Alarm System.
3. System to provide coverage for exterior overhangs.
4. Design Criteria:
    a. Provide a 3-inch connection to the FDC in lieu of a 2 ½-inch connection which is required by most other municipalities.
    b. Design, furnish and install the automatic sprinkler system to provide full coverage for all areas of the building where required by code, and including sprinklers for exposure protection where required by code.
    c. Base the piping system and arrangement of heads upon Architectural and Structural considerations. All pipe sizes and number of heads to be used for each area or room shall conform to the requirements of the CBC, Section 903.
    d. Provide pendant position sprinkler heads at suspended ceilings and in upright position at all other locations.
    e. In case of existing buildings the first preference is to install all sprinkler piping above ceilings, but if not possible the exposed piping shall be installed to have minimum impact on the existing lighting fixtures, filter change areas and diffusers. The exposed main

piping shall run along the two sides of a room and sidewall sprinkler heads shall be used where the conditions allow. If sidewall heads do not provide full coverage then branches shall be extended into the space. The sprinkler system branch arrangements shall be symmetrical to the room axis and shall not run below light fixtures and diffusers.

f. Where heads are located at suspended ceilings, spacing shall be as required by NFPA and the following:

1) Sprinkler heads shall be approximately equidistant between lights, between wall and lights, between lights and air diffusers, and between wall, lights and air diffusers.

2) Sprinkler heads shall be approximately centered in tiles.

3) See Architectural reflected ceiling plans, but comply with codes for general design.

4) Coordinate with other trades to avoid HVAC filter changing zones.

a. Obtain water flow test data from authorities having jurisdiction to determine volume and pressure available from incoming water supply. DSA requires this data to be current when documents are submitted. Please check with DSA for requirements and obtain updated data as necessary.

b. Each valved branch main shall not serve more than 100 heads. Valves shall be accessible for easy access in the event of a pipe or head failure.

1) Provide separate valved branch mains for exterior sprinklers.

2) In larger schools, provide valves and flow switches on each floor.

5. Whenever changes in sizes of pipe occur, make the change with reducing fittings as the use of bushings will not be permitted.

6. Sway bracing calculations shall be based on Horizontal Force Factor, per the modifications to ASCE 7-05 described in 2013 CBC Section 1615A. Horizontal Force Factor shall be as required by the Fire Marshal but not less than 50% of weight of water-filled piping.

7. Provide the following on the shop drawings:

a. Building address

b. Clearly identify area of work

c. Name of contractor & C-16 license number

d. Signed DSA stamp and stamp and signature of designer on each page

e. List Hazardous Classification

f. Copy of the waterflow information

g. List any special areas requiring sprinklers based on building design and/or exceptions per the California Building /Fire Code. Provide code references.

h. For new buildings or buildings with change of occupancies, provide fire flow information calculated per the California Fire Code and industry standards.

i. Site Plan, showing fire department connections and fire truck access (and turnaround) areas.

j. Provide seismic bracing locations and calculations per requirements of CBC Chapter 16a.

k. Show spacing of all hangers and detail of connections to the building structure.

l. Provide equipment list on the cover sheet listing quantity, make and model # for equipment with listing numbers. Sprinkler Identification Number (SIN) manufacturer, temperature rating, sprinkler type, orifice size

m. Manufacturer's installation instructions and technical data for any specially listed equipment, including descriptions, applications, and limitations for any sprinklers, devices, piping, or fittings in accordance with NFPA 13. This includes backflow preventers, fire pumps (including performance curves), pressure reducing valves, and accessory devices.

n. Sprinkler piping plans shall not be drawn over reflected ceiling plans with gridlines, or otherwise overcrowded with information.

o. Provide complete sets of calculations to sprinkler the entire building(s) even if the current project is limited in scope to partial coverage.

p. Area of design (Minimum Remote Area (MRA))

q. Show calculation for the long and short side of the MRA

r. Total number of sprinklers calculated

s. Area of operation per sprinkler

t. Number of heads per branch line. Show factor for head spacing

u. Total Flow(MRA X Density X 1.1=Hose stream allowance)

v. Minimum end head flow

w. Minimum start pressure

x. Elevation for calculating elevation loss

y. K factor

z. Pressure and/or minimum end head pressure

aa. Type of pipe being installed with appropriate K factor/schedule

bb. State friction loss for each type of equipment and component of the sprinkler system

8. Provide inspectors test from highest points at end of major branch(s)
9. Provide OS&Y and backflow prevention exterior to the building (if possible). Provide an operable cage secured by breakaway padlock for this assembly. Ensure that nothing obstructs the connection of LOCAL FIRE DEPARTMENT hose to OS & Y.
10. Show post indicator valve location.
11. Provide new piping to and meter.
12. Contactor to flush and provide separate testing date of main and sprinkler system.
13. Contactor to provide NFPA Completion Forms to the District and the IOR.
14. Properly label where needed (piping, etc.)

C. Kitchen Hood Suppression System

1. For additional information, contact SUHSD Maintenance and Operations Department
2. Automatic extinguishing system required to protect commercial cooking equipment from which grease-laden vapors emanate.

a. Fire suppression system: Range Guard or Pyro Chem. UL listed or FM approved automatic detection and local/remote manual activation

b. Tie fire protection system into the auxiliary alarm (municipal street box). Both an audible and visual notification is required at the fire alarm control panel (FACP). Tie fire protection system into the local alarm signaling device of building in which kitchen is located. Provide system in conformance with current Uniform Mechanical Code, NFPA and applicable State and Local codes. Engineering and final testing are responsibility of the Contractor. Easy-to-clean filter preferred, such as Flame Guard. For details, see Fire Alarm System. Conform to UL 300.

3. Kitchen hood: Type I, 22-gauge stainless steel
4. Ductwork:16-gauge stainless steel
5. Filter: Baffle type
6. Hood light: Vapor-proof incandescent light fixtures
7. Kitchen exhaust fan: Loren Cook, aluminum construction, weather cover, bird screen, grease trough, drain and access door. UL listed for restaurant exhaust appliances or UL 762
8. Properly label designated piping, enclosures, equipment.

DIVISION 22 – PLUMBING

A. General

1. Design all systems to current version California Plumbing Code including Amendments
2. Ensure that existing, modified, and new emergency eyewashes and deluge showers have provisions for sloped drainage either via direct connection to a drain line (in the case of emergency eyewashes) or by a floor drain in close proximity (2 feet or less) to the unit. Provide eyewashes and emergency showers with a pad and pad holder for the regular inspection recording.
3. All plumbing fixtures that are provided with hot and cold water shall have the water mixed at the faucet or supplied through a mixing valve to multiple fixtures that do not include a mixing type of faucet.
4. All rainwater leaders shall be provided with a clean-out at the base of the leader.
5. During any plumbing system upgrade the contractor shall make sure that all the reused systems are free of any plugs or defects.
6. Provide plumbing chases whenever possible.
7. Provide floor drains and lockable hose bibs in all toilet rooms. A trap primer for floor drains shall be installed only in areas not subject to frequent janitorial service. Locate floor drains out of the accessible path of travel for persons with disabilities, such as directly under toilet partitions between standard inaccessible stalls, and ensure that floor slopes do not exceed ¼" per foot throughout.
8. Provide a hose bib in each boiler room and restroom.
9. The main cold water line reduced pressure backflow preventor of a facility shall be installed outdoors unless it is located in a mechanical room that has a floor drain large enough to handle the water flow.
10. Hot water heating systems should be centralized when possible to minimize maintenance intensive insta-hot type hot water heaters.
11. Sump pumps and sewage pumps shall be duplex type, with non-submerged motors, and controls package that will report alarms (failure, high water alarm) to the EMS.
12. All below-building (except specialty waste lines) sewer and storm drain piping shall be cast iron pipe with 'Husky' type 2000 couplings or equivalent.
13. All products that convey water for human consumption, including for drinking or cooking, shall be listed as lead-free in compliance with California Health and Safety Code 116875 as established by AB 1953, including faucets, bubblers, glass and pot fillers, etc.
14. Remove all abandoned equipment, piping and appurtenances.
15. The A/E shall include in the project specifications the requirement that the mechanical contractor provide preventative maintenance and service for all mechanical equipment for a period of two years from date of substantial completion. Maintenance service shall include changing filters, performing inspections every 4 months, and making necessary adjustments. The service shall be recorded and reports of all service work performed shall be sent to SUHSD.
16. Any type of drainage shall not be near electrical/ utility panels, vaults, Christy boxes.

B. Contractor Licensing

1. C-4 License is required for all boiler, hot water heating, and steam fitting contractors.
2. C-16 Fire Protection License is required to work on fire sprinkler systems.
3. C-36 Plumbing License is required to work on plumbing systems.

4. American Water Works Association License and registration is required to inspect and test backflow prevention devices.

C. Shut-Down and Start-Up

1. Contractor shall coordinate and notify SUHSD Maintenance and Operations Department for utility system shut-downs and start-ups, including gas, electricity, and water, and for coordination with other agencies and utility companies. Contractor shall be responsible for tasks such as reactivation of flushometers, lighting of gas pilots and re-setting of fire alarm system after flow switch work, re-charging of hot water systems, and other appropriate procedures.
2. The SUHSD Maintenance and Operations Department shall be notified, approved in writing, and be present for shut-downs and start-ups of all utility systems.

D. Plumbing Systems

1. General
2. Refer to the Plumbing paragraph in the Design Criteria section earlier in this Division for additional requirements and guidelines.
3. Design all systems to current version California Plumbing Code including amendments
4. Lead-Free Plumbing Fixture Advisory
5. California's lead-free plumbing law, California Health and Safety Code 116875, created by Senate Bill SB 1334 and Assembly Bill AB1953, requires that all plumbing fixtures that provide water for human consumption, including those for drinking or cooking, be lead-free.
6. New faucets, including those at sinks in all classrooms, teacher's lounges, cafeterias, food service areas, etc., those at all lavatories, and all drinking fountains, including bubblers mounted on sinks, must comply with Health and Safety Code 116875, and must be certified by an independent, accredited third party as being in compliance. Fixtures shall not be accepted until compliance has been proven. Fixtures that fail testing must be replaced. Contract documents shall include language stipulating these requirements.

E. Toilet Room General Design Guidelines

1. Design for high-use, high-humidity environment for ease of maintenance and cleaning.
2. Provide isolation valves behind locked access panels for each toilet room.
3. Each toilet room fixture is to have shut-off valves. Locate them behind locked access panels.
4. Toilet rooms shall be provided with recessed wall hydrant type keyed hose bib. See specified product later in this section.
5. Provide trap primers in restrooms. The trap primer system shall consist of a stainless steel, service access panel, 12" x 12", bronze lead-free ball valve upstream and a copper x FIP (female iron pipe) union downstream. Bronze ball valves shall be manufactured by NIBCO or approval equal.
6. Janitor sinks shall be floor mounted mop sinks and shall be provided on all floors unless otherwise authorized by the District.
7. Floors shall be sloped to drain. Do not exceed CBC and ADA requirements for maximum 2% floor slope or maximum plumbing fixture heights. Provide minimum clearances under plumbing fixtures. Design dimensions shall include appropriate construction tolerances.
8. Toilet rooms shall be designed with vapor barrier under slab and behind wall wainscoting.

9. A/E should include in modernization project specifications the requirement that the contractor clear waste lines all the way to the nearest lateral tie-in outside of building.
10. All toilet rooms including staff and unisex restrooms shall be equipped with floor drain.

F. Domestic Water Supply and Faucet Type by Use Guideline

1. *Student restrooms:* Single-temperature, self-metering, cold is standard but tempered (95 F) may be allowed on a case-by-case basis depending on site request and available system. Review conditions with and obtain approval from SUHSD Maintenance and Operations Department. Provide either dedicated hot water supply with recirculation loop from water heater or a local mixing valve.
2. *Student Classrooms:* Single-temperature, single-handle, single-hole, cold is standard. Dual-temperature, dual-handle, cold and tempered (110 F), is allowed on a case-by-case basis. Review conditions with and obtain approval from SUHSD Maintenance and Operations Department. Provide either dedicated hot water supply with recirculation loop from water heater or a local mixing valve.
3. *Student Laboratories:* Single-temperature, single-handle, single-hole, cold, gooseneck (no bubbler) is standard. Dual-temperature, dual-handle, cold and tempered (110 F) gooseneck is allowed on a case-by-case basis. Review conditions with and obtain approval from SUHSD Maintenance and Operations Department. Provide either dedicated hot water supply with recirculation loop from water heater or a local mixing valve.
4. *Adult public restrooms:* Single-temperature, self-metering, cold is standard. Single-temperature, self-metering, tempered (110 F) is allowed on a case-by-case basis. Review conditions with and obtain approval from SUHSD Maintenance and Operations Department. Provide either dedicated hot water supply with recirculation loop from water heater or a local mixing valve.
5. *Adult staff restrooms, staff lounges, and food service:* Dual-temperature, dual-handle, hot (120 F) and cold. Provide either dedicated hot water supply with recirculation loop from water heater or a local mixing valve.
6. Tempered is 110 degrees max, Provide either dedicated hot water supply with recirculation loop from water heater or a local mixing valve. Hot is 120 F (140 F FOR KITCHENS) degrees max.

G. Signs and Labels

1. Fasten a red-headed tack to each T-bar suspended ceiling push out tile at valves, etc.

H. Pipe Identification

1. Identify and color-code all piping including piping in furred ceiling spaces. Provide directional arrows on circulating systems. Identification shall be in accordance with ANSI A13.1-1981, Scheme for Identification of Piping Systems (OSHA) and as specified herein.
2. Plastic Markers: Setrnark Type "SNA", Brady or equal. Each marker must show approved color-coded background, proper color of legend in relation to background color, approved legend letter size and approved marker length.
3. Location for Pipe Identification:
4. Adjacent to each valve and fitting (except on plumbing fixtures and equipment).
5. At each branch and riser take-off.
6. At each pipe passage through wall, floor and ceiling construction.
7. On all horizontal runs spaced 25-feet maximum.

I. Valve Identification

1. Provide tags on all control and line shut-off valves. Tags shall note valve service and number as hereinafter specified and shall be Seton Style 250-BL, Brady, or equal, brass tag fastened to the valve stem with copper wire.
2. Provide three (3) typewritten schedules giving numbers, service and locations, and notations of normally open or closed, of all tagged valves, where purpose of location is not easily identifiable. Enclose each schedule in separate transparent plastic binder. Include locations on as-built drawings.

J. Equipment Identification

1. Properly identify each piece of equipment and its controls using engraved laminated plastic descriptive nameplates, attached to equipment and controls using round head brass machine screws, pop rivets or contact cement. Cardholders in any form not acceptable.

K. Anchors / Hangers

1. Use metal anchors and hangers for supporting plumbing fixtures.

L. Clean-outs

1. New clean-outs shall be designed to be accessible for regular maintenance. Clear space shall be maintained at existing cleanouts to allow access for maintenance.

M. Plumbing Insulation

1. Pipe Insulation
2. Glass fiber insulation under the symbol FG
3. Steam piping, 1-1/2 inch
4. Condensate, 1 inch
5. Heater water supply and return 1 inch thick
6. Domestic hot water-1/2 inch
7. Chilled water supply and return
8. Domestic cold water in concealed spaces
9. Where insulation is exposed, wrap in metal jacketing.

N. Plumbing Piping

1. Domestic Cold and Hot Water Compressed and Instrumentation Air Piping or Tubing. Copper, seamless ASTM B-88
2. ~~2.~~ Domestic CW & HW-Type K, soft temper for underground pipe,
3. Domestic CW & HW-Type L, hard drawn for above ground pipe
4. Compressed Air-type L, hard drawn for above ground and K for underground
5. Instrumentation Air-Type L, hard drawn

6. Fittings, Copper, socket joint ASTM B-75
7. Solder. Comply with California “No-Lead” requirements.
8. All underground copper shall be brazed and not soft-soldered.

O. Backflow Preventers

1. FEBCO, Wilkins, Watts, Ames
2. For domestic hot water shall be backflow protected in a manner that is appropriate based upon the degree of hazard
3. For make-up water shall be reduced pressure type assembly
4. New backflow devices for domestic cold water, fire sprinkler and irrigation shall be tested by the Contractor. A Department of Public Health sticker shall be placed on each device before the system is accepted by District.

P. Pumps

5. Manufacturers: Bell and Gossett.
6. Factory assembled and tested.
7. Base-Mounted Pumps: Include pump casings that allow removal and replacement of impellers without disconnecting piping.
8. Motors: Furnish single-, multiple-, or variable-speed motors, with type of enclosures and electrical characteristics indicated. Include built-in thermal-overload protection and grease-lubricated ball bearings. Select each motor to be non-overloading over full range of pump performance curve.
9. Finish: Manufacturer's standard paint applied to factory-assembled and -tested units before shipping.

Q. Sanitary Sewerage

1. Sewage Pumps

a. Sewage pumps are to be avoided unless absolutely necessary and as approved by the District Maintenance and Operations Department. If provided, follow the requirements as indicated below.

b. General Description: Centrifugal, end-suction, single-stage sewage pump, with motor and operating controls.

c. Impeller: ASTM A 532 (ASTM A 532M) abrasion-resistant cast iron, statically and dynamically balanced, open or semi open non-clog design except where otherwise indicated, overhung, single suction, keyed to shaft, and secured by locking cap screw.

d. Wet-Pit-Mounted, Vertical Sewage Pumps: Vertical, separately coupled, suspended type, mounting style to be removal type. Include holes in cover as required.

e. Pump Arrangement: Duplex.

f. Casing: Cast iron, with open inlet.

g. Pump Shaft and Sleeve Bearings: Stainless-steel shaft with bronze sleeve bearings. Include oil-lubricated, intermediate sleeve bearings at 48 inches (1200 mm) maximum intervals where basin depth is greater than 48 inches (1200 mm), and grease-lubricated, ball-type thrust bearings.

h. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

i. Seals: Stuffing box, with a minimum of 4 graphite-impregnated braided-yarn rings, bronze lantern ring between center 2 graphite rings, and bronze packing gland.

j. Motor: Vertically mounted on cast-iron pedestal.

k. Pump Discharge Piping: Manufacturer's standard galvanized-steel or bronze pipe, except where specific material is indicated.

l. Controls: Type 1 pedestal-mounted float switch, complete with floats, float rods, and rod buttons. Include automatic alternator to alternate Operations of pump units on successive cycles and operate both units when 1 pump cannot handle the load.

m. Pump Discharge Piping: Factory or field fabricated, ASTM A 53, Schedule 40, galvanized-steel pipe, bronze pipe, or copper tube, except where specific material is indicated.

n. Controls: Wall mounted, except where pedestal mounting is indicated, in a NEMA, Type 1 enclosure. Controls consist of 4 float switches; mounting rod; and electric cables. Include an automatic alternator to alternate Operations of pump units on successive cycles and operate both units when 1 pump cannot handle the load.

o. Float Guide Pipe: Include guide pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm) and where indicated.

p. High-Water Alarm: Rod-mounted, micro-pressure-switch alarm matching the control, with alarm bell Operation is 120 volts a.c.

R. Storm Drainage

1. Storm Drainage Piping

Design per Code

2. Rainwater Leaders

In wall RWL shall be cast iron. Exterior RWL shall be Schedule 40 galvanized steel welded to supports.

3. Sump Pumps

Refer to Sewage Pumps.

S. Plumbing Equipment

1. Instant Hot Water Heaters

a. Use when hot water supply is not available to location of fixture. When such conditions exist, provide electrical outlet under sink for electric instant hot water heaters, such as at nurse's rooms.

b. Local instantaneous type electric: Voltage to be determined.

c. Local gas water heater: Norritz Takagi or equal, high efficiency condensing instantaneous water heater.

2. Gas Water Heaters

a. AO Smith, State, or equivalent

b. U.L. approved type units w/ glass lined steel tank

c. Magnesium anode
d. Temperature and pressure relief valve
e. Operating and safety controls
f. Minimum 125 psig working pressure
g. Provide isolation valves for hot and cold supply
h. Provide expansion tank per code
i. Provide seismic bracing per code
j. Provide isolation valves for all associated equipment
k. Controls provision for on/off control via EMS

3. Domestic Hot Water Circulating Pumps

a. Grundfos, Bell & Gossett, or equal
b. Electric motor driven
c. In-line style centrifugal pumps that require no lubrication.
d. Bronze construction: Bronze casing, impeller, sleeve bearing and mechanical seal.
e. Stainless steel shaft provision for on/off control via EMS.

T. Plumbing Fixtures

1. Toilets – Wall-Hung

a. Wall-hung toilets are required at all new buildings and are preferred where possible at existing school modernizations.
b. White vitreous china fixture, elongated bowl, 1.28-gallon, 1½" top spud:
c. Kohler – Kingston wall hung model K-4325
d. Exposed Flush Valve: Sloan Royal #111-1.28 for 1.28-gallon toilets
e. Carrier: Jay R. Smith for siphon jet toilets, waste 4", vent 2", CW 1"
f. NO SUBSTITUTIONS ARE ALLOWED beyond any of these products during either design or construction.

2. Toilets – Floor-Mounted

a. Wall-hung toilets are required at all new buildings and are preferred where possible at existing school modernizations. When floor-mounted toilets are required, the A/E shall account for the increased depth from the rear wall to the front rim in the design and layout of the toilet stall. This is especially critical in accessible stalls.
b. White vitreous china fixture, elongated bowl, 1.28-gallon, 1-1/2" top spud:
c. 16 ½" for 17 ¾" high seat (17"-19" required accessible seat height Toilets: Kohler – Wellworth floor mount model K-3575
d. Exposed Flush Valve: Sloan Royal #111-1.28 for 1.28-gallon toilets. Waste 4", vent 2", CW 1".
e. NO SUBSTITUTIONS ARE ALLOWED beyond any of these products during either design or construction.

3. Urinals

a. Individual, wall-mounted, white vitreous china fixtures with 3/4" top spud. 1/8-gallon (1-pint) urinals are required for all new construction and modernization/retrofit projects. Review existing conditions with SUHSD Maintenance and Operations Department.

b. Acceptable fixtures:

1) American Standard "Washbrook FloWise" 6590.001 0.125 gpf urinal; Sloan Royal #186-0.125 gpf manual flush valve; OR American Standard 6045.013.002 0.125 gpf manual-operated flush valve, for Washbrook Urinal

2) Carrier: Manufactured by Jay R. Smith, waste 2", vent 2", CW 3/4". Coordinate exact model number with specified urinal fixture.

c. NO SUBSTITUTIONS ARE ALLOWED beyond any of these products during either design or construction.

d. Provide accessible floor clearance and accessible mounting height at accessible urinals per CBC.

4. Lavatories & Sinks

a. Individual wall-hung basins with concealed arms, no troughs, white vitreous china fixtures

b. Single-hole: Kohler "Greenwich" K-12643 (1-hole) or American Standard "Lucerne" 0356.421 (1-hole)

c. 3-hole, 4" centers: Kohler "Greenwich" K-2032 or American Standard "Lucerne" 0355.012 – required for all self-metering faucet applications (combine with District standard 3-hole self-metering faucet)

d. Drain: Kohler K-7726 with 1¼" tailpiece, Kohler K-7131-A with offset 1¼" tailpiece

e. Kohler K-7608 lead-free Speedway rigid 3/8" riser with 1/2" key angle stops

f. Trap: McGuire 8902 1-1/4"x1-1/2" brass trap

g. Carrier: Jay R. Smith floor-mounted #700-E. Waste 1-1/2", vent 1-1/2", CW 1/2"

h. No other products are allowed to be listed in the project specifications. Proposed contractor substitutions shall be reviewed for approval by the SUHSD Maintenance and Operations Department

i. Follow CBC required mounting heights and clearances for adult lavatories. Provide required accessible clear floor and knee space.

5. Classroom Sink

a. Single bowl 18 gauge type 304 stainless steel self-rimming or under counter, Elkay or Just Sinks or approved equal. Proposed contractor substitutions shall be reviewed for approval by the SUHSD Maintenance and Operations Department**.**

b. See Faucets section for bubbler and drain requirements at classroom sinks.

c. Provide required accessible classroom sink per CBC.

6. Service Sinks

a. Molded stone, mop service basin with 3" drain. Provide hose, bracket, mop-hanger and bumper guard.

b. Faucet shall have ~~2~~ threaded spout, brace, backflow preventer and polished chrome finish

7. Faucets

a. Install lead-free faucets complying with California Health and Safety Code 116875. See Lead-Free Plumbing Fixture Advisory earlier in this chapter.

b. Plastic parts are not allowed because of bacteriostatic problems and additional maintenance costs.

c. Avoid concealed-mount faucets. When replacing existing, replace with deck-mounted faucets.

d. Single-temperature metering (self-closing) with tempered or cold water for use with lavatories:

1) 3-hole, 4" centers, 4¾" spout (preferred): Chicago 3400-ABCP "ECAST" – Specify 10% additional replacement parts to be provided by contractor.

2) Single-hole, 3-3/8" spout: Chicago 333-665PSHVPAABCP "ECAST" allowed only when necessary for single-hole application retrofits

~~e.~~ Deck-mounted gooseneck

f. Dual-temperature faucets:

1) Dual wrist blade handles, 2-hole (not concealed), 8" centers: Chicago Faucets 1100-GN2AE3-317ABCP "ECAST"

2) Dual wrist blade handles, single-hole: Chicago Faucets 50-317VPAABCP "ECAST"

g. Single-temperature faucets: Single wrist blade handle, single-hole: Chicago Faucets 350-317VPAABCP "ECAST"

h. Classroom sink and lavatory faucets 1.5 GPM and shall be supplied with 0.5 gpm aerators.

i. Food service and custodial faucets to be 2.2 GPM.

j. Provide a bubbler mounted at art and science classrooms. Bubbler shall have flexible (not metal) shield to avoid children accidentally chipping their teeth:

1) Elkay LK1141A (Do not specify the 'VR' version)

2) Chicago 748-665FHCP

k. No other products are allowed to be listed in the project specifications. Proposed contractor substitutions shall be reviewed for approval by the SUHSD Maintenance and Operations Department

l. Drain: grid with 1¼" tailpiece Kohler K-7726: grid with offset 1¼" tailpiece Kohler K-7131-A. Trap: 1¼"x1½" cast brass trap. McGuire-8902. Speedway rigid 3/8" riser with ½" key angle stops Kohler K-7608 (lead-free). Carrier: Jay R. Smith floor mounted #700-E or equal Zurn model. Waste 1½", vent 1½", CW ½"

8. Emergency Showers and Eyewashes

a. Per California Education Code, provide both emergency showers and eyewashes at all science labs that use chemicals. Install at a central, readily accessible location. Provide floor drain at emergency showers and slope floor to drain when practical. Review each condition and proposed solution with SUHSD Maintenance and Operations Department.

b. Emergency Shower: Combination Unit HAWS 8300-8309 with dust cover 9102 and emergency test kit 9010 provided for each shower.

c. Eyewash with acid-resistant drain: HAWS 7460BT with dust cover 9102

d. Emergency eyewashes and showers shall meet ANSI 358.1 requirements for permanently installed units and shall be hard-plumbed into the building drain system.

e. A 3' x 3' square of floor in front of the emergency eyewash and beneath a deluge shower shall be clearly marked with contrasting flooring or paint stripes. The location shall further be marked with overhead signage.

9. Drinking Fountains

a. In addition to locations required by code, provide at least one drinking fountain at all rooms where students are regularly served and consume food, including cafeterias and multi-purpose rooms, per California Education Code Section 38086, pursuant to California Senate Bill 1413, and Section 203 of the federal Healthy, Hunger-Free Kids Act of 2010.

b. Install lead-free drinking fountains complying with California Health and Safety Code 116875. See Lead-Free Plumbing Fixture Advisory earlier in this chapter.

c. Bottle Filler: Global TAP #GT1500, wall mounted, 2-bottle filler.

d. Free-Standing: Haws 3300 pedestal fountain (powder-coated finish) or 3150 pedestal fountain (adjustable height and exposed aggregate finish), with 5725 Envirogard bubbler and 6426 lead filter, when no building wall surfaces are available. NO SUBSTITUTIONS ARE ALLOWED during either design or construction.

e. All interior and exterior drinking fountains shall provide applicable front and side approach clearances and adequately sized floor area with slope no greater than 2% in all directions, per ADA and CBC.

f. Exposed piping shall not interfere with required knee clearance.

g. Provide locking access panel for waste cleanout and a ball valve to isolate water supply directly below fountain (if possible).

h. See Faucets section for bubbler requirements at classroom sinks.

10. Wall Hydrant Hose Bib

a. Zurn Z1350VB encased/recessed narrow wall hydrant type keyed hose bib with vacuum breaker – install at all restrooms

11. Floor or Shower Drains

a. Jay R. Smith 2005Y Floor Drain with adjustable strainer heads, vandal proof screws, nickel bronze strainer.

12. Gaskets

a. Toilet and urinal gaskets: Use treated felt closet bowl gasket or neoprene gasket with wax coating around entire outside surface

13. Plaster Traps (For Art Classrooms)

a. Zurn solid intercepter Z-1181.

14. Rat-proofing

a. Provide barrier to rodent infiltration where pipes penetrate from the exterior.

U. Water Heaters

1. Domestic Hot Water Storage Tank Heaters

a. Mixing valves set at maximum degree F for supply hot water temperature are required on all water heaters. Per 2013 CPC, "Hot water delivered from public-use lavatories shall be limited to a

maximum temperature of 120°F. The water heater thermostat shall not be considered a control for meeting this provision." Since most mixing valves require a min. 20°F delta T to work properly the storage temperature will need to be 20°F higher than the highest supplied temperatures.

b. 140°F shall be the maximum temperature setting. Avoid using temperature boosters for dishwashers. Provide for chemical sanitation instead.

c. Water heater requirements:

d. Horizontal or vertical style

e. ASME labeled for 150 psi working pressure

f. Provide thermometer with nine-inch scale, temperature control sensor, and ASME-rated temperature and pressure relief valve.

g. Tank lining with 5 year warranty

h. Acceptable manufacturers: A.O. Smith, State, Patterson-Kelley

i. Accessory equipment by Watts or McDonnell Miller

j. Water heaters must be seismically anchored.

2. Water Heater-Expansion

Similar to Amtrol FILL-TROL tank and valve unit.

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

A. Design Criteria

1. General

The District Maintenance and Operations department shall be included in the design and selection process for all mechanical systems and equipment that will be installed in new buildings and as part of modernizations of existing buildings. The District Director of Facilities and A/E team, including MEP engineers and any other appropriate design consultants, shall meet with District Maintenance and Operations department staff during the initial design phase (Project Assessment and/or Schematic Design) to obtain input on existing conditions and feedback on initial design concepts, and will schedule additional meetings at appropriate milestones during subsequent design phases.

2. Energy Efficiency

a. Except when specifically exempted by the District Maintenance and Operations department the energy performance of new buildings and buildings undergoing modernization shall meet the following requirements:

   1) All new buildings (with or without AC) – min. 16% below Title 24

   2) Major modernizations using performance compliance method (whole-building energy model) – min. 10% below Title 24

   3) Modernizations using prescriptive compliance method (no whole-building energy model) must comply with Title 24.

b. Major modernizations are generally considered those that include the following:

   1) Project cost of $500,000 or more

   2) Interior project area of 5,000 s.f. or more

   3) HVAC system replacement or EMS/lighting system controls installation or upgrade

c. The A/E shall review the proposed compliance method and resulting energy efficiency goals with the District Maintenance and Operations department at the Project Assessment and/or Schematic Design phase.

3. HVAC Systems

a. Design or upgrade mechanical systems to meet or exceed the most stringent requirements of the latest editions of ASHRAE 62, the California Energy Code, and the California Building Code. Minimum outside air quantity per person shall be per current code.

b. Air conditioning/mechanical cooling is prohibited except at computer labs or spaces with other unique conditions only when adequate justification is provided and approved by the District Maintenance and Operations department. Where air conditioning is approved for use, the design shall include a mixed mode of Operations where natural ventilation and/or mechanical ventilation precedes the use of mechanical cooling. AC units shall comply with CEE (Consortium for Energy Efficiency) Tier 2 requirements. For any new construction, air conditioning should be installed, and may be installed for certain modernization projects.

c. New heating and ventilating only systems as well as upgrades shall provide economizer and an adequately sized fan system that will ensure some ventilation during the warm season with 100% outside air. A relief air opening with backdraft damper shall be provided.

d. All spaces with high density occupancy such as gymnasiums and auditoriums shall be provided with CO2 sensors that will control the outside air damper minimum position. All other spaces shall be provided with CO2 sensors as required by California Energy Code.

e. Outside air intake location for the HVAC system shall be at high level and inaccessible to pedestrians.

f. The first preference for a heating system is to use one gas furnace, high efficiency, condensing type, furnace, with outside air economizer per classroom, installed in a special cabinet enclosure or gypsum board alcove.

g. Vertical classroom fan-coil unit (with economizer) will be used when an existing heating hot water system is readily available for heating hot water distribution to the classroom units.

h. Water elimination on outside air intakes: install moisture eliminators in louvers.

i. Electric resistance heating shall not be used for space conditioning including reheat coils at CAV/VAV boxes, unless shown to be life-cycle cost effective and complying with T24 energy code. Preferred heat sources are gas boiler and gas furnace.

j. First priority shall be given to installation of HVAC equipment indoors: in mechanical rooms, floor mounted, or in classrooms in specially designed fully acoustically lined closets to conceal the furnaces, in built up soffits.

k. New fin tube systems shall be provided with removable covers to allow for the fin tubes to be cleaned.

l. HVAC systems for all new buildings shall include ducted returns as opposed to plenum returns.

m. Design HVAC systems to achieve a Noise Criteria level of not exceeding NC-30 in classrooms.

n. Laboratories, darkrooms, locker rooms, janitorial and housekeeping areas, toilets, and any other area where hazardous gases, chemicals, and/or cooking and combustion sources may be present or used shall be under negative pressure to prevent contamination transfer to adjacent areas of the facility. This requirement applies to both new construction and modernization projects.

o. Except where adequate justification is provided, air systems shall be designed so that service can be performed during school hours without disruption to classes. The systems should be designed such that they can be serviced by a single employee (without use of ladder or lifts for routine service).

p. New and existing heating hot water systems to be refurbished shall have automatic vent valves at all high points of the system. Each vent valve shall be provided with a shut-off valve up-stream of vent valve.

q. Choose ventilation diffusers that can be readily washed.

r. Equip all ventilation grates or duct terminations into crawl space with fine mesh screens for rodent guards.

s. Filtration: See Filters section later in this division.

t. Laboratory Fume Hoods: Provide only ducted laboratory hoods exhausting air to the exterior of the building. Exhaust fans shall be installed outdoors at the end of the exhaust system to have all the exhaust ducts inside the building under negative pressure. Hood exhaust duct termination shall meet or exceed Cal/OSHA requirements as specified in Title 8 CCR 5154.1. Do not install recirculating or ductless hoods. Do not install two-sided hoods.

u. Dust collection systems: special collection systems like by Ventaire Inc., Sternvent Co. or equal.

v. Controls: See Energy Management System (EMS) section later in this Division for controls

w. Staff training on HVAC system shall include instructions about not storing any objects/materials on the air handling cabinets or any other HVAC equipment.

x. Access doors shall be provided at all coils installed in ductwork or HVAC units for coil inspection.

4. Miscellaneous

a. Remove all abandoned equipment, piping and appurtenances.

b. The A/E shall include in the project specifications the requirement that the mechanical contractor provide preventative maintenance and service for all mechanical equipment for a period of one year from date of substantial completion. Maintenance service shall include changing filters, performing inspections every 4 months, and making necessary adjustments. The service shall be recorded and reports of all service work performed shall be sent to SUHSD.

B. General Requirements

1. Contractor Licensing

a. C-4 License is required for all boiler, hot water heating, and steam fitting contractors.

b. C-16 Fire Protection License is required to work on fire sprinkler systems.

c. C-36 Plumbing License is required to work on plumbing systems.

d. American Water Works Association License and registration is required to inspect and test backflow prevention devices.

2. Shut-Down and Start-Up

a. Contractor shall coordinate with District Maintenance and Operations department for utility system shut-downs and start-ups, including gas, electricity, and water, and for coordination with other agencies and utility companies. Contractor shall include tasks such as reactivation of flushometers, lighting of gas pilots, and re-setting of fire alarm system after flow switch work, re-charging of hot water systems, and other appropriate procedures.

b. The District Maintenance and Operations department shall be notified, approve in writing, and be present for shut-downs and start-ups of all utility systems.

3. Fire Alarm System

Contractor will be responsible for any impact to the fire alarm system, such as duct smoke detectors, smoke/fire dampers, and for re-certification of the entire system if devices are added or removed.

4. Pre-Engineer Submittal

a. The District will provide assistance to pre-engineer the complete energy management control system before bid to avoid deferred approval as a submittal.

b. Fan Drives and Belt Guards: Two belts on motors $\geq$ 1/2 hp motor of belt driven fan shall be provided w/adjustable pitch drive: Dodge, Browning

C. Mechanical

1. General Duty Valves for HVAC Piping

a. Valves: NIBCO, Watts, Stockham,

b. Gate valve > 3 inches for water service: American Darling Valve and Manufacturing Co.Ludlow-Renssel Architect and Engineer Valve Division

c. Gate valves > 3 inches for water service: Walworth Fig 726F, Crane

d. Ball valves < 2 inches for water and air service: Nibco, Crane Co.

e. Globe valve < 2 inches: Nibco, Walworth Co. Crane Co

f. Globe valve > 3 inches: Walworth Co., Crane Co. Nibco

g. Needle disc type globe valve: Walworth, Jenkins,

h. Check valve < 2 inches: Walworth Co, Crane

i. Check valves 3-12 inches: Ludlow-Renssel Architect and Engineer Valve Clearway check Division Valves

j. Check valves < 2 inches for heating water piping: Mueller Steam Specialty, Combination Pump and Valve Co., Nibco

k. Check valves ≥ 2 1/2 inches heating waste piping: Mueller Steam Specialty Combination Pump and Valve Co

l. Pressure reducing valves: C.M. Bailey Co., Fisher

m. Relief valves: C.M. Bailey Co., Consolidated Watts

n. Automatic air vents: Hoffman Co.

o. All air vents should be automatic as opposed to manual. The District prefers Hoffman No 79s, with valve up-stream to enable trouble free change out.

2. Identification for HVAC Piping and Equipment

a. Signs and Labels

1) Fasten a red-headed tack to each T-bar suspended ceiling push out tile at heating coils, filter changing locations, fire dampers, valves, control devices, etc**.**

2) A printed sign shall be posted at water treating equipment stating, "USE NO CHROMATES".

3) A printed sign shall be posted at each automatically started equipment stating," WARNING THIS MACHINE IS AUTOMATICALLY CONTROLLED AND MAY START AT ANY TIME".

b. Pipe Identification

1) Identify and color-code all piping including piping in furred ceiling spaces. Provide directional arrows on circulating systems. Identification shall be in accordance with ANSI A13.1-1981, Scheme for Identification of Piping Systems (OSHA) and as specified herein.

2) Plastic Markers: Setrnark Type "SNA", Brady or equal. Each marker must show approved color-coded background, proper color of legend in relation to background color, approved legend letter size, and approved marker length.

3) Location for Pipe Identification:

- Adjacent to each valve and fitting (except on plumbing fixtures and equipment).
- At each branch and riser take-off.

- At each pipe passage through wall, floor and ceiling construction.
- On all horizontal runs spaced 25-feet maximum.

c. Valve Identification

1) Provide tags on all control and line shut-off valves. Tags shall note valve service and number as hereinafter specified and shall be Seton Style 250-BL, Brady, or equal, brass tag fastened to the valve stem with copper wire.

2) Provide three (3) typewritten schedules giving numbers, service and locations, and notations of normally open or closed, of all tagged valves, where purpose of location is not easily identifiable. Enclose each schedule in separate transparent plastic binder. Include locations on as-built drawings.

d. Equipment Identification

Properly identify each piece of equipment and its controls using engraved laminated plastic descriptive nameplates, attached to equipment and controls using round head brass machine screws, pop rivets or contact cement. Cardholders in any form not acceptable.

D. HVAC Insulation

1. Duct Insulation

a. Glass fiber LN insulation

2. Pipe Insulation

a. Glass fiber insulation under the symbol FG

b. Install in the following locations, minimum:

1) Chilled water supply and return

2) Domestic cold water in concealed spaces

c. Minimum thicknesses:

1) Steam piping, 1-1/2 inch

2) Condensate, 1 inch

3) Heater water supply and return 1 inch thick

4) Domestic hot water-1/2 inch

d. Where insulation is accessible to students, wrap in metal jacketing

E. Instrumentation and Control for HVAC

1. Compressed and Instrumentation Air Piping or Tubing

a. Copper, seamless ASTM B-88

b. Domestic CW & HW-Type K, soft temper for underground pipe, jacketed

c. Domestic CW & HW-Type L, hard drawn for above ground pipe

d. Compressed Air-type L, hard drawn for above ground, K for underground, jacketed

e. Instrumentation Air-Type L, hard drawn

2. Fittings

Copper, socket joint ASTM B-75

3. Solder

a. ASTM B-32, Grade 95TA, 95-5 wire solder

b. All underground copper shall be brazed and jacketed and not soft-soldered.

4. Two-Way Control Valves

a. Belimo, Johnson Controls, Honeywell, Delta,

b. Valves shall be single seated equal percentage type and cast brass bodies

c. 125 psi rating for size 1-1/2"and 2"

d. Each valve shall be completely assembled with motor actuator with 24VAC power and 0 to 10 VDC signal when proportional and tested

e. The motor operated valves are tight closing for use w/steam and hot water.

f. Size specifications: As noted below for Three-Way Control Valves

5. Three-Way Control Valves

a. Belimo, Johnson Controls, Honeywell, Delta,

b. Mixing type w/2 inlets and 1 outlet

c. Assembled with motors using customized linkage or equal with 24VAC power and 0 to 10 VDC signal when proportional and factory tested

d. Valves shall conform to specifications according to size

e. Brass modulating plug includes a molded and bonded composition disc

f. 316 stainless steel valve stem

g. Valves shall have brass trim and handle fluids up to 281 degrees F

h. Size specifications:

1) 1/2"-1" cast iron bodies per ANSI B16.15, Class 250, re-movable cast brass cage w/ integral seat

2) 1-1/2"-2" cast brass bodies rated at 125 psi, with metal to metal seating and post guiding brass plug

3) 2-1/2"-4" shall have 125 psi rated ASA flanged cast iron bodies

6. Self-Contained Thermostatic Control Valves

a. Bell and Gossett, Danfoss

b. The preferred system is to control room temperature by EMS room sensor when replacement of total EMS system considered

c. Self-contained thermostatic control valves pose a vandalism hazard. Any remote thermostatic controls shall include rigid conduit protection of wires. Where only EMS boiler control replacement is considered, control valves shall be non- electric adjustable suitable up to 250 degree F HW or 15 psi steam service and working pressures of 200 psi

d. Valves shall be angle or straight pattern type w/ nickel plated cast bronze body, stain- less steel stems and springs

e. Valve actuator shall be self-contained adjustable thermostat w/ temperature sensing element

F. HVAC Piping and Pumps

1. Heating Water Supply and Return Boiler Piping

a. Schedule 40 carbon steel, black, seamless ASTM A-53 Grade B piping for heating hot water supply and return piping. For 2-1/2" and smaller may use Type L copper ASTM B88.

b. 2 inch and smaller w/ screwed joints

c. 2 1/2 inch and larger butt welded or flanged

d. Fittings: 2 inch and smaller 150 lb malleable iron, black ASTM A-197 or ASTM A-47, 2-1/2 inch and larger, carbon steel butt welding ASTM A-234, Grade WPB.

e. Unions: 300 lb malleable iron, black ASTS A-197 or ASTM A-47

2. Branch Connection

a. 2 inch and smaller screwed or socket weld tee fittings

b. 2 1/2 inch and larger tees or reducing tees, forged carbon steel ASTM A-105, 300 pound WOG with butt welded or socket welded or threaded outlet as required.

3. Flanges

a. Forged steel ASTM A-181, Grade I, slip on or welding neck type, faced and drilled, 150 pound 1/16 inch raised face ANSI B16.5

b. Neck bore shall match pipe ID

c. Steel insulating flange shall be machined off when mating w/a cast iron flat faced flange

4. Bolting

a. 150 and 300 pound flanges: carbon steel, ASTM A-307 Grade A hex head bolts and nuts

b. ASTM A 307, Grade B square head bolt and heavy hex head nut when making flange is cast iron and flat ring type gasket

c. 1/8 inch undersize bolting material is used for insulating flanges use ASTM A 193, Grade B7 alloy stud bolts and ASTM A-194 Grade 2H carbon steel heavy hex nuts

5. Gaskets

a. Cranite, Johns-Mansville No 60

b. 1/16 inch non-asbestos composition flat ring type w/RF flanges

c. 1/16 inch thick full face type w/flat face flanges

6. Thread Lubricant

Teflon type

7. Weld Rod

AWS A5.1, E6010 for shielded metal arc process

8. Flow Regulators/Circuit Setters

a. Bell and Gossett, Barco

b. Max working pressure of 300 psig for NPT models and 200 psig for sweat models; max operating temp of 200 degree F.

c. Bronze body, brass ball construction w/glass and carbon filled TFE seat rings

d. Valves to be bronze body, brass ball construction with glass and carbon filled FTE seat rings

e. Differential pressure read-out ports

f. Valve bodies to have 1/4" NPT topped drain/purge port

g. Accuracy ± 1%

9. Strainer

a. Amtrol, C. M. Bailey, Sarcol

b. 250 pound w/ 0.045 inch mesh iron body stainless steel monel cylinder and gasketed cap in steel line.

c. 125 pound bronze body in copper line.

G. Pumps

1. General

a. Manufacturers; Bell and Gossett, Grundfos Pump Co., Weil Pump Co.

b. Factory assembled and tested.

c. Base-Mounted Pumps: Include pump casings that allow removal and replacement of impellers without disconnecting piping.

d. Types, Sizes, Capacities, and Characteristics: As indicated.

e. Motors: Furnish single-, multiple-, or variable-speed motors, with type of enclosures and electrical characteristics indicated. Include built-in thermal-overload protection and grease-lubricated ball bearings. Select each motor to be non-overloading over full range of pump performance curve.

f. Finish: Manufacturer's standard paint applied to factory-assembled and -tested units before shipping

2. Expansion Tanks

a. Bell & Gossett

b. Overhead, non-diaphragm air replacement type tank for 240 degree F.

c. 125 psig design pressure

d. Steel construction

e. Flanged opening on top

3. In-Line Circulators

a. Bell and Gossett, Grundfos Pump

b. Description: Horizontal, in-line, centrifugal, single-stage, bronze-fitted, radially split case design; rated for 125-psig (860-kPa) minimum working pressure and a continuous water temperature of 225 deg F (107 deg C). Include the following:

c. Casing: Cast iron, with threaded companion flanges for piping connections smaller than 2-1/2 inches (DN65) and threaded gage tappings at inlet and outlet connections.

d. Connection Option: Include unions, instead of threaded companion flanges, at connections for casings that are not available with threaded companion flanges.

e. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.

f. Impeller: ASTM B 36 (ASTM B 36M), rolled-temper-brass fabrication, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.

g. Shaft and Sleeve: Steel shaft with oil-lubricated copper sleeve.

h. Seals: Mechanical type. Include carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.

i. Pump Bearings: Oil-lubricated, bronze journal and thrust type.

j. Motor Bearings: Oil-lubricated, sleeve type.

k. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

l. Motor: Resiliently mounted to pump casing.

4. Heating Hot Water Pumps

1. Bell and Gossett, Grundfos pumps, which require no lubrication
   a. In-Line
   b. Electric motor drain
   c. Direct drive, no coupling
   d. Centrifugal
   e. Cast iron casing
   f. Bronze impeller
   g. Steel shaft
   h. Pump suction and discharge connections shall be 150 pound flanged
   i. Suitable for 250 degree service
   j. With on/off controls via EMS, Use timer and aquastat for control if no EMCS is available.
2. Bell and Gossett, Grundfos pumps which require no lubrication
   a. Base mounted
   b. Electric motor
   c. Horizontal
   d. Single stage centrifugal
   e. Cast iron casing
   f. Pump suction and discharge connections shall be 150 pound flanged
   g. Bronze impeller, stain-less steel shaft

h. Mechanical seals
i. 250 degree F service
j. Pump curves shall be non-overloading within 150% of design GPM
k. TDH no less than 10% below maximum impeller diameter with on/off controls via EMS
l. Strainer, triple duty valve and venturi
m. Later impeller should be trimmed to precision duty.

5. Chemical Feeder

a. J.L. Wingert
b. Steel, bypass type w/ feeder cap, 5 gallon tank with drain.
c. Designed for 150 psig working pressure

H. HVAC Air Distribution

1. Ductwork and Accessories

Fabricated of galvanized prime steel sheets

2. Mixing Boxes

a. Lennox, Carrier, McQuay
b. Return and outdoor dampers w/2 inch disposable filters

3. Filter Housing

a. Provide filter housing from the same manufacturer as filter media or provided by the air handling unit manufacturer. Coordinate media size with filter rack design. Contractor-fabricated housings or filter racks shall not be accepted.

b. Provide multi-stage filter housing constructed with filter tracks of aluminum construction. The housing and tracks shall accommodate the filters specified without modifications. Provide minimum two doors for access from both sides. Access doors shall be swing open type and completely removable with positive sealing, heavy duty latches and high-memory sponge neoprene gasket for door-to-filter seal. Do not secure doors with nuts, bolts, wing nuts, or sheet metal screws.

4. Filter Gauges

a. Provide dial type filter gauges, 3-7/8-inch diameter dial, diaphragm-actuated, with external zero adjustment in a metal case with auxiliary electrical control contacts to sound high pressure alarm at central control panel.

b. Provide one gauge for each filter bank, suitable for flush or surface mounting. Include an air filter gauge accessory package consisting of mounting bracket, aluminum tubing, two static pressure tips, and 2-way vent valves for each gauge. Range shall be as recommended by filter manufacturer.

c. Filter gauges shall be manufactured by Dwyer, or approved equal. Proposed substitutions must be reviewed for approval by the SUHSD Maintenance and Operations Department.

5. Sound Traps

a. Industrial Acoustics, Rink, Merit Engineered Poducts, Koppers, Gale

b. Standard rectangular and round silencer units

c. 22 gauge galvanized steel outer casing

d. 22 gauge perforated galvanized steel interior partition

6. Manual Balancing Dampers

a. Galvanized steel

b. Round damper < 11 inches in short dimension shall be single blade type

c. rectangular damper > 12 inches in short dimensions shall be multi-bladed opposed blade w/ maximum 7 1/2 inch individual blades

d. Damper regulators shall have position indicating dial and locking mechanism

e. Damper actuating system shall have brass bushings (plastic coated fittings not allowed).

7. Flexible Duct Connections

a. Ventfabrics Inc., Duro-Dyne

b. Fire resistant, water proof fabric, edged w/24 gauge galvanized metal strips

8. Flexible Air Ducts

a. Flexible Air Duct Connectors installation shall be in accordance with CMC Chapter 6, and length shall not exceed 7ft. and angular deflection shall not exceed 15F-degree.

9. Smoke Detectors

a. UL approved

b. Required in supply air duct and air systems providing more than 2000 CFM. Must be tied into fire alarm system (see Electrical Section).

c. Provide duct access door for servicing duct detector parts inside the ductwork.

I. Fans / Units and Gravity Relief Vents

1. General

a. Fans and Fan Units: Provide easy access to the filters. Do not place fan units above T-bar ceilings, requiring removal of T-bar to change filters.

b. Fasten a red-headed tack to each T-bar suspended ceiling pushout tile at, filter changing locations.

2. Fan and Fan Units

a. B1, AF centrifugal fans: New York Blower, Barry, Pace, Loren Cook

1) Cleanout door in fan scroll

2) Certain fans shall be equipped with outside VIVs

b. FC Utility Fans: Greenheck, Trane, ILG, Pace, Loren Cook

1) Control fans/dampers via EMS

c. Hood Exhaust Fans: Heil, Hartzell, Pace, Loren Cook

1) Plastic vaneaxial

2) Direct drive motor and assembly or belt drive

d. Centrifugal Roof Exhaust Fan: Penn, ILG, Greenheck, Architect and Engineerrovent, Loren Cook
   1) Metallic weatherproof hood, backdraft damper and bird screen
e. Axial Roof Mounted Supply Fan: Penn, ILG, Trane, Buffalo, Loren Cook
f. Centrifugal Wall Exhaust Fan: Penn, ILG, Greenheck, Loren Cook
g. Propeller Roof Mounted Supply Fan: Penn, ILG, Greenheck, Buffalo, Loren Cook
   1) Weatherproof hood
   2) Weatherproof bird screen
   3) Sound attenuating curb
h. Propeller panel mounted exhaust fan: Penn, Greenheck, Loren Cook
i. In-line centrifugal fan: Greenheck, ILG, Loren Cook
j. In-line cabinet fan: Penn, Trane, Loren Cook
k. Cabinet fan: Pace, Tempmaster
l. Fan assembly and galvanized steel enameling cabinet : Buffalo, Loren Cook
m. DWDI, AF, centrifugal
   1) Interim of fan cabinet shall be lined w/ 1 inch thick insulation
   2) Adjustable mounting of drive motors

3. Fan Bearings

a. SKF, Link-Belt
b. Pre-lubricated
c. Relubricable w/ grease fittings and self-aligning
   1) Fafnir, SKF, Link-Belt ball bearing power transmission units.
d. All bearings shall be pre-lubricated, relubricable, with grease fittings and self-aligning.
e. Where required, grease fittings shall be extended to easily accessible location.
f. Flange-mounted bearings shall have at least four mounting holes.

4. Exhaust Fans

a. Greenheck,
   1) Belt driven w/adjustable sliding base rails.

5. Centrifugal Fans

a. General

1) New York Blower, Barry, backwardly-inclined, airfoil-bladed, fans.
2) All fans shall have cleanout doors in the fan scroll.
3) Certain fans shall be equipped with outside-type variable inlet vanes.
4) Linkage shall be external to the airstream and accessible without dismantling fan or opening access doors.

5) Internal inlet-type vanes are prohibited.

6) Fans shall be constructed, tested and rated in accordance with the AMCA Standards and shall carry the AMCA Certified Rating Seal.

b. Centrifugal-type Roof Exhaust Fans

1) Penn, ILG, Greenheck, Architect and Engineerrovent

2) Metallic weatherproof hood

3) Backdraft damper

4) Bird screen

c. Centrifugal-type Wall Exhaust Fans

1) Penn, ILG, Greenheck,

2) Metallic weatherproof hood

6. Propeller-type Roof-mounted Supply Fans

a. General

1) Penn, ILG, Greenheck, Buffalo

2) Metallic weatherproof hood

3) Bird screen

4) Sound attenuating curb

b. Propeller-type Panel-mounted Exhaust Fans

1) Penn, Greenheck

2) Guards for fan and motor

c. Fans and Fan units Exposed to Weather

1) Completely weatherproof

2) Motors shall be the totally enclosed, equipped with weep holes

7. Gravity and Relief Vents

a. Penn, ILG roof vents

b. Fabricated of aluminum.

c. Vents shall be furnished with sound-attenuating curb and bird screen

d. Sizes of gravity and relief vents shall be suitable for intended services

8. Drives for Belt-driven Fans

a. General

1) Dodge, Browning short-center V-belt drives with cast iron sheaves.

2) Drives shall have sufficient capacity to transmit required power without slipping when starting. Use at least two belts on every drive for 1/2 HP and larger motor size. Ratings shall be such that with all belts, horsepower rating shall be at least 1.5 times motor horsepower and, without the belt, rating shall be at least equal to the motor horsepower.

3) Shafts of belt-driven fans shall have accessible, center-punched ends for tachometer readings. Hollow shafts shall have factory-installed, center-punched plugs installed for this purpose.

4) Complete sound power level data (re 10-12 watts) at design operating point shall be furnished for all fans. Ratings shall be based on AMCA Bulletin No. 300, Test Setup No. 1.

b. Variable and Constant Air Volume

1) Reheat Units: Barber-Coleman, Carrier

2) Hot water reheat

3) Air Outlets: Barber-Colman, Tuttle and Bailey, Titus

4) exhaust air outlets discharging into ceiling plenum do not need volume control

5) Intake registers shall have opposed blade volume damper and fabricated from aluminum

J. HVAC Air Cleaning Devices

1. Air Filters

a. Cambridge "Hi-Flo", Continental "Conosak"

b. Stainless Steel holding frame for 2 inch thick prefilters designed for upstream access

c. Holding frame shall be as specified

d. Filter test report shall be submitted by the manufacturer

e. F.W. Dwyer, Cambridge

f. All filter assemblies shall be equipped w/ manometer draft gages

2. Filters

Filters shall be manufactured by Camfil Farr, American Air Filter, or Eco-Air.

3. Filter Cartridges

a. Pre-filters

1) Provide replaceable, factory-assembled filters with microfiber glass laminated to an all glass mesh backing and formed into uniform radial pleats. Provide stainless steel retainer and header. Filter shall be Camfil Farr 30/30 series or equal, MERV 8 efficiency and 25-30% dust spot efficiency as per current ASHRAE Standard 52 requirements, U.L. Class 1 listed.

2) Do not exceed an initial pressure drop of 0.33-inch WG at 500 fpm face velocity. Do not exceed a final pressure drop of 1.0 inch WG at 500 fpm. Media velocity at maximum catalogued capacity shall not exceed 150 fpm.

b. Final Filters

1) Provide replaceable, factory-assembled filters with microfine glass laminated to a reinforcing backing to form a uniform lofted media blanket. The media blanket shall be formed into uniform radial pleats and supported by a non-metallic stiffened media backing. The media shall be mechanically and chemically bonded to the inside periphery of the enclosing frame to prevent air bypass.

2) Construct the non-metallic enclosing frame of multiple laminate layers that shall be resistant to high humidity and maintain a rigid and durable enclosure.

3) Filter shall be capable of withstanding 10" w.g. air pressure without failure.

4) Provide 12 inch deep filter as manufactured by Camfil Farr Riga-Flo E series PH or equal, MERV 13 efficiency and 80-85% dust spot efficiency as per current ASHRAE Standard 52 requirements, U.L. Class 1 listed.

5) Initial pressure drop shall not exceed 0.65-inch WG at 500-fpm face velocity. Final pressure drop shall not exceed 1.5 inch WG.

c. Spare Cartridges

Install new filter cartridges immediately prior to acceptance. Furnish one (1) complete set of new filter cartridges for each filter bank on completion and acceptance of the Work.

K. Central Heating Equipment

1. Hot Water Boilers

a. Locate emergency shut-off near the exit doors.

b. Use temperature reset depending on outdoor temperature.

c. Designed for 50 psig

d. Sectional cast iron or high efficiency condensing type

e. Factory assembled or knock down mode

f. Atmospheric burner, natural draft for natural gas of 1050 BTU/Cu Ft

g. Gas delivered at 7" w.c. to 14" w.c. Mechanical Engineer to verify pressure in field.

h. Shipped w/steel skid for forklift and eye-bolts for rigging.

i. Installed complete with specified trim, instrumentation and controls piping circulation and valves

j. Include third party boiler inspection to be paid for by contractor and approved by the District. Provide written report of boiler inspection.

k. Heavy steel insulated flush jacket with baked enamel finish

l. Backflow prevention device shall be a reduced pressure principal device. A separate pressure reducing station may be needed if the pressure is excessive.

2. Operating Controls:

a. Modulating gas controls

b. Specified trim:

1) 30 lb ASME relief valve(s) sized per ASME standards

2) Electronic probe type low water cut-off (LWCO) w/manual reset and probe test button and lamp, and alarm contacts

3) Combination water feeder and LWCO

4) Pressure and temperature gauge

5) Water temperature controls

6) Manual reset hi-limit with alarm contacts

7) Dry contacts for all alarms

8) Supply and return water temperature sensors to EMS by controls contractor

9) Control panel to include 24 VAC relay for on/off control wired to terminal strip and dry contacts for all alarms wired to terminal strip wired for EMS interface

10) California Trim package and LoNox package where required.

3. Forced Air Furnace

a. Carrier, York, McQuay

b. Factory assembled and pre-wired upflow type

c. Built-in draft inverter heat exchanger and heavy duty gas burner

d. System control via EMS

4. Heat Exchangers

a. South Gate Engineering, Patterson- Kelly, Yuba

b. 150 psig ASME labeled

c. Straight tube type, removable type bundle, fully floating tube sheet

d. Pressure relief valve

e. Steel shell, cast iron bonnet

f. Relief valve w/ 100 psi gage pressure relief setting

g. Watts, McDonnell Miller, Conbra Co.

h. Provide double walled vented heat exchanger where required

L. Decentralized HVAC Equipment

1. Evaporator Cabinet Construction

Construct cabinet and chassis of heavy gauge galvanized steel, serviceable from one side only. Attach mounting brackets to the cabinet.

2. Air Distribution

a. For units with a nominal cooling capacity of 3 tons or less, provide a direct-drive fan assembly with double-inlet blower, self-aligning ball bearings, and lifetime lubrication. Fan motor shall be permanent-split capacitor, high efficiency type, equipped with two speeds for air flow modulation. Dehumidification shall utilize the lower fan speed.

b. For units with a nominal cooling capacity of 4 to 8 tons, provide a belt-drive, centrifugal type, double width, double inlet fan. The shaft shall be heavy-duty steel with self-aligning ball bearings with minimum L10 life of 100,000 hours. The fan motor shall be 1750 rpm and mounted on an adjustable base. Equip the drive package with an adjustable motor pulley. The fan/motor assembly shall be mounted on vibration isolators.

c. Where shown on drawings the evaporator section shall be supplied with an air distribution plenum with integral filter. The plenum shall provide 4-way air distribution, for installation into a standard 2'x4' ceiling grid. Filter size shall be 4" deep pleated type with minimum efficiency of 20%, based on ASHRAE standard 52-99.

d. Where an air distribution plenum has not been shown on drawings provide a filter box with 4" deep pleated type filters with minimum efficiency of 20%, based on ASHRAE standard 52-99.

3. Direct Expansion Coil

a. The evaporator section shall include evaporator coil, thermostatic expansion valve, and filter drier. The evaporator coil shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of 500 ft. per minute. The coil shall be provided with a stainless steel drain pan. Refrigerant flow shall be controlled by an externally equalized thermostatic expansion valve.

b. Provide unit with controls and control panel to interface with BMS.

4. Testing

a. All fans, motors and drives shall be field-tested for dynamic balance and, if necessary, field-balanced by an approved independent testing agency. Balancing of fan assemblies shall be accomplished to a tolerance of less than two mils (2/1,000 inch) peak-to-peak amplitude, as measured by Stuart-Warner, IRD electronic balancer when measured on top of fan bearing housings.

b. Performance characteristics and drive motor sizes of fans shall be suitable for intended services.

c. Furnish a written certification of testing agency, starting the amplitude for each fan as first tested and as finally corrected.

5. Water Heating Coils

a. Water to air w/copper tubes

b. Copper or aluminum fins

c. All coils shall have a flanged casing

6. Fan Coil Unit Heaters-Vertical Floor Mounted

a. Force Flo Dunham Bush, CR, Aaon, Carrier, McQuay

b. Packaged unit, assembled and prewired.

c. Flow regulator, circuit setter, 24 VAC control valve for on/off Operations or 0 to volt proportional control via EMS.

d. When total EMS is considered; where only EMS boiler controls replacement is considered, leave existing proportional room thermostat, fan relay and isolation valves

e. 18 gauge chassis

f. Dbl deflection discharge grille

g. 25% O.A. mixture

h. Return air inlet grille

i. Coils suitable for 75 psi or 200 psi steam or HW up to 275 degree F.

j. Motor shall have integral thermal overload protection and start at 87% of rated voltage

k. Vertical air blast under window and horizontal air blast against wall.

7. Fan Coil Unit Heaters-Inverted Recessed Wall-Hung

a. Dunham-Bush, Aaon, Carrier, McQuay

b. Assembled, pre-wired unit flow regulator or circuit setter, 24 VAC control valve for on/off Operations or 0 to 10 volt proportional control via EMS when total EMS replacement is considered; where only EMS boiler control replacement is considered, leave existing proportional room thermostat, fan relay and isolation valve

c. 18 gauge chassis
d. Inlet and outlet grilles 15 degree downward deflection
e. Insulated front panel over entire coil section and front access door
f. Coils for up to 75 psi steam pressure or 275 degree F HW and tested at 300 psig air under water
g. Removable filter
h. Integral thermal overload motor to start at 87% of rated voltage, and operate at 90% of rated voltage.

8. Propeller Unit Heaters, Wall Mounted

a. Dunham-Bush, Aaon, Carrier, McQuay
b. Flow regulator, circuit setter, 24 VAC control valve for on/off Operations or 0 to 10 volt proportional control via EMS when total EMS replacement is considered; where only EMS boiler controls replacement is considered, leave existing proportional room thermostat, fan relay and isolation valves
c. The basic unit w/Model A fan
d. Assembled and pre-wired
e. Fan shall have high efficiency blades, factory balanced and sturdy for spark proof applications
f. Louver fan diffuser
g. Aluminum coil fins bonded to seamless copper tubing suitable for steam pressure up to 75 psi or HW up to 200 psi or 325 degree F
h. Coils shall be tested at 300 psig air under water
i. Motors shall be totally enclosed explosion proof 115/60/1 Class B insulation w/thermal overload protection.

9. Propeller Unit Heaters, Ceiling Mounted

a. McQuay, Sterling
b. Assembled and pre-wired w/ flow regulator, circuit setter, 24 VAC control valve for on/off Operations or 0 to 10 volt proportional control via EMS when total EMS replacement is considered; where only EMS boiler controls replacement is considered, leave existing proportional room thermostat, fan relay and isolation valves
c. Fan w/high efficiency blades, factory balanced and sturdy for spark proof applications
d. Aluminum coil fins mechanically bonded to seamless copper tubing for steam pressures of 75 psi or HW up to 200 psi or 325 degree F
e. Coils shall be tested at 300 psig under water
f. Explosion proof motors shall be totally enclosed, 115/60/1 Class "B" insulation w/ thermal overload protection

10. Heating & Ventilating Unit

a. Pace, McQuay, Carrier
b. Horizontal, draw-through
c. DWDI, AF centrifugal

d. Galvanized steel cabinets
e. 1 inch thick insulation lined glass fiber fan cabinet
f. Fans and fan units exposed to weather shall be waterproof
g. Field tested for dynamic balance and/or field balanced control via EMS

11. Convector Radiators

a. Dunham-Bush, Vulcan, Trane
b. Heating element shall be non-ferrous consisting of 1/2" diameter copper tubing and .012" thick aluminum plate fins w/full-flanged collars.
c. Cabinets shall be formed from cold rolled steel and suitably braced and reinforced, free standing type FH; wall hung, flat-top type WH; wall hung, slope top type SH/SFH; fully recessed type MH; partially recessed type RH.
d. Institutional type convector
e. Front gauge shall be 14 and inner gauge shall be 16
f. Dampers and access doors shall be w/Allen Head operators.
g. Optional Accessories:
    1) Textured, embossed steel enclosure
    2) Baked enamel finish
    3) Louvered inlet grille
    4) Dampers shall be 20 gauge flanged and rolled for stiffening. Operator shall have 2 freewheeling clutches for automatic engagement at full open or closed position, and shall be anti-jamming. (No thermostatic valves)
    5) Full back plate
    6) Stamped inlet grille
    7) Extruded, clear hard coat anodized aluminum bar grille.

M. Domestic Hot Water System

1. Domestic Hot Water Systems:

a. Where applicable, the domestic hot water circulation pump(s) shall be enabled and disabled based upon an independent start/stop schedule.
b. The minimum required monitoring and control points shall include:
c. Hot water supply temperature
d. Hot water pump(s) start/stop
e. Hot water return temperature
f. Other as applicable

2. Air Handler Systems:

a. Each air handler shall be started via the boiler system optimum start program. As applicable, the supply and return fans shall start in a time-staggered manner. The heating coil valve is sequenced

with the economizer section, if so equipped, such that the economizer dampers maintain the supply air temperature setpoint as the first stage of heating, then the pre-heat coil, if so equipped, then the heating valve is modulated open to maintain the setpoint as the second stage of heating.

b. The heating coil valve shall be interlocked with the supply fan such that when the fan is disabled, the valve shall be closed.

c. Air handler economizer sections may be two position or modulating, as specified on the project documents. The economizer dampers shall modulate to maintain either the heating or cooling setpoint, as sensed by outside and return air temperatures. Outside air and exhaust air dampers shall be closed when the fan is disabled. When the fan is enabled and no heating or cooling is required, the modulating outside and exhaust air dampers shall not close below a minimum position of 20%. When the fan is enabled and no heating or cooling is required, the two-position outside and exhaust dampers shall fully close and the return air damper shall fully open.

d. If so equipped, the duct static pressure shall be maintained by modulating the variable frequency drive(s) (VFD) or the discharge dampers. The return fan VFD shall modulate identically with the supply fan. A high static pressure sensor shall shut down the fan(s) upon sensing a high static pressure condition. The duct static pressure setpoint shall initially be set to 1" WC, adjustable.

e. Where terminal boxes with reheat are installed, the supply air temperature shall be reset as follows: When return air temperature is 68°F, the supply air temperature shall be 72°F. When return air temperature is 73°F, the supply air temperature shall be 55°F, adjustable.

f. Interlock all associated exhaust fans with the air handler supply fan.

g. The smoke detector shall be wired to shut down the unit in the event smoke is detected in the return or supply ducts.

h. The minimum required monitoring and control points shall include:

Each Air Handler	
Supply fan start/stop	Discharge damper or VFD
Return fan start/stop	Smoke detector status
Supply fan status	Filter status
Return fan status	Hot water coil
Supply air temperature	Pre-heat coil
Return air temperature	Multi-zone zone control
Mixed air temperature	High static pressure
Supply static pressure	Outside air temperature
Mixed air dampers	

9. Air Terminal Units:

a. Each pressure independent terminal units with no reheat shall operate from its own optimal start program and shut down based upon the time schedule. The box controller shall measure airflow and maintain an airflow setpoint by modulating the inlet air damper. Airflow increases or decreases depending upon how far away the space temperature is from the heating or cooling setpoint. When the space temperature rises above its setpoint, the box airflow setpoint is increased from minimum cooling CFM toward maximum cooling CFM. When the space temperature falls below its heating setpoint, the box airflow setpoint is increased from minimum heating CFM toward maximum heating CFM. During all occupied times, a minimum airflow shall be maintained.

b. Each pressure dependent terminal units with reheat (electric or hot water coil) shall operate from its own optimum start program. The box controller shall measure airflow and maintain an airflow setpoint by modulating the inlet air damper. Airflow increases or decreased depending upon how far away the space temperature is from the heating or cooling setpoint. When the space temperature rises above its setpoint, the box airflow setpoint is increased from minimum cooling CFM toward maximum cooling CFM. When the space temperature falls below its heating setpoint, the box airflow setpoint is increased from minimum heating CFM toward maximum heating CFM. If the maximum heating CFM is not capable of maintaining the space temperature setpoint, the electric or hot water coil is sequenced to maintain the space setpoint. During all occupied times, a minimum airflow shall be maintained.

c. For terminal units equipped with fans, the fans shall run when the terminal unit is in the occupied mode.

d. The minimum required monitoring and control points shall include:

1) Fan start/stop
2) Supply and Return air temperature
3) Airflow
4) Damper
5) Hot water coil valve

10. HVAC and Lighting Override Panels:

a. Where indicated, install an override panel which shall index the HVAC (boilers and applicable HVAC units) and lighting to their occupied mode. Upon activation for any particular heating requirement, the associated HVAC equipment and boilers shall revert to their occupied mode for an adjustable time period. Override buttons shall be momentary type.

b. Override panels shall be equipped with lighted LEDs indicating which mode they are currently in.

c. As specified within the project documentation, outdoor lighting shall be controlled by an outdoor photo cell such that when the adjustable levels of light are reached, the outdoor lighting is turned on or off. Indoor lighting shall be normally controlled by a time-of-day program.

d. The minimum required monitoring and control points shall include:

e. Individual override button enable/disable

f. Individual override button status

g. Outdoor light level

N. Commissioning

1. General:

a. SUHSD will provide design guidelines for the Energy Management System and Commissioning Requirements. Work should be done by SUHSD's preferred vendor and included in the contract.

2. Start up and Testing:

Table 1
Reporting Accuracy

Measured Variable	End-to-End Accuracy
Air and Water Temperature	±1ºF
Relative Humidity	±5% RH
Water Flow	±5% of full scale
Airflow (10% to 100% of scale)	±10% of full scale
Air Pressure (ducts)	±0.1 in. w.g.
Air Pressure (space)	±0.01 in. w.g.
Water/Steam Pressure	±2% of full scale
Electrical (Amps, Volts, Watts, Power Factor)	±1% of reading
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO_2)	±50 ppm

b. Startup and testing shall be completed by the EMS contractor prior to notifying the District of the system demonstration. The District may participate and/or witness the startup and testing. As such, provide the District with a startup and testing schedule.

c. Enable control systems and verify each input and output device's calibration as indicated in the Table below:

d. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal (or power fail) positions are correct.

e. Verify that all analog output devices are functional and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel as necessary.

f. Verify that systems and equipment operates according to the specified sequences of Operations. Simulate and observe each operational mode by overriding and varying inputs and schedules.

g. Simulate a power failure of the entire EMS and ensure systems are automatically operational when power is restored.

h. Prepare a log documenting all startup and testing with technician's initials, data and time, certifying each device and sequence has been calibrated and tested.

3. Demonstration:

a. Prior to District acceptance, perform the following operational tests to demonstrate compliance with the specification after and in addition to tests specified above.

b. The District or their designated representative will be present to observe and review system demonstration. Notify the District at least ten (10) days before system demonstration begins.

c. Demonstrate actual field operation of each sequence of operation as specified and approved.

d. Demonstrate calibration and response of any input and output points requested by the District.

e. Provide and operate test equipment required to prove proper system operation.

f. Demonstrate compliance with sequences of operation through each operation mode.

g. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

h. Demonstrate power fail and restoration.

4. Control System Acceptance:

a. The EMS shall not be accepted until completed demonstration forms, checklists, and logs are submitted and approved as required herein.

b. Subsequent to the satisfactory start up, testing, demonstration, and receipt of the forms, checklists, and logs, the District will recommend the acceptance of the control system.

5. Training

Provide training for designated District staff. All training shall be at the project site. Training shall enable the staff to understand the following:

1) Control system architecture and configuration
2) Location of all equipment and system components
3) System operations and sequences
4) System drawings and Operations and Maintenance manuals

6. Submittals and As-Built Documentation

a. Submittals will include detailed, project specific shop drawings, and product data sheets defining hardware, software, programming, and equipment to be furnished and installed. No work shall begin until submittals have been approved for conformity with the design intent. Provide all submittal material in hard and electronic copy. Submittals shall be provided in editable AutoCAD® or format. Provide information including but not limited to the following:

1) Cover sheet, table of contents, and symbol sheets
2) Wiring diagrams and layouts for each control panel
3) System architectural drawings including diagrams of communication and power wiring
4) Complete listing of I/O points
5) Complete bill of material
6) Floor plans indicating all controlled equipment and component locations
7) Sequences of Operations

b. As-builts will consist of updated documentation as listed above and additional documentation as follows:

1) Testing, commissioning, and acceptance reports used to meet the commissioning requirements
2) Printed and electronic Operations and Maintenance (O&M) manuals
3) Warranty contact information
4) Programming documentation

5) Copy of entire software database
6) Software licenses
7) Guarantees and warranties

c. The EMS contractor shall install within each control cabinet, as-built documentation specific to that control panel.

d. Project-specific software and documentation shall become SUHSD's property. This includes, but is not limited to;

1) Record drawings and documentation
2) Database
3) Application programming code

DIVISION 26 – ELECTRICAL

A. General Requirements

1. General

a. These guidelines apply to all new buildings and comprehensive lighting replacement projects at existing buildings. In such instances, where the criteria listed in this section conflicts with the information in the "Lighting…- General" section above, this section shall supersede. If there is any question regarding applicability, consult with the SUHSD Maintenance and Operations Department**.**

b. Contractors and their employees shall be certified by the State of California Department of Industrial Relations, Division of Apprenticeship Standards, and shall remain in compliance until the end of each project. Contractors shall provide SUHSD Maintenance and Operations Department with their certification numbers immediately after award of the contract.

c. Major revisions to electrical systems, especially fire alarm systems, exit signs, emergency lights, and transformer vaults shall be designed and located so that they do not interfere with accessibility requirements. Review by SUHSD Maintenance and Operations Department shall be required.

d. The purpose of this Project Standards and Specifications is to summarize the Codes and standards, and standard design criteria and practices that will be used during a project. The general electrical design criteria defined herein form the basis of the design for the electrical components and systems of the project. More specific design information will be developed during detailed design to support equipment and erection specifications. It is not the intent of this Project Standards and Specifications to present the detailed design information for each component and system, but rather to summarize the codes, standards, and general criteria that will be used

e. All field devices (i.e. receptacles, switches, junction boxes, lighting, motors, and any other load device) shall be clearly labeled with panel and circuit designation. Provide screwed phenolic labels with ¼" block black lettering on white background for all panels and motors. Hand lettering and/or permanent markers are not allowed.

f. Contractor shall make every attempt not to interrupt electrical service during construction and it shall be her/his responsibility to understand how to reset all systems at the site, i.e. master clocks/bells, fire alarm, security, telephone, ups, lighting and other Division 26 equipment controls. Coordinate with the District for all shut down of power and other systems.

g. Contractor shall be responsible for contingent overloads to the electrical system from additional added loads. Additional branch or distribution panels shall be added as needed to avoid overloading existing panels.

h. Terminations to branch or control panels shall be made neat and workmanlike so as to preserve the integrity of the panel. Conductors shall be labeled appropriately and be free from damage.

i. All panels and equipment shall be located so as to have the working clearance required by the current applicable edition of the CEC. There shall be no lesser code allowed.

j. Contractor shall not salvage existing boxes, fittings, etc. in lieu of installing new.

k. All surplus material shall be itemized and sent to the SUHSD Maintenance and Operations Department with 72-hour notice.

l. Contractor shall be responsible for providing temporary power for the project without interrupting or overloading the existing electrical system. Contractor shall coordinate with SUHSD Maintenance prior to providing temporary power.

m. Contractor shall provide a copy of the initial punch list to the inspector SUHSD Maintenance and Operations Department, and architect/engineer, and shall indicate in the closeout documents that all items on the punch list have been corrected.

n. Architects, Engineers, and Contractors shall allow for spares and ampacity for future at each panel, distributor.

o. As-builts shall be created during project and submitted to SUHSD in closing docs.

p. Contractors shall coordinate with SUHSD Project Managers for periodic job-walks to include Maintenance and Operations departments.

q. All submittals shall be presented to SUHSD Maintenance and Operations well in advance for review and approval.

r. All electrical parts, equipment, etc. shall have “U.L.” rating.

2. Shut-Down and Start-Up

a. Contractor shall inform SUHSD Maintenance and Operations Department for utility system shut-downs and start-ups: gas, electrical and water with advanced notice and approval by SUHSD Maintenance and Operations and site administration.

b. Contractor must ensure that all systems are in complete working order prior to shut down and to present to SUHSD Maintenance and Operations Department an inventory of listed devices not presently functioning at the time of shut down. Contractor shall be responsible for any damages caused by improper starting procedures. SUHSD Maintenance and Operations Department must be contacted in the event of system failure at start up.

3. Interior Lighting

a. SUHSD high performance goals for new construction lighting projects include high visual comfort and energy efficiency. In order to achieve these goals, special attention during the design process shall be paid to efficient lighting systems and appropriate illumination level, minimum glare, and effective use of natural daylight and Title 24 requirements/guidelines.

b. For new buildings and modernization projects that include a full light fixture replacement or lighting controls upgrade, appropriate electrical system commissioning specifications shall be included in the Construction Documents package to insure proper operations of the high performance systems and controls (example; Section 26 99 99 – Electrical Systems Commissioning).

c. Lighting controls shall include those standard items listed below under “Lighting Controls,” including a lighting control panel with Ethernet connectivity to allow remote programming and control of lights.

d. Dimmable light fixtures shall be provided where appropriate to comply with lighting guidelines and Title 24 requirements.

e. Interior Daylight sensors shall be provided to control lighting in all daylight areas to comply with Title 24 requirements and lighting guidelines.

f. HID lamps shall be pulse start ready. HPS, LPS, Mercury Vapor are no longer allowed. .

g. All fluorescent and HID pulse start lamps, to the greatest extent practicable, shall be TCLP compliant and labeled ALTO, Ecologic, Ecolux or an equivalent "low-mercury" designation.

h. Standard Fluorescent lamps to be 4100K color temperature, 28 watts or lower, super T8, minimum 3100 lumen initial rated output, 24,000 hour rated lamp life , with a minimum CRI of 85 for increased color rendering. Minimum lamp efficacy shall be at least 85 lumens per watt for linear fluorescent and 60 lumens per watt for compact fluorescent lamps.

i. T5 lamps, where used, shall have a minimum rated lamp life of 20,000 hours for 18 and 40 watt lamps and 12,000 hours for 27 and 50 watt lamps.

j. For rooms or areas subject to frequent on/off control of lighting (i.e. occupancy sensor controls), fluorescent ballasts shall be extra high efficiency, fully electronic, programmed start, parallel wired, with reduced output ballast factor (max 0.75 bf).

k. All fluorescent ballasts shall be "A" sound rated, multi-tap 120/277V inputs, THD of less than 20%, minimum power factor of 0.9, maximum crest factor of 1.7, and shall include a minimum 5-year warranty.

l. The combined use of high output long life T8 lamps and programmed start, reduced ballast factor, electronic ballasts is intended to provide reduced overall energy usage with equal light (lumen) output to standard lamp/ballast combinations. When used, provide a clear label inside the fixture, visible within sight of the lamps that identifies the proper lamps to be used for replacement. Inadvertent replacement of standard lamps with reduced ballast factor ballast will reduce the overall light output to below acceptable levels.

m. For rooms or areas where lighting is turned on and off less than 4 times per day and burns for at least 3 hours per start, provide extra high efficiency Instant Start, fully electronic, parallel wired ballasts and compatible lamps for increased energy efficiency.

n. To provide the best lighting visual comfort, pendant-mounted direct/indirect light fixtures shall be used wherever possible on new construction projects with ceiling heights of 10 feet or higher, using 18" pendant lengths and seismic restraints. Minimum hanging height of pendant fixtures (to bottom of fixture) is 8'-6" and minimum pendant suspension length shall be 12" from ceiling (to top of fixture). Consider alternate fixture types when these requirements cannot be met. Fixtures shall be of a design that allows maintenance and replacement of lamps by a single District employee. Review fixture selection with the SUHSD Maintenance and Operations Department.

o. Recessed architectural fixtures with medium based E26 and LED lamps are acceptable in offices, restrooms (with sealed trim rings), staff lounge areas, and in auditoriums (as long as they are part of a dimming system).

p. Wall-mounted open indirect/direct light fixtures are not recommended along public corridors and restrooms. Such fixtures if preferred shall by judiciously selected and compatible for spaces being lighted.

q. LED lamping option to be determined by SUHSD Maintenance and Operations Department.

r. Install J-boxes to serve several fixtures in a given area.

s. Lighting circuits shall not be shared with power circuits in same raceway.

t. Lighting installations on high ceilings and walls shall be accessible without the use/need of a scaffold.

u. Emergency ballasts or back-up shall be installed in special fixtures, each classroom, specific office space, and hallways.

4. Exterior Lighting

a. Provide sufficient egress and security lighting around perimeter of buildings. Review requirements with school site staff and consider after-hours events and building/site access routes.

b. Photo-cell controls where required by Title 24 shall control outdoor lighting in addition to programmable timers and/or lighting control panels. Provide Astro-dial function digital programmable with volatile memory time clock as required by CCR Title 24 and under the control of the lighting control panel.

c. Comply with all new CCR Title 24 exterior lighting requirements, including source efficacy, time clock controls, spill light and glare, and maximum power density levels (based on geographic region). Install cut-off shields to minimize spill light and glare to neighboring houses or other structures.

d. Exterior lighting may not exceed 80% of the lighting power allowed by CCR Title 24.

e. Exterior lighting shall be controlled by a lighting control panel with override capabilities and not by external time clocks unless authorized by the District.

f. Provide vandal-resistant models.

g. Exterior lighting wall packs shall be located less than 20 ft. above finish grade or on accessible roof for maintenance access. Pole light fixtures at parking lots to be a maximum of 30 ft. high.

h. All exterior wall-mounted fixtures shall be either HID Pulse Start Metal Halide 100 Watt (minimum) , compact fluorescent with district approval with G24 base, 4100K minimum-rated lamp, LED with 3300 Lumens equivalent, and inductive – no exceptions. Lighting shall have proper lumen rating to serve the needs of specified locations.

i. LED lighting shall be rated at a minimum 50,000 hours of maintenance free operations to L70 at 15 degrees Celsius. Low copper, die cast aluminum housing and frame. Dark bronze polyester powder coat finish. Tempered glass lens, thermal shock and impact resistant. Universal voltage ROHS compliant. UL listed for wet locations and 3 year warranty.

j. No direct light beam radiation from exterior light fixtures shall leave the project site. Provide sharp cut-off fixtures compliant with CCR, Title 24, Part 6, Section 132 (b), and balancing requirements with security issues as allowed per code.

k. Exterior fixtures shall be high impact-resistant, vandal-proof, with watertight covers, and listed for exterior use.

5. Lighting Controls

a. Provide lighting controls for all lighting installations as required by the California Title 24 Mandatory Measures.

b. When new construction or complete whole building lighting upgrade is involved, all lighting, both interior and exterior shall be derived and controlled from lighting control panels. Interior lighting shall have dual override switches in each room adjacent the entry doors. Control panels shall be Watt Stopper, Micro-Lite, Leviton, GE, Hubbell, or Siemens, and WEBRELAY-10 Plus from Xytronix Corporation installed in a NEMA1 approved enclosure. Panels shall be fed by dedicated circuit, have Ethernet for remote programming, silver-coated contacts, manual override, emergency battery backup, and be accessible to maintenance personnel. The main lighting control panel shall be in a central location with slave panels connected to it. All controls must come from a lighting control panel. Mechanical lighting contactors are not allowed. Lighting control panels shall stand alone and be separate from any existing or new BMS.

c. Dual technology (infrared and ultrasonic) occupancy sensors shall be used in all classrooms and other teaching spaces, ceiling-mounted, applied in proper coverage patterns to suit room layouts and sizes. Wattstopper # DT-200 (90 degree), DT-300 (360 degree), or equal. Provide 10% of total quantity installed as spare units to the District.

d. Locate dual technology occupancy sensors high on wall or at ceiling in locations appropriate to the coverage patterns listed by the manufacturer and out of normal reach to minimize vandalism. Insure that pendant mounted lighting fixtures or other obstructions do not block coverage and/or provide additional coverage to insure proper Operations.

e. Provide bi-level local wall switch overrides for off-switching in each room (stepped dimming). For rooms with dual technology occupancy sensors, install power pack ahead of standard light switches

to provide automatic on/off control, but still allow local "off" override when required. Dimming of individual lights (i.e., dimmable ballasts) shall be provided where required to comply with Title 24. Exceptions must be authorized by the SUHSD Maintenance and Operations Department and where mandatory by codes.

f. All rooms shall be provided with mandatory multi-level control lighting for individual fixtures. "Checkerboard" lighting or alternating on/off fixtures or rows of fixture is NOT allowed. Dimmers shall be used to comply with multi-level lighting, except where exempted by Title 24. The use of daylight sensors to automatically turn off lights shall be mandatory at all daylight areas per criteria noted in Title 24.

g. Provide wall switch type infrared occupancy sensors in all private offices, janitor closets, storage rooms, or other rooms less than 250 square feet in size, where entire room is visible from switch location. Wattstopper # WA-300 (bi-level), WA-200 (single level), or equal. Provide 10% of total quantity installed as spare units to the District.

h. Provide a time-clock-based relay control system with zone overrides for all common areas not covered by occupancy sensors. Minimize the quantity of time clocks at each campus to the absolute minimum by specifying networkable systems that allow remote panels to share a single time clock.

i. Include commissioning, adjustment, and testing of all occupancy sensors and time-clock-based lighting controls as part of the contractor's construction services.

j. Commissioning shall include the services of a factory-trained technician for the lighting control systems. Also include training by the technician for District personnel – electrical shop and Plant Manager (at final completion). Include an additional site visit by the technician at 4 weeks after initial site visit and system commissioning in order to verify system Operations and re-program system parameters as may be requested by the District.

6. Emergency Lighting

a. All emergency lighting shall have its own dedicated circuit. No other loads shall be supported from this circuit.

b. Generators are allowed for emergency lighting based on field conditions.

c. Use Emergi-Lite Survive-All SV Series Nema-4x model #W12SV54M-2MW-D emergency lights, white finish, 12 volt, 54 watt power supply, (2) 20 watt MR16 lamps, and non-audible self-diagnostics option or LED as approved by the District (self-diagnostic not to be installed in PAC and high ceilings). Project specifications shall contain "approved equal" language. Proposed contractor substitutions shall be reviewed for approval by the SUHSD Maintenance and Operations Department.

d. Fluorescent with integral battery back-up ballasts shall not be used, unless pre-approved or required. Use only in areas prone to vandalism. Designer must consult SUHSD Maintenance and Operations Department, when fluorescent fixtures with integral battery back-up ballasts are being considered for use.

e. Where approved for use (as noted above including other occupied spaces such as offices and food kiosks), back-up battery ballasts used in fluorescent light fixtures must be self-testing type that automatically test according to the National Electric Code and Life Safety Code requirements. Bodine Co. REDiTEST B50ST or equal. -Mount indicator lamp & test switch on outside of housing.

f. For damp-rated fixture, mount ballast inside the fixture and test switch in remote location to be approved by District Electrical Engineer.

g. Lighting fixtures must be secured according to DSA seismic safety standards.

h. Lock-on all circuits used for emergency lighting to prevent site staff from using panel breakers to turn off banks of lights at night. Standard breaker handle locks that require the removal of the panel

cover for removal or unlocking are suitable lock-on devices and will allow the breakers to operate under overload or short circuit.

i. Mount fixtures high enough to prevent vandalism and still provide code-required illumination at ground level.

j. Install lexan shields.

k. The use of central inverter style battery back-up system shall be field determined and approved by SUHSD Maintenance and Operations Department.

7. Combined Exit / Emergency Lighting

a. Use Emergi-Lite 'Survive-All' LPEX600-N combination emergency exit light fixture or Exitronix G602-WB-WH-AT-EL-2A LED.

b. All LED signs must have self-diagnostics (except at PAC, MUR's, and Gymns) and be self-testing with 25-year warranty.

c. Exit and emergency light fixtures in locker rooms, gyms, and other vandal-prone areas shall have heavy gauge woven wire mesh screen protection.

d. Lock out all circuits used for exit/emergency lighting as described above. Emergency power system: Specify only after consultation with District (if required).

e. Provide emergency power system for the following applications:

1) Emergency lighting
2) Exit signs
3) P.A. system
4) Fire alarm system
5) Areas required by code
6) Boiler room
7) Mechanical equipment room
8) Electrical equipment room
9) Rooms in use after daylight hours
10) Food Services
11) Admin
12) PAC
13) MUR's/ MP's

8. Exit Signs – Over Doors

a. Radioactive exit signs are not allowed.

b. Non-powered exit signs may include photoluminescent pigmented (self-glowing) exit signs that do not use radioactive products – BradyGlo, Active Safety, Mule, Exitronix or approved. Photo luminescent exit signs shall be continuously illuminated by emergency powered night light fixtures.

c. Exit signs shall be applied in accordance with California Codes and Regulations with State Fire Marshall Amendments.

d. Fixtures (mounted over doorways or on the ceiling for minimal vandalism), single or twin face, shall use light emitting diodes (LEDs) for their light source, with self-contained battery, green color letters

on white faceplate; universal mount, universal arrows, self-testing, self-diagnostic test feature, and LED downlight.

e. See combined exit/emergency above.

f. Mounted high enough to meet code and minimize vandalism.

g. Retrofit all existing fluorescent and/or incandescent exit signs with new LED style as noted above.

h. Lock-on circuits for combined exit lighting as described above.

i. Avoid stem mounted devices wherever possible unless authorized by the district. Attach exit signs to hard surfaces wherever possible to limit damage. No stem mounted devices allowed for exterior.

9. Exit Signs – Low-Level

a. Radioactive exit signs are not allowed.

b. Non-powered exit signs may include photoluminescent pigmented (self-glowing) exit signs that do not use radioactive products – BradyGlo, Active Safety, Mule, Exitronix or equal. Low level photo luminescent exit signs shall be continuously illuminated by emergency powered night light fixtures

c. Provide automatic diagnostic test feature and LED downlight except in PAC's, MUR's, Gyms.

10. General Lighting Guidelines

a. PCB Ballasts: Ballasts that contain polychlorinated biphenyl (PCB) must be removed, handled and disposed of according to all appropriate hazardous material control requirements.

b. Fluorescent/HID Relamping: Relamping of fluorescent/HID fixtures must be handled and disposed of according to all appropriate hazardous material control requirements. All Mercury Vapor lamps shall be replaced / removed. No new mercury vapor or low- or high-pressure sodium lamps or fixtures shall be used. Provide metal halide where HID sources are to be used, CFL, or LED.

c. Luminance Values: The following are the targeted average maintained values in foot Candles. Natural daylighting may be considered for daytime illumination, but listed values must be attained for night illumination or bad weather days. Lighting designers may determine more specific requirements in compliance with IESNA recommendations, suited to each particular use:

Classrooms	40-50
Computer Areas	30
Drafting Room, Labs And Shops.....	50
Corridor/stairways and Wash Rooms.....	10
security needs may require 15fc or more	
Library	30
Food Preparation area	50
Dining / Cafeteria	10-30

	10fc for simple dining, but security may require more Task lighting for self-serve areas. Multi-purpose areas 30fc	
Gymnasium	.....	50-80
	50fc for high school / 80fc for high school inter-schoc special events	

11. Light Fixtures and Lamps

a. The general guidelines in this section apply to all projects, including both new construction and modernizations. See the "New Project Lighting Guidelines" section above for additional information that is applicable to new construction and comprehensive lighting replacement projects only.

b. Lighting systems shall be energy efficient and easy to maintain, and they shall provide a visual environment that is conducive to learning. The installed lighting power target shall be at least 10% lower than the CCR Title 24 allowance if possible.

c. The number of different types of lamps and ballasts shall be minimized to reduce maintenance costs. New lamps and ballasts shall match existing (to remain), unless it is not energy efficient, at the same building or campus to avoid inadvertent replacement with the wrong or incompatible lamp or ballast.

d. The use of incandescent, high-pressure sodium, and mercury vapor lamps and fixtures is not allowed unless prior approval has been obtained from the SUHSD Maintenance and Operations Department**,** only for re-lamping or matching of existing fixtures.

e. Provide 48" T-8 medium bi-pin rapid start lamps rated 32 watts, minimum 2850 approx. initial lumens, average rated life of 20,000 hours or more. Verify with each campus to match existing stock prior to final specification or ordering.

f. Fluorescent lighting fixture shall use high efficiency electronic ballasts, rapid-start, A-sound rated, with universal voltage input (120/277V), and operating frequency above 20KHz. Minimum ballast factor 0.9, maximum THD of 10%. All ballasts to have minimum 5 year warranty.

g. Lamps to be 4100K color temperature, with minimum CRI of 85

h. The use of T12 lamps and ballasts with incandescent screw shell lampholders is not allowed. All existing T12 fluorescent lamps encountered in renovation projects shall be replaced or re-lamped with new T8 lamps, electronic ballasts, and sockets as listed above.

i. Recessed ceiling fixtures shall be 2'x4' recessed fluorescent fixtures with hinged acrylic lens diffusers, direct/indirect reflectors that allow re-lamping by a single SUHSD maintenance employee with no special tools or lock releases: Lithonia Avante series or approved equal.

j. LED lighting fixtures may be used for new buildings to meet 2013 (or the latest) Title 24 maximum lighting density requirement.

k. Pendant-mounted linear fluorescent fixtures shall have hinged lenses or covers that allow re-lamping by a single SUHSD maintenance employee with no special tools or lock releases. Review product cut sheets and operations with SUHSD Maintenance and Operations Department**.**

l. Compact fluorescent and HID fixtures and lamps may be used in special applications (e.g., downlights and wallwashers).

m. Compact fluorescent lamps shall be triple-tube, 4-pin style, min. CRI of 80, color temperature to match adjacent sources, minimum 10,000-hour rated lamp life.

n. All light fixtures below 10'-0" AFF shall have tamper-proof screws except at recessed fluorescent, indirect lighting, and recessed can light fixtures.

12. Light Fixtures By Room:

a. Bathroom fixtures: moisture-resistant and vandal-proof.

b. Classrooms: 4-ft. fixtures and lamps wherever practical. Number of lamps will vary according to illumination levels required.

c. Workshops: Industrial-type strip fixtures with slotted top reflectors and wire guard, unless another option is approved by SUHSD Maintenance and Operations.

d. Gymnasiums: Provide access for relamping or lowering mechanism.

e. Provide unbreakable diffusers or wire guards. Wireguards shall be installed in areas subject to high possibility of vandalism, such as locker rooms and restrooms.

f. Locate switches to minimize both vandalism and accidental switching or breakage by flying balls.

g. Provide covers or cages over all devices subject to ball contact.

h. All stem-hung gymnasium light fixtures shall be supported from ¾" rigid conduit or a stem having a minimum of ¾" outside diameter to resist damage from flying balls. Provide one additional slack stainless steel cable connecting fixture housing and roof structural elements for back-up safety.

i. Auditoriums: Provide access for relamping or lowering mechanism. Fixtures must be easily accessible after installation without hazardous access away from cat walks or other access routes.

j. New installations of lighting systems in gymnasiums and other locations where there is a potential for flying object damage shall make use of fixtures that fully enclose the bulbs and have a covering lens of glass or plastic material and protective grille/cage. Renovations and retrofits in gymnasiums and other locations where there is a potential for flying object damage shall either: include the replacement of open fixtures with fixtures that fully enclose bulbs and have some form of protective shield as noted above, or (less preferred option, requires SUHSD Maintenance and Operations Department approval) install, replace, and/or repair wire guards on open fixtures and retrofit fixtures with self-extinguishing ("T" designated) bulbs.

k. Locate light fixtures at both the top and bottom landings of wheelchair lifts.

l. Maintenance:

1) The Contractor shall instruct both on-site custodial staff and area supervisors and district's electrical shop on how to open light fixtures and replace bulbs/lamps.

2) Two sets of special tools are to be given to the site wherever necessary. However, fixtures requiring such tools are to be limited to bathrooms and other areas where supervision is difficult.

3) Training should be provided to the district electrical shop and plant manager.

4) Toilet Lighting: Provide emergency battery light(s) for general and/or over mirror lights. Ceiling mounted motion sensor(s) controlling the light(s) shall be provided with local off-by-pass key switch(es) to comply with Title 24. Motion sensor(s) locations shall cover toilet-bowl stalls such as above the partition(s) between the stall(s) and the general area in the toilet room. Provide one small fluorescent wall/ceiling fixture with build-in battery pack inside ballast channel emergency lighting such that each stall is sufficiently illuminated per code.

13. Switches for Lighting

a. All switches used for lighting shall be spec grade self-grounding type.

b. All switches shall be screw terminal wired. No push-in connectors are allowed.

c. Provide switch controls with silver-coated contacts for Corridor Lighting. Provide key switches in all student and unsupervised areas such as bathrooms or common corridors. On-off switching at the breaker panels is not allowed.

d. Provide 3-way switches where there are 2 doors in a space/ room and 4-way switches where there are 3 doors in a space/ room.

14. Panelboards

a. Panels shall be by Square D, Type NQOB for 225 A and below, and I-line distribution for 400 and above, or approved equal by General Electric or Cutler-Hammer

b. Provide UL-listed safety dead-front lighting and power panel boards. Panel boards shall meet or exceed requirements of NEMA Standard Publication PB-1, and UL-50 and 67. Provide cabinets with flush hinges and combination catch and lock. Provide wiring gutters to accommodate large multiple feeder cables and lugs. Wiring gutters shall be at least 4" for lighting and 208 V panels and 6" for 480 V panels. Where two section panels are required, bolt boxes together to form one unit. Trim shall be two-piece construction with doors of equal size over each section.

c. Provide molded case, bolt-on, thermal-magnetic trip, single, two or three pole branch circuit breakers. Multiple pole breakers shall be single handle, common-trip.

d. Main buswork of panels shall carry at least full rating of feeder overcurrent device that supplies panel.

e. Provide separate equipment ground bus for each panel board. Ground bus shall be insulated from panel enclosure if isolated.

f. Power and lighting panels shall have heavy-duty, continuous, section vertical-hinged to box section for access to wiring gutters in addition to trim door (door-in-door construction referred to a door in door.

g. Provide 6 spares; provide enough ampacity.

h. Review and adhere to electrical requirements in the Telecommunication section of Electronic Safety and Security (Division 28).

15. Clock / Bell System

a. New campuses and modernizations that include an entirely new building communication system shall generally include low-voltage program bell integrated with the public address and bell system. See the following Public Address section for requirements of such a system.

b. The District may prefer to use wireless clocks. Confirm the system design with the SUHSD Technology Department**.** A Wireless atomic self-adjusting clock system powered by battery and receives time correction signals from the national atomic clock in Colorado.

c. PA, Clock, and Bells conduits must not be combined with any other system. The installation must be kept in its entirety.

d. Clocks shall be housed in a separate clock/speaker back box.

e. Clocks shall be minimum 12” diameter round.

f. Provide clocks and PA speaker for bells at locker rooms and other spaces with high ambient noise. Adequate coverage for large yards and corridors may require additional horns and/or sound projectors.

g. All exterior junction boxes shall be NEMA 3R or with an equivalent weatherproof rating.

h. Provide new power supplies for existing bells and include re-programming of bells, fire alarm, and data systems when the power is turned off.

16. Wiring

a. See Fire Alarm section under this Division for wiring requirements, including wire gauges and colors, specific to fire alarm systems.

o. Copper, minimum size No. 12 AWG, stranded, THWN.

p. Boiler control wiring: Copper, minimum size No. 14 AWG, stranded, THWN.

q. All wire and cable shall be rated for minimum of 125 degrees Celsius. Tag all conductors at both ends.

r. Provide equipment ground in all systems.

s. Splices; Wiring splices shall be terminated in standard twist-type wire nuts and/ or Polaris type connectors. The use of push-in quick connectors is not allowed. All fire alarm connections shall Buchanan insulated crimp on connectors.

17. Conduit

a. Minimum size 3/4". Use 1/2" conduits only if 3/4" conduits doesn't work and only with the authorization of the District. Fittings shall be steel compression/ water-tight type for outdoor purposes. Die-cast zinc fittings for interior dry areas are allowed.

b. All exposed raceways and boxes in occupied areas or on exterior walls are to be painted to match adjacent finishes (after installation). Install all exposed conduits parallel to building lines and in a neat professional manner consistent with the adjacent area.

c. All underground conduit to be schedule 40 PVC (unless schedule 80 PVC or rigid galvanized conduit is required per code) with schedule 80 stub-ups and elbows. Provide spare conduits per each utility (electrical, low voltage, etc.) – coordinate with SUHSD Maintenance and Operations and Technology.

d. All conduit fill to comply with CEC (40% max).

e. All interior exposed raceways shall be rectangular steel and matching boxes (Wiremold or equal); #V500 for branch power runs on ceilings and walls (used with V500 series straps, elbows, connectors and V5000 series low profile boxes and covers); #2000 or 2400 low profile for larger power run requirements on ceiling or walls (used with V2000 series straps, elbows, connectors and low profile boxes and covers); #2400D for dual service power and tel/data run requirements (used with divided V2400 boxes and covers). Plastic raceways are allowed only with district approval. Combine line and low voltage wiring. Wireway shall be V- or G-4000 with center divider and other accessories similar to V-5000.

f. Standard stamped steel or drawn junction boxes (or devices of similar appearance) shall not be used for exposed installations in normally occupied areas.

g. Circuit wiring for lighting and power circuits shall remain separate in dedicated conduits, unless otherwise approved by the District.

18. Grounding

a. Genearal

1) Most existing electrical power systems have insufficient or non-existent system grounding. All new power systems or system upgrades are to have their systems checked for ground and upgraded as needed -in accordance with California Electrical Code, except that water piping shall not be used for primary grounding.

2) Grounds and grounding systems shall have a resistance to solid earth ground not exceeding the following values (as measured using a standard 3-point fall-off potential method):

3) Pad mounted Transformers (75 kva to 500 kva): 5 ohms

4) Metal enclosures of primary voltage equipment: 10 ohms

5) Secondary neutral, non-current carrying metal parts associated with electrical equipment and for grounds not covered above: 25 ohms

b. Grounding Conductor

1) Insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits.

2) Separate from electrical system neutral conductor.

3) All ground wires to be insulated and installed in raceways. #6 and smaller to be green. #4 and larger may be black insulation when clearly taped at all splices or junctions with a green electrical tape wrap to identify grounding use.

c. Grounding Rod

1) Solid copper or copper clad steel of adequate diameter to permit driving full length in the earth, but not less than 3/4" diameter.

2) Length shall be at least 10 feet or longer to meet the maximum resistance allowed.

3) When more than one rod is driven, space them at least 20 feet or 2 lengths apart, whichever is longer.

d. Branch Panels

1) Provide (4) 1-inch spare conduits and (1) 1-1/4” spare conduits in flush mounted installations. Stub spare conduits above ceiling and below floor if there is a subfloor.

2) Flush-mounted in wall where possible except at Utility Rooms and Substations.

3) Provide door in door hinged panels. Provide only Cutler Hammer, GE, and Square D as approved by district.

4) All underground conduits shall be Schedule 40 PVC with rigid steel stub-ups. Above finished grade and floor exposed PVC conduits are not allowed.

5) Tag all circuits in junction boxes and panels.

6) Lockout circuits used for emergency systems as described above.

7) Panels to be lockable with keys; extra set to be provided for each of site, SUHSD Maintenance and Operations and Fire Safety Coordinator.

8) Provide screwed phenolic labels with ¼ block black lettering on white background. Hand lettering and glue-on label are NOT ALLOWED.

9) Panels must be identified from where it is fed and where it sub-feeds on the same name panel ID nameplate.

10) Provide 6 minimum spare CKTS for future.

11) Provide certain percentage (to be determined by Electrical Engineer and SUHSD Maintenance and Operations Department) of ampacity for future.

12) Review and adhere electrical requirements in the Telecommunication section of Electronic Safety and Security (Division 28).

e. Transformers

1) Low voltage dry-type transformers shall be NEMA (National Electrical Manufacturers Association) TP-1 compliant high efficiency transformers as required by Title 20 1605.3(t)).

2) In projects with existing transformers near the end of their useful life, replacement with CSL-3 compliant transformers shall be considered after January 1, 2018.

3) For new construction projects, use high-efficiency transformers that meet the Department of Energy CSL-3 rated standard for transformer efficiency and lowest life cycle cost (to exceed TP-1 standards): Powersmiths E-Saver-C3 or equal, with K rating as required for the intended application.

4) Transformers must be identified from where it is being fed and what it is feeding.

19. Receptacles

a. Provide in each classroom (4) 4-plex (at each possible location of teacher's desk for a maximum of four corner locations and four (4) convenience locations at the center of each of the four walls) per classroom including outlets for computer workstations and peripherals. Layout receptacles according with load location approved for by the site. Each of the four 4-plex at the four corners shall share (2) dedicated circuits and the other four 4-plex shall also share (2) dedicated 20A circuits.

b. All Smart Board installations to be provided with four-plex and (1) dedicated circuit.

c. Provide (1) dedicated circuit for each charging station. For 15 PC/tablet charging.

d. All receptacles shall be 20A-rated spec grade self-grounding type. No residential grade allowed.

e. Do not connect more than four (4) duplex receptacles on any one circuit..

f. All computer workstation and peripheral receptacles shall be surge-protected.

g. All receptacles serving workstations shall be installed directly below and be dedicated to serve only the equipment in the computer lab.

h. No receptacles in unsupervised areas.

i. Cover plates: Plastic cover plates are NOT ALLOWED. Use nylon and/or stainless steel cover plates. Coordinate colors with design architect and SUHSD Maintenance and Operations Department to match device color, unless otherwise required.

j. Floor receptacles are allowed as authorized by the district. All locations have to be approved by the District and shall have flush steel cover if allowed by the District.

k. Monument boxes are not allowed on the floor.

l. All exterior general purpose outlets shall be GFCI with hinged and tumbler locked NEMA 3R opaque cover, U.L listed "weatherproof while in use."

m. All devices shall be industrial /specification grade or higher. Residential or standard commodity grade devices are not acceptable.

n. Corresponding branch panel and circuit shall be labeled with transparent tapes on all trim plates.

o. All general use 20 amp receptacles shall be spec grade Leviton, Hubbell, or Pass & Seymour or District-approved equal. All must be self-grounding type one-piece design, minimum 0.05" solid brass strap, high strength, heat resistant, glass-reinforced nylon base. Devices shall accept up to #10 wire, side or back-wired with screw terminals.

p. Specific receptacles in offices and classrooms shall be on emergency back-up.

q. Service receptacle(s)/ GFCI shall be installed in all utility rooms and closets.

r. Service receptacle/ GFCI shall be installed on rooftop near HVAC equipment.

20. Mechanical Equipment Controls

a. All mechanical controls to be designed and installed by Division 23 (wiring, terminations, and testing).

b. Division 26 to specify line voltage controls only, including conduits, to be coordinated with Division 23.

c. Division 23 Mechanical Contractor to incorporate existing BMS when installing new equipment.

21. Photovoltaic Systems

a. Provide visible disconnecting means from point of connection to inverter. Label where the system terminates to Main Distribution Panel. Install signage per applicable codes and PG&E requirements.

b. Solar panels shall be installed with all applicable codes. Refer to DSA Interpretative Manual for other design guidelines and building and electrical code issues.

c. Anchorage of PV panels shall be reviewed and approved by DSA, State Architect's office.

d. Testing of system is required and needs to be approved/ confirmed by Inspector and SUHSD Maintenance and Operations.

e. Training shall be provided to SUHSD Maintenance and Operations upon completion and testing.

22. Close-Out Photographs

a. Photographs and/or video documentation shall be taken before, during, and after project construction. Project areas to be documented shall include, but not limited to the following:

1) Underground applications to facilitate minimizing damage to underground utilities, etc.

2) Behind the wall applications to facilitate minimizing damage to piping, cabling, etc.

3) Above ceiling applications, especially where not visible or limited accessibility.

4) Other areas for overall assistance with the progress of the various installations that may or may not be recorded or seen before, during, and/or after field-walk.

b. Photographic documentation shall assist in case of incomplete, incorrect, and/or missing as-built information.

c. Photographic and video documentation shall be provided as part of the closing/ close-out documentation package to the District.

23. Testing

a. Thoroughly test for the complete operation and functionality of the following electrical systems and devices in the project area:

1) All existing and new lighting fixtures, switches, and control sensors.

2) Power receptacles and outlets

3) Motorized equipment

4) Other Owner designated equipment and devices

5) Fire alarm

6) Intrusion

7) Photovoltaic

8) HV Wiring (MEGGHER)

b. Testing shall demonstrate to the District's Representative that all devices, equipment, and systems are operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.

c. Upon completion of work, at a time to be designated by the District, the Contractor shall demonstrate for the Owner the operation of the installations, including any and all special items installed by the Contactor, or installed under his supervision.

d. Provide test reports to the District with the following:

   1) Summary of project
   2) Description of equipment tested
   3) List of test equipment used in calibration and calibration date
   4) Test results
   5) Conclusions and recommendations
   6) Appendix, including appropriate test forms

DIVISION 27 – COMMUNICATIONS

A. General

1. Test complete systems with a District representative present.
2. The installation shall support analog and digital voice applications, and local area networks (LAN).

B. Codes and Standards

1. All work shall conform to applicable codes and regulations of the State of California.
2. Use guidelines for all telecommunications work and pathways as set forth by the following:
   a. ANSI/TIA/EIA-568-B.1-2001, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
   b. ANSI/TIA/EIA-568-B.2-2001, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
   c. ANSI/TIA/EIA-568-B.3-2000, Commercial Building Telecommunications Cabling Standard, Part 3: Optical Fiber Cabling Components Standard.
   d. ANSI/TIA/EIA-568-B.2-1, Transmission Performance Specification for 4-Pair 100 Ω Category 6 Cabling (Standard).
   e. ANSI/TIA/EIA-569-A.2001 (Including 5 addendums), Commercial Building Standards for Telecommunications Pathways and Spaces.
   f. ANSI/EIA/TIA-570-1991, Residential and Light Commercial Telecommunications Wiring Standard.
   g. ANSI/TIA/EIA-606-1993, The Administration Standard for the Telecommunications infrastructure of Commercial Building.
   h. ANSI/TIA/EIA-607-1994, Commercial Building Grounding and Bonding Requirements for Telecommunications.
   i. Latest UL Fire Resistance Directory.
   j. NFPA - National Electrical Code (NEC).
   k. National Electrical Manufacturers Association (NEMA).
   l. Occupational Safety and Health Administration (OSHA).
   m. Federal Communications Commission (FCC).
   n. Institute of Electrical and Electronic Engineers (IEEE).
   o. Local Codes, Amendments and Ordinances.
   p. BICS, Building Industry Consulting Service International

C. Submittals

a. A detailed equipment schedule is to be created and submitted by Contractor for approval. Items with long lead times must be identified.
b. Provide complete material list, including the manufacturer's names, model numbers, and technical information on all equipment proposed.

c. Submit, prior to installation, a statement listing every technical and Operation parameter of the submitted equipment which varies from that originally specified.

d. Provide all submittals in a single package to the extent possible. Item with long lead times must be identified as such. Do not delay submission for lack of one or two items.

e. Each submittal shall be complete, clear, and definitive, and shall include only that material pertinent to the subject of the submittal.

f. Any deviations from specified requirements shall be clearly indicated in submittals.

D. Materials Delivery and Storage

a. Cost of all shipping to the site, inside handling, and of all unusual storage requirements, shall be borne by the Contractor.

b. Make appropriate arrangements, and coordinate with authorized personnel at the site, for the proper acceptance, handling, protection, and storage of materials so delivered.

c. Upon completion of all work functions, a final walk-through with SUHSD representative shall occur to inspect all work.

E. Installation

Wall mounted equipment cabinets shall be securely fastened to the walls and seismically braced. Labet.

F. Completion of Work

Upon completion of all work functions, a final walk-through with SUHSD representative shall occur to inspect all work.

G. Voice and Data Communication System.

1. General

a. Communication cabling shall be copper transmission media. The copper transmission media shall be terminated within this project.

b. Materials to be provided include, but are not limited to:

1) Equipment racks, fiber, copper and termination enclosures and/or panels.

2) All termination blocks.

3) All copper cables, patch cables for intertie of rack mounted equipment, horizontal distribution cable, tie cable, cross-connects and termination panels.

4) All support materials required for the wire and cable, such as wire and cable supports.

5) All information outlets (fiber, data or tel. outlets) jacks and faceplates.

6) Any other parts and/or miscellaneous equipment required to provide a complete structured communications wiring distribution systems of the types intended by this specification.

c. Wiring installed in walls and other inaccessible areas shall be installed in conduit..

d. Label all data and voice outlets and cables with white or transparent tape. Label format to be determined by the District.

2. Cabling System

a. The cabling system shall be used for interconnecting telephones, voice/data switches, local area networks (including personal computer and associated peripherals), televisions, fax machines, and for linking these systems to outside networks. The cabling system, including coax, copper and fiber optic applications shall be configured as documented on this RFP. Except where indicated, specific products and quantities must be determined from the Contract drawings, by field conditions, and as required by the Specifications.

b. All cables shall be dressed in a neat manner at each workstation, equipment and cabling cabinet, in each riser shaft, in floors and ceilings and within each desk. Cables installed below 8'-0" AFF shall be enclosed in raceway.

c. Horizontal copper cabling shall be Mohawk/CDT or Superior Essex Cat 6 Non Plenum rated cable. All designated "data" & "voice" cables shall be blue in color.

d. The cable length from any workstation location to the termination in the telecom equipment rack shall be equal to or less than 295 ft. This maximum length includes all wiring in the run. Any deviation from this requirement of maximum length shall be brought immediately to the District's attention.

e. Contractor is responsible for assuring that the length of the cable run plus slack does not cause the transmission limits of the cable to be exceeded. Contractor shall immediately notify the District of any situations where this does, or may, occur. Cables must be routed and dressed so as to avoid congestion, ensure accessibility, and guarantee proper maintenance clearance between cable/wire terminals.

f. All cables will be protected from sharp metal edges.

g. Cables shall be routed so that cable pileups or blockage of other cable runs is avoided. Provide Channel Tests for cables and connectors:

3. Testing

a. All voice cables shall be tested for continuity, polarity and shorts.

b. Test all data Cat. 6 cables in accordance with the EIA/TIA TSB-67 specifications for Cat. 6 testing. Tests shall include wire map, length, attenuation, NEXT and testing of FEXT, ELFEXT, PSELFEXT and PS NEXT utilizing a category 6 or greater tester, Wave-Tek LanTek PROXL or equal.

c. Test all fiber optic system, including cables, connectors, outlets and patch panels. Fiber optic fibers shall be tested and reported for attenuation, return loss, graded refractive index and propagation delay. The testing shall include the following:

1) Power Meter Measurements

2) Acceptance Test - loss per unit (cable only).

3) System Test - loss per installed unit length (connectors and cables). System test results shall not exceed: 3.75dB/km@1300nm. Each connector shall not exceed .1dB loss.

4) Optical Time-Domain-Reflectometer (OTDR) System Test to include
   - 850nto End-to End Bi-directional Tests.
   - 130 On to End-to End Bi-directional Tests.

d. Test Results: Provide test results in minimum two sets of CDs.

4. Faceplates and Outlets

a. Leviton Extreme 6+ (p/n 61110-R*6) QuickPort ® telecommunications outlet connector module with Category 6 modular jack devices and 8-position, 8-conductor modular jacks terminated to 110 type

IDC connections for the installation of UTP cable. Cat.6 RJ45 connectors for data must be EIA/TIA 568B specifications. Provide and install blank inserts as needed.

b. Provide and install faceplates for mounting telecommunication outlet connector modules described above. Leviton four-port faceplate (p/n 41080-4WP) or Wiremold (p/n 5507FRJ) dual device plate as required.

c. All designated data & voice jacks shall be Blue in color. Data & voice cables shall be terminated onto Leviton extreme 6+ (p/n 69586-U48) universal patch panels.

5. Station Outlets:

a. For hard wall locations: Two cat 6 data cables using two leviton (61110-RC6) quick port jacks (connectors) and one voice cable using one leviton (61110-RL6) quick port jacks (connector). Install into one leviton four-port faceplate (41080-4WP). Provide blanks for unused outlets.

b. For surface-mounted wireway such as Wiremold V4000 or G-4000 of color per project architect, same as hard wall location stipulated above except without the voice cable and voice jack, unless otherwise noted.

6. Multi-Pair Copper Wiring

The multi-pair copper feeder connecting the station cabling to the telephone switch or backbone cable shall be 100 pair Category 6 compliant PVC, per EIA/TIA-TSB-36, unless otherwise stated. Feeders shall be terminated onto 110 style 100 pair rack-mount punch blocks. Multi-pair cables over 295 feet shall be 22 ga copper.

7. Multi-Strand Fiber

a. The fiber feeder cable shall be provided in 12 strand 50 micron multi-mode and 12 strand single-mode to connect the data switching equipment. All fiber connectors shall be terminated using SC at each end. All fiber connectors shall be installed onto Leviton rack-mount panels loaded with SC couplers at each end.

b. All inner-duct shall be ribbed and 1" in size. Contractor shall provide inner-duct in all locations where fiber is exposed. Inner-duct shall be provided right to the termination points.

8. Wall Mounted Equipment Rack and Cable Tray

a. Heavy Duty wall mounted open frame equipment rack, 19"W x 42"H x 24"D, 12" universal cable tray for purposes of terminating copper and fiber media shall be manufactured by Chatsworth or equivalent. Black in color.

b. Seismic support and bracing, as required by all state and local codes, must be provided for equipment rack and 12" universal cable tray.

c. Provide both 12-strand single mode and 12-strand 55 micron multi-mode fiber optic cables from each building IDF (BDF) to the MDF in each campus, or if building is small and next to an existing IDF, MM and SM can be "daisy chain" linked to the existing IDF MM and SM cables. Fiber optic cables connector shall be duplex SC. "Daisy chain" shall be approved by SUHSD IT Department.

9. Wire Management

a. Vertical: All vertical wire management shall be Leviton 49266-VFR).

b. Horizontal: Horizontal wire management shall be provided between all data patch panels.

c. All horizontal wire managers for data shall be 19-inch rack mountable and manufactured by Leviton (p/n 49275-VFR).

d. Horizontal wire management shall be provided between all voice 110 Blocks.

e. Conduit “sleeves” shall be installed through full height and firewalls. Installation procedures shall be in compliance with all state and local codes and the SCS requirements.

f. Cable supports above the suspended ceiling shall be in compliance with all state and local codes and the SCS requirements.

10. Wireless/ WiFi

a. Provide (2) wireless WiFi access point portals at two diagonal corners in each classroom for teacher to select for the teacher’s station/desk. Access portals shall be power over IP; 120 volt receptacles are not required.

11. Firestopping

a. Where plenum cabling or conduit penetrates fire or smoke rated walls, floor slab, etc., these penetrations shall be filled with a UL listed, fire stop system approved. The fire stop systems shall be manufactured by the 3M Fire Protection Products, Spec Seal Fire Stop Products, or their equivalent.

12. Grounding

a. Copper ground bus 12”x4”x1/4”, T & B, 3M or equal.

b. Green insulated #6 ground wire.

c. Bonding kits and 2 hole crimp connectors, T & B, 3M or equal.

H. Public Address (PA) System

1. New campuses and modernizations that are replacing, bells, and intercom/PA system(s) shall generally include a wired, integrated building communication system that includes all components in one package:
2. Bogan Quantum System – NO SUBSTITUTIONS ARE ALLOWED during either design or construction of new campus.
3. For design parameters and assistance and system approval, contact SUHSD Maintenance and Operations Department.
4. While some existing schools may use the phone system to provide intercom/public address functions, this is not acceptable for new buildings or modernizations that are required to provide a new public address system. When an existing phone/intercom system will remain, coverage should be augmented to include common areas like corridors, assembly areas, and outdoor school grounds that are typically not covered by the phone/intercom system. When compatibility allows, connect new speakers to existing telephone PBX system. Review capabilities with PA system provider and SUHSD Maintenance and Operations Department.

I. Spare Conduits for Low Voltage

1. Provide in each inter-building trench, one spare conduit and/or sleeve for power, signal, and fire alarm system. Spare conduit (s) to match the conduit sizes of power, signal, and fire alarm inter-building conduit (s). There shall be minimum one spare and/or sleeve provided. The power spare conduit shall match the power conduit. The low voltage spare conduit shall match the largest low voltage conduit.

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

A. General Comments

1. New fire alarm systems and modifications to existing fire alarm systems must be reviewed and approved by DSA and the Fire Marshal. Coordinate with the SUHSD Maintenance and Operations Department.
2. Ensure compliance with Contractor Licensing Requirements as listed later in this section.
3. Applicable publications(all reference publications should be the current editions applicable by law):
   a. National Fire Protection Association (NFPA)
   b. NFPA 70 National Electric Code (NEC)
   c. NFPA 72 National Fire Alarm and Signaling Code
   d. Local Jurisdiction Fire Code
   e. Local Jurisdiction Building Code
   f. California Building Code

B. Fire Alarm System

1. General Requirements

a. Gamewell is the District Standard.
b. Fire alarm control panel
c. Fire alarm remote annunciator panel
d. Manual pull stations and covers – Provide pull stations with battery operated covers.
e. Pull station operating force shall be equal or less than the ADA maximum allowable operating force.
f. Addressable horns, strobes and combination horn/strobes with isolation modules.
g. Smoke detectors.
h. Heat detectors located above combustible ceiling space.
i. Waterflow and tamper switches, when building/area is sprinklered.
j. Door holders (by hardware package) – 120V, use relay module to open circuit upon detection of smoke. Door holders should NOT be powered by the fire alarm system.
k. Elevator recall monitor and control
l. HVAC shutdown controls
m. It is advisable to standardize devices for flow switches, smoke detectors, and tamper switches.
n. Additionally, both strobes and combination horn/strobes require wire guards in student toilets and other areas prone to vandalism.
o. All fire alarm cabling is to be installed in minimum ¾" conduit unless noted otherwise.
p. All fire alarm panels shall be fed from a dedicated circuit. No other loads shall be supported from this source. Label the derivation source for each circuit and panel. Before terminating in the fire alarm panel, the Contractor shall provide a 24"x24"x6" hinged junction box to allow termination of ~~solid~~ field wiring to terminal strip before connection to the panel. All wiring in the junction box shall be neatly dressed and labeled with appropriate field device and loops.

q. All devices to be identified.

r. Any devices above the ceiling shall be identified below the ceiling (or the underside of t-bar or GB ceiling)

s. All connectors in boxes shall be twist-style wire connectors.

t. Provide conduit raceway and wiring from IDF or MDF to FACP for remote dialer Internet interface.

u. All inter-building network ties on new systems to be fiber optic outside plant rated cable in underground conduit to avoid moisture effects on fire alarm system operations.

v. Provide terminal cans for wiring routing on each floor of each building. Provide wiring gutters above each FACP or remote panel for wiring management.

w. The voltage drop in all circuits shall not exceed 10%.

x. Fire devices, systems, and compatibility shall be State Fire Marshal listed and UL-approved.

y. Provide SUHSD Maintenance and Operations Department an opportunity to salvage old fire alarm equipment.

z. Provide SUHSD Maintenance and Operations Department with maintenance kit, including two of each type of device installed, including end of line resistors and any items recommended by manufacturer (keys).

2. Fire Alarm Modifications

a. Contractor will be responsible for any impact to the fire alarm system, such as installation of new devices and documentation with NFPA Certification of Completion form. Contractor will also be responsible for coordination required with other agencies and utility companies such as PG&E and the local Fire Department.

b. Fire Alarm System: Use Gamewell E-3 FACP for new building and existing building which shall be inter-trip with existing Gamewell FACP. Gamewell E-3 is an emergency voice speaker communication (PA) style system with intercom capability per 2013 State Fire Alarm Code. E-3 mass notification control panel shall be located in the Administration/ Office Building.

3. Training

a. SUHSD Maintenance and Operations staff and custodians to be instructed on how to silence fire alarm control panel (FACP) but preserve trouble condition until a SUHSD electrician and/or contractor arrives for resetting and repair.

b. SUHSD Maintenance and Operations Department to be given orientation by contractor and Gamewell technician at time system is put on-line.

c. Contractor to provide eight (8) hours of training by supplier with contractor present during training.

4. ADA Compliance

a. Meet ADA requirements. Install strobe lights at 96" above finish floor or 6" below ceiling, whichever is lower.

b. Refer to NFPA 72 guideline provisions for 'equivalent facilitation' for coverage requirements.

c. Ceiling mounted strobes are also acceptable.

5. Submittal Requirements

a. A/E shall obtain Fire Department (having jurisdiction - TYP) and DSA approvals after reviewing design package with District and before bidding. Design submittal shall include drawings that provide the following:

1) Floor Plans showing device locations and quantity of devices (equipment) on each floor

2) Zone configurations / Loop designations

3) Additional measures to secure manual pull stations and other devices within reach of students to wall or ceiling to deter vandalism.

4) Equipment location of:

- Fire Alarm control panel: Locate in Main Office
- Remote annunciator(s)
- Transmitters/Transponders
- Municipal fire alarm system connection

5) Riser diagram(s) indicating:

- Arrangement of devices with respect to control units
- Control Panel
- Power supply input
- Alarm initiating circuits
- Alarm notification circuits

6) Calculations and Details:

- Battery Capacity Calculations
- Pull Station and Fire Detector Locations
- Dimensioned locations of each manual alarm station and fire detector
- Typical data needed for determining fire detector locations
- Ceiling construction

7) HVAC system layout and control conduit and wiring drawings

- Normally not dimensioned
- Size dictated by CEC, but not less than ¾ inches
- California State Fire Marshall listing service sheet for all fire alarm equipment to be used.
- Where existing system is to be replaced, provide demolition plans to document all devices and conduit to be removed. Conduit may be reused if acceptable by engineer.

b. Contractor shall submit the following package to the A/E of Record. A/E will then submit the approved package to the local Fire Department (s) and DSA before construction. Seven (7) approved sets with local Fire Department (s) and DSA Fire Marshal stamp/signature must be made available (one for site, two for SUHSD Maintenance and Operations Department, one for FPC, one for A/E

1) Table of contents
2) Names of owner and occupant
3) Address of building, including assessor's block and lot
4) Contractor's name, address, telephone number and license number
5) Point of compass
6) Symbol list
7) Full-height cross section of schematic diagram of building, if required for clarity, including ceiling construction and height
8) Locations of partitions and walls, indicating which ones extend through concealed spaces
9) Use of each area or room
10) Location of each device
11) Mounting heights of manual fire alarm boxes and visual notification appliances
12) Equipment list showing quantity, make, model, and CSFM listing sheet of each device
13) Manufacturer's specification sheets
14) Type and size of wire, cable*, conduit and conduit fill ratio. *include manufacturers specification sheet
15) Single line riser diagram
16) Point-to-point wiring diagram
17) Wiring diagram showing the connection to the primary power supply
18) Standby battery calculations for notification appliance circuits
19) Voltage drop calculations
20) Sequence-of-operations description or matrix
21) Assignment of class designations, style designation or both to initiating device circuits based on their performance capabilities under abnormal conditions. (This does not apply for addressable initiating device circuits.)
22) Description of annunciation zones or list of device locations and their addresses
23) DACT – Digital Alarm Communication Transmitter
24) Type of system (i.e. protected premises, central station, etc.) and identification of zones transmitted, if any
25) Voice message content and languages (if applicable)
26) Description of ancillary features and operations (e.g. smoke evacuation, fire damper operations, fan shutdown, door hold-open devices, special extinguishing systems, fire pump monitoring, etc.)
27) Description of any special features such as detector cross zoning or alarm verification
28) Name of alarm service company which will be responsible initially for inspection, testing and of system after it is accepted
29) Final Test (by contractor)

30) Pretest all devices before final test and provide District with documentation to demonstrate that this pretest has been completed. Do not submit for final testing unless the pretest was completed 100%.

c. Contractor shall submit the following documents:

1) Fire Alarm and Emergency Communications System Record of Completion(2013 NFPA 72 Handbook A.10.18.2.11) – 24 hours prior to Final Acceptance

2) Fire Alarm and Emergency Communication System Inspection and Testing Form(2013 NFPA 72 Handbook A.14.6.2.4) – at Final Acceptance (see below for closeout)

6. Final Testing

a. Perform final test in presence of manufacturer, local fire department and School District representatives with completed Certificate of Completion and close out documentation such as as-builts and O&M manuals. School District representation should include site administration, SUHSD Maintenance and Operations Electrical Lead, SUHSD Maintenance and Operations Plumbing Lead, DSA inspector. Date of testing to be approved by campus administration and SUHSD Maintenance and Operations.

b. The contractor shall pay for expenses at $100/hour/person attending a final test should more than three devices fail.

c. Perform 100% final test. Testing should include verification of communication to the District's security monitoring system.

d. Half of test shall be performed on stand-by power (battery test).

e. Initiating circuits and notification circuits shall be opened in at least one location per zone.

f. At least 72-hours' notice must be given to invite the following parties to the final testing: local Fire Department (s), SUHSD Maintenance and Operations Electrical Lead, site, FPC PM, FPC Electrical Engineer, DSA inspector, subcontractor and Supplier's Technician.

g. The contractor shall provide the necessary personnel and equipment to conduct the tests outlined above as part of their contract.

h. Provide written confirmation that the fire alarm system is communicating with the District's monitoring service/ vendor.

i. Contractor to obtain DSA acceptance sign-off upon successful completion of test.

j. The system warranty shall start after final acceptance sign-off and approval by the IOR.

k. The final acceptance test shall be performed within two weeks of putting the new system on line. If the contractor is not ready for final acceptance, then an Operation test for occupancy with the local Fire Department (s) will be performed within two weeks and a full acceptance test will be scheduled on a later date.

7. Close-out Documentation (by Contractor):

a. Five sets of as-built drawings with electronic copy on compact discs, material submittals, and O&M manuals per 1-7.2.2.2.1 of the current edition of NFPA 72 required: one for site, and two for SUHSD Maintenance and Operations Department.

b. Loop resistance and capacitance of SLC circuit (s) to be recorded as part of the as-builts.

c. Four sets of keys: one set for site and two for SUHSD Maintenance and Operations Department.

d. NFPA 72 Certificate of Completion

8. Contractor Licensing

a. Contractors and their employees shall be certified by the California State Department of Industrial Relations, Division of Apprenticeship Standards at the time of bid submission and shall remain certified and in compliance through the completion of the project. Contractors shall provide certification card numbers to the District Director of Facilities immediately after the contract has been awarded.

b. UL certification required.

c. C-10 Electrical Contractor License is required,

d. C-16 Fire Protection Systems Contractor License,

e. C-61 Limited Specialty License for Low-voltage Systems is recommended only.

f. NICET Level II technicians.

9. Fire Alarm Operations

a. Upon activation of any manual station, automatic detection device, or sprinkler flow switch, the fire alarm system shall operate as follows:

b. Audible alarm indicating devices shall be silenceable by the alarm silence switch on the main panel or annunciator.

c. Visual alarm indicating devices shall be silenced upon system reset.

d. Appropriate initiating device address or zone shall show on the control panel and remote annunciator until the system is reset.

e. Subsequent zone alarm shall reactivate the alarm indicating appliances.

f. Doors normally held open by door control devices shall be released upon general alarm or fire drill.

g. Provide shutdown and/or control of all air handling systems if required (e.g. Over 2,000 CFM).

h. A supervised signal to the local fire station and off site remote monitoring vendor shall be activated by the master pull station or automatic detection device only.

10. AC Power Disconnect Switch

a. Non-fused type, padlock-off handle, enclosed switch mounted next to FACP to test system on batteries. Provide ITE CFN211 AC power disconnect switch.

11. Remote Annunciator Panel

a. Alarms to be zoned by floor and labeled by device and location on annunciator panel.

b. 24-hour battery back-up.

c. Locate at main firefighters' entrance, in administrator's office.

d. Display initiating device zone until the system is reset.

12. Auxiliary Disconnect

a. Shall be provided to isolate auxiliary system from local system, so that local system can be tested without calling the Fire Department.

13. Fire Alarm Control Panel (FACP)

a. Both trouble signal and alarm signal to be zoned by floor, and labeled on annunciator panel or displayed by address.

b. Annunciator panel to include LCD with keyed activation for alarm silence and system reset and fire drill.

c. At large campus sites, provide a graphic annunciator with red alarm and amber trouble LEDs in addition to LCD keyed annunciator.

d. Power on dedicated circuits with local disconnect.

e. 24-hour battery back-up.

f. Locate in main administrative office.

g. Independent of contractor work, District will arrange for evacuation plan posting that will display shut-off location for gas, electricity, water, sprinkler on 11"x17" floor plan enclosed in clear plastic jacket.

h. Display initiating device address or zone until the system is reset.

i. Local signal disconnect and auxiliary system disconnect can be integrated with the FACP

j. Address initiating devices on FACP ; for example, "3rd fl N. Stairwell #4 across from Rm 347 Smoke Detector M1-101"

k. Address signaling devices on FACP; for example, "2nd fl Corridor by Rm 201 Horn Strobe TAC 2-1-1"

l. Numbering system must follow existing school room numbers and other areas.

14. Fire Drill

a. Provide fire drill test switch to permit site to practice fire drills with local fire department monthly visit.

b. Fire drill test switch shall not call the local Fire Department (s).

15. Gate Valve Tamper Switch

Provide supervisory signal that has to be acknowledged and reset at the FACP.

16. Manual Pull Stations (in Student Areas)

a. Shall trip only the local alarm only and shall not trip off-site fire monitoring vendor

b. Dual action type, MS95-L series ADA compliant pull station.

c. Shall be attached to stud with a minimum of 2-1/2" penetration. Provide conduit attachment for surface conduits just above or below box to minimize possible physical damage from vandalism.

d. Provide tools to open and reset

e. Provide Safety Technology International (STI) or approved pullstation clear convex covers to protect against physical damage and false triggering. Covers to be clearly labeled.

f. Shall be installed on other side of light switch, away from door, so as to not be confused with light switch.

17. Master Fire Alarm Pull Station (in Administration Staff Areas)

a. Mounted close to FACP.

b. Single action types with no metal cover protection, unless requested by local Fire Department (s).

c. Locate in Administrative area and in CC and other program offices if work hours extend beyond those of the main school - also in boiler room(s).

~~d.~~ Shall trip both the local alarm and off site monitoring vendor.

e. All equipment for the system must be housed within the school

18. Branch Panels

a. Flush-mounted in wall required in new construction; surface-mounted acceptable if existing.

b. Tag all circuits in junction boxes and panels within 2-4 inches of tie down.

c. Lock-out circuits for fire alarm system.

d. Panels to be lockable with keys; extra set to be provided for each of site, two sets for SUHSD.

19. Signal Pattern

a. Temporal 3 Pattern.

20. Signal Time

a. Fire alarm system signal shall continue until acknowledged at the FACP and silenced. Fire alarm battery power shall allow for minimum 5 minutes of general notification device alarm signal state and minimum 15 minutes of voice evacuation signal state.

21. Smoke Detectors

a. Provide smoke detector coverage to comply with Senate Bill 575 – Full coverage throughout all areas to supplement sprinkler system. Heat detectors required above accessible and concealed (accessible) combustible ceiling areas where sprinklers are not used for building protection (above ceilings).

b. Where (e) devices no longer required by code, consult with FPC Electrical Engineer.

c. Shall trip the local alarm and City Box in all instances.

d. Required to signal FACP to activate all magnetic door hold-open mechanism at fire separation doors in corridors.

e. Required in storage areas greater than 1500 square feet.

f. Required at all HVAC fire/smoke dampers at fire separations. Coordinate provisions of smoke detectors and accessories with Division 23 for all Fire/Smoke Damper locations. Detectors to be provided by Division 26, installed by Division 23, and connected complete by Division 26. Each FSD to be standalone control via local detector, with 120V normal power connection.

g. Required at all air handling units over 2,000 CFM rated for automatic shut-down upon alarm. Detectors to be provided by Division 26, installed by Division 23, and connected complete by Division 26. Automatic shut-off to be locally wired through respective unit starter HOA contacts.

h. Provide remote test switches and indicators for all concealed detectors at FSDs or HVAC units. Switches to be located out of normal reach.

i. Required if combustibles are present below raised floors (e.g. sophisticated computer room).

j. Locate one adjacent to the FACP and/or remote transponder panels or power supplies.

k. Require one detector only in separation door with headers less than 24" high and per the latest edition of NFPA 72, including amendments.

l. Required at all doors normally held open to corridors and at main office, verify with site.

m. Required at all elevator smoke doors.

n. At ceilings higher than 20 ft., provide infrared beam detectors (sending unit and receiver), installed per NFPA guidelines. Locate detectors min. 8" below ceiling and max. 18" below ceiling with coverage to match manufacturer's listings.

22. Warning Devices-Audible

a. Addressable devices compatible with Gamewell panel.

b. Designated signal pattern until silenced by the alarm silence switch at the FACP.

c. 15 dba above ambient noise in all normally occupied building locations.

d. Separate and distinct from other audible signals.

e. Separate circuit from visual devices, unless 2-wire addressable system is used.

a. Wall mounted appliance shall have their bottom heights above the finished floor at 96" or their top at no less than 6" from the ceiling, whichever is lower. 80" mounting heights shall not be used, unless specifically required.

23. Warning Devices-Visual

a. Addressable devices compatible with Gamewell panel.

b. Existing systems which employed visual alarms and were approved at the time of installation may have their use continued throughout the building without conforming to the following.

c. Existing buildings shall comply with the requirements below (CCR Section 7204(a)) when extensive remodeling occurs on more than 25% of the floors of the building-extensive remodeling shall mean when more than 75% of the existing interior walls or partitions of the floor (measuring lineal footage) are removed or relocated or when new interior walls or partitions are added which exceed 75% of the total lineal footage of the combined existing walls and partitions.

d. Continuous flash until the system is reset or timed out.

e. New fire alarm systems and renovation of existing (excluding maintenance and alterations/additions caused by remodeling) shall be upgraded to include strobe lights (ADA type).

f. Flash rate shall be no more than 2 flashes per second (2Hz) and no less than 1 flash every second (throughout the listed voltage range of the appliance) per NFPA 72.

g. Wall mounted appliance shall have their bottom heights above the finished floor at 96" or their top at no less than 6" from ceiling, whichever is lower. Ceiling mounted devices are acceptable, when properly listed for use and coverage. 80" mounting heights shall not be used, unless specifically required.

h. Calculations to substantiate visibility conformance with ADA are required.

i. Install at 99' intervals in corridors.

j. Locate in all classrooms, restrooms, corridors, enclosed stairways, music practice rooms, band rooms, gymnasiums multipurpose rooms, occupational shops, toilets, meeting rooms with capacity of 4 or more, teacher lunch rooms, on enclosed elevator lobbies, rooms with instruction for the hearing impaired, areas that generate noise that will interfere with detection of audible signaling device, occupancies of more than 50 people; stair enclosures devices to be negotiated.

k. Provide wire guard in boys' and girls' restrooms, gymnasiums.

l. Provide approved covers that will not minimize audible or visual coverage of strobe/horns.

24. Waterflow Switch

a. Shall trip and notify local fire department and off-site monitoring vendor and local alarm bell and horn /strobes when activated.

b. Also activate 120VAC exterior bell, independent of FACP.

c. Potter type VSR is the District standard.

25. Fire Alarm System Wiring Requirements

a. Door holders shall be 120V power and controlled via relay module. Wiring shall be #12, THHW stranded, brown (negative) and gray (positive).

b. Annunciators shall be on 24V power. Wiring shall be #14, THHW stranded, black (negative) and white with red tracer (positive).

c. Communication for annunciator shall be #14 FPLP, twisted/shielded, solid, red jacket, black (negative) and red (positive).

d. If needed, power shall be 24V for duct detectors or ZAM. Wiring shall be #14 THHW stranded, black (negative) and white with red tracer (positive).

e. ID or Mapnet channel wiring shall be #16 FPLP twisted/shielded, solid, red jacket, black (negative) and red (positive).

f. TAC Communication wiring shall be #16 FPLP twisted/shielded, solid, red jacket, black (negative) and red (positive).

g. Wiring for addressable notification circuits (horns/strobes) shall be #12 FPLP, twisted, solid, red jacket, black (negative) and red (positive).

h. Wiring for exterior non-addressable horns shall be #14 THHW stranded, purple (negative) and blue (positive).

i. Wiring for existing “old” non-addressable strobes is #14 THHW stranded, yellow (negative) and orange (positive).

j. Wiring for existing “old” non-addressable horns is #14 THHW stranded, purple (negative) and blue (positive).

26. Fire Suppression System

a. Required in school kitchens with Type I hood, which collects and removes grease and smoke. However, the suppression system is not required for Type II hoods, which collects and removes steam, vapor, heat or odors.

b. Shall be supervised from the FACP located in the main office.

c. Shall provide a disabling push button for kitchen horn in FACP.

d. Shall include a separate pull station and horn in the kitchen area, and a gas shut-off valve or power disconnect, depending on the type of cooking range.

e. Use shunt trip breakers for all electric appliances under type 1 hoods.

f. When a fire suppression system is activated either by fire or by pulling a local kitchen pull station, it should do the following:

    1) Send an audio and visual signal to the FACP.

    2) Shut supply valve for gas cooking range or trip the power to the electric cooking range. Sound general alarm and notify local fire department and off-site monitoring vendor.

3) Kitchen area horn shall also be activated in case of pulling of any pull station within the school area.

27. Post Indicator Valve (PIV)

a. Provide a means for supervision to the FACP.

b. If such device is mounted along vehicular traffic, concrete filled steel pipe bollards, 36-inches high shall be installed around the PIV that shall also meet local government fire department agency approval having jurisdiction over the school site. Pipe bollards shall be painted bright red.

C. Elevator

1. Elevator recall required for automatic elevators having a travel of 25 feet or more above the ground level or per the California Elevator Code. Provide smoke detectors at each elevator lobby and in the elevator machine room.
2. Program all elevator related smoke detectors for recall and alternate recall of elevator machines using addressable control modules located at the elevator controller (one for each signal – standard recall for all floors, except alternate recall for main floor devices.
3. When sprinklers are used at the top of elevator shafts or in the elevator machine room, provide a fire alarm system smoke detector AND heat detector within 2 ft. or EVERY sprinkler head in the elevator areas. Coordinate requirements and locations for elevator shaft access panels with Architect to insure proper access for maintenance within each shaft. Detector(s) can be located on the inside surface of fire rated access hatch(es) located at the top of the shaft, within 2 feet of the sprinkler head(s). Connect with flexible conduit to allow swing-out of the access hatch out of the shaft, to allow maintenance.
4. Heat detectors shall alarm at a temperature sufficiently below the melting point of the sprinkler head to allow shunt tripping of elevator power prior to application of water onto the elevator equipment.
5. Program heat detectors to shunt trip the main elevator controller upon alarm with an addressable control module located at the sub-feed breaker or elevator disconnect. The elevator sub-feed breaker or disconnect shall be of the shunt trip style.
6. Also provide each elevator with a separate 120V cab lighting circuit, a telephone line connection, and a GFI outlet at the elevator machine room. Provide a GFI outlet and a pit light with switch at the bottom of each pit, adjacent to the pit ladder.
7. Provide a GFI outlet or other power requirement for any pit sump pumps (to be located adjacent the sump pump in the pit). Coordinate any required alarm or signal for the sump pumps with Division 23.
8. Provide power and fire alarm system connections to any required elevator lobby smoke doors. Smoke doors shall automatically close upon any elevator shaft, elevator lobby, or elevator machine room smoke detector alarm. Coordinate provision of “fire-fly” control interface with design Architects for each smoke door.
9. Provide factory installed Form C dry contact micro limit switch at the elevator main power disconnect switch (anit-entrapment switch) interface wiring to the elevator to indicate when the main line disconnect and feeder breaker are manually put in the open position. This is intended to prevent the lowering device from operating upon manual opening of the power to the elevators.
10. Provide security key switch.
11. One (1) key shall be installed in elevator pit or in key box, as per State code. Two or more (2+) keys shall be given to SUHSD Maintenance Lead Carpenter, not to site; SUHSD Maintenance to distribute.
12. Telephone shall be tested by contractor and confirmed by SUHSD Lead Electrician.

D. Wheelchair Lift Requirements

1. Provide each wheelchair lift with a separate dedicated circuit and conduit run for power.
2. Lift must be equipped with an audible signaling device.
3. Provide appropriate lighting levels.
4. Do not provide automatic electrical-powered door operator at wheelchair lift gate. Provide the required floor clearances for gate swing.

E. Nameplates

1. Provide laminated plastic nameplates, minimum engraved lettering shall be 1/4" high, white on red matte finish.
2. Label the following devices:
   a. FACP: DSA final acceptance date, electrical contractor with phone number
   b. Door leading to FACP - "FACP INSIDE"
   c. Disconnect - "AC POWER DISCONNECT"
   d. Gate valve - "SPRINKLER SHUT-OFF"
   e. Door leading to gate valve - "SPRINKLER SHUT-OFF INSIDE"
   f. Inspector's test valve - "INSPECTOR'S TEST VALVE"
   g. Door leading to inspector's test valve - "INSPECTOR'S TEST VALVE INSIDE"
   h. Post indicator valve - "POST INDICATOR VALVE"
   i. Pull station - "LOCAL ALARM ONLY"
   j. Master pull station - "CALLS FIRE DEPARTMENT"
   k. Flow switch - "WATER FLOW SWITCH"
   l. Door leading to flow switch - "WATER FLOW SWITCH INSIDE"
   m. All junction boxes - "FIRE ALARM"

F. Fire Watch Provisions

In the event a fire alarm system is disabled, fire watch must be arranged by the Contractor with a certified security services agency with coordination with the District Director of Facilities. Contractor to also make the following arrangements:

a. Notify local Fire Department(s) when systems are placed out of service and when reconnected.
b. Signs to be posted at all pull stations and FACP to call 911 in case of fire.

G. Area of Rescue Assistance Communications System

1. CBC 1007.6 requires that all areas of rescue assistance be provided with a two-way communications system to allow a person requiring assistance to alert and communicate with on-site school staff, off-site District personnel, and/or local fire department.

2. Mount the master telephone/display station and all area of rescue communications stations to comply with applicable accessible height, reach, and clear floor area requirements. It is preferable that both the master station, secondary master station, and all area of rescue stations be mounted so that the face of each is flush with the adjacent wall surface. When this is not feasible, for stations that project more than 4" from the adjacent wall and whose bottom edge is higher than 27", mount each station so that it does not project into the path of travel or otherwise provide with required detection system (e.g., guardrail, wing walls, or wall furring) to avoid creating a hazard for persons with visual impairments, per CBC and ADA requirements.
3. One master telephone/display station shall be provided at the facility's main office and secondary master display stations shall be provided at locations of all remote fire alarm annunciator panels (FAAPs). Review and obtain local fire department approval for system design, layout, and installation at the same time as that for the facility's main fire alarm system. See Special Requirements section within Division 00 of the SUHSD District Guidelines and Standards for information on other requirements for areas of rescue assistance.
4. Coordinate with design and installation of the security system to provide security camera coverage for each area of rescue assistance provided. For coordination with the security system, contact SUHSD Maintenance and Operations Department.

H. Security System

1. General

a. Requirements for each project shall be addressed on a case-by-case basis. Contact SUHSD Maintenance and Operations Department

b. Intrusion detection system and emergency communications system must be reviewed and approved by the SUHSD Maintenance Lead Electrician.

c. Submit plans and gain the SUHSD Maintenance Lead Electrician's approval of the security system design at the completion of the Design Development phase of the drawings. Plans are to show room layouts, door swings, and ceiling heights for all rooms.

d. Submit plans for review and approval of the SUHSD Maintenance Lead Electrician when the drawings are submitted to DSA.

e. Provide a dedicated phone line for the security system, which is properly tagged and identified at the telephone panel board.

f. Salvage or provide protection/re-installation of existing devices when contract work may damage or destroy them.

g. The contractor shall provide a qualified technician to install and program the security and card access control systems where used. Install systems per manufacturer's recommendations. Once installed, both systems must be accessible (nonproprietary) to District personnel for programming into the District central security system.

2. Control Panels - see California Security or current intrusion provider and SUHSD Maintenance and Operations Department for approval of:

a. Control panels to be Ademco Vista – 50P, complete with back-up batteries, power supply, enclosures, and all peripheral equipment, connections, and programming required for a complete installation. Panel must have Ethernet installed for remote programming.

b. Provide Ademco Alpha Keypads - #6160. Locate at specific entry areas, elevators, and wheelchair lifts. Coordinate locations for each project.

c. Motion sensors shall be Ademco DT 7500 SN, DT901, and DT907 (35' 90' and 200') and mounted at heights of 8', 9' and 9' respectively.

d. Provide Ademco 748 dual tone outdoor sirens, for local alarm notification.

e. Final install and testing must include battery to be installed to supply combined auxiliary power, polling loop and bell current in excess of 750mA.

3. Dual Technology Motion Detection

a. In the event of unauthorized entry, alarm detectors to send electronic signal to District's existing computerized Central Control Station. Upon receipt of alarm notification, security personnel will dispatch local police to site and area in which alarm was detected.

b. Sensor equipment to be dual technology motion detectors.

c. Sensors to home-run into existing panel or new panel as necessary.

d. Control for activation, deactivation and performing electronic system tests to be done remotely by Central Control Station Alarm Monitor. Authorized personnel to telephone Central Control Station Alarm Monitor of entry to site after regular school hours to request that the site alarm system or portion thereof be disarmed. Central Control Station records when system was armed/disarmed and by whom.

4. Door Contacts

a. Door contact switches are to be used only for roof hatches. Sensors to be Sentrol #2505A steel door contacts, suitable for mounting in roof hatch frames. Coordinate drilling and conduit/wire penetrations into door frames with hardware installer.

b. Door contact sensors should not be installed without prior approval from the District.

c. Plastic door contacts are NOT ALLOWED.

5. Cameras

a. Wall-mounted cameras to be Security Integration, Inc. #3895-WIR (high resolution color dome camera) and shall be compatible with the existing CCTV System.

b. In vandal prone areas, camera shall be vandal-resistant Security Integration, Inc. model # SI-PTZ-23 (high resolution color dome camera) and shall be compatible with the existing CCTV system.

c. Recording software and hardware shall be compatible with existing systems and shall be Security Integration model #SI-32-1000.

d. For more specific information of security systems contact:

6. Card Access Systems

a. Secured card access (proximity card key/fob reader) systems shall be as manufactured by Keri Systems, Inc. PKT-10X/PKT-26X.

b. Tiger Controller #PXL-500P, with #SB593 Satellite Board and all required enclosures and power supplies.

c. MS-5000 proximity card readers and mounting hardware.

d. Install per manufacturer's recommendations. Provide programming for a complete operating system.

e. Turn over all key tags to District (to be forwarded to SUHSD Maintenance and Operations Department at the closeout of each project.

f. Consider providing card-key access to school main entry door(s). Review on a case-by-case basis with SUHSD Maintenance and Operations Department for applicability and system requirements.

g. If Keri Access Control System is adopted, the door hardware shall be Von Duprin 99EL Series (finish to match new or existing door accessories) with a Von Duprin PS914X2RS power supply.

h. All door locking mechanisms to be approved by SUHSD Maintenance and Operations Department.

7. Video Doorbell Entry Systems

a. Video doorbell entry system to be Aiphone AX Series

b. CEU shall be AX-084C

c. Door Station shall be AX-DV

d. Master Station shall be AX-8MV

e. If Aiphone is specified, the associated door hardware shall be Von Duprin 99EL Series (finish to match new or existing door accessories) with a Von Duprin PS914XRS power supply.

f. All door locking mechanisms to be approved by SUHSD Maintenance and Operations Department.

8. Conduit

a. Wiring to all devices to be enclosed in rigid or flexible metal conduit for physical protection, with a minimum size of ¾"

b. All exterior pathways to be sealed for water protection. Refer to other guidelines related to wiring contained in this Section.

I. Telecommunications (refer to SUHSD Technology Department)

1. General Requirements

a. Review scope, proposed design solutions, and any proposed deviations from the District Standards with the SUHSD Technology Department.

b. The District intends to provide network services to all sites, accessing data from computers on site and at other sites. These networks will be tied into all instructional areas at schools.

c. Five data connections for student workstations and two data connections for a teacher workstation and peripheral shall be provided in each classroom.

d. Computer and multimedia technology requirements for library/media centers should be reviewed with the SUHSD Technology Department on a case-by-case basis.

e. Provide one data outlet to go with one duplex power receptacle for point-of-sale equipment at the primary location of food distribution to students at each school site (e.g., cafeteria, multi-purpose room, etc.), per the direction of the SUHSD Maintenance and Operations Department.

f. Provide typical classroom layout for technology. Refer to Appendix A – Typical Classroom Layout for Technology.

g. Provide typical IDF Room/Closet for technology. Refer to Appendix B – Typical IDF Layout.

h. Provide for each classroom in-room audio. Refer to Appendix A – Typical Classroom Layout for Technology, and Appendix C – TopCat (Access) Specifications.

2. Electrical Power Considerations

a. General upgrades to the electrical service at a site may be necessary to accommodate improvements to the computer/data network. The A/E team should consider the following early in the design process and review proposed or required associated power upgrades with the SUHSD Maintenance and Operations Department.

b. Most existing electrical power systems have insufficient or non-existent system grounding. And must be engineered to provide suitable amount of receptacles and circuits to allow for balanced loads and requirements of all-encompassing equipment.

c. All new power systems or system upgrades are to have their systems checked for proper grounding and installed per Grounding sections found earlier in this Division.

d. Power conditioning is required for panel boards serving computers or other non-linear power supply loads. Transient Voltage Surge Suppression (TVSS) protection is required at the panels or at receptacles where computers are located; i.e.: in the administrative areas and computer labs. Plug-in (power corded) power strips are not allowed.

e. Electrical panels are to be located in each computer lab for immediate access by the computer lab supervisor.

f. Provide a minimum of four duplex receptacles on one circuit in different locations. Sites with more power needs shall be engineered so that no more than four outlets share the same circuit.

g. Equipment closet to be designed/ accommodated on each floor through which all conduit runs will merge before penetrating to other floors; include patch panels with room for expansion for ease in routing signals (4'x4' closet minimum).

h. Emergency Power: Provide emergency power for selective receptacles and/or equipment in Offices in Administration Building, Science Classrooms, and other rooms as directed by the user or the District. Use generator power if generator is available, otherwise use self-contained inverter (s) or UPS batteries at the discretion of the user, and/or the District. Building with science classrooms and other designated rooms such as science preparation rooms of office shall have portable plug-in small UPS units if UPS power is required. Verify with users, the project manager, or the District. IDF and MDF rooms shall have similar back-up power with UPS rack-mounted units and further backed up generator if available. Coordinate with the District IT Service Department.

i. IDF Layout: IDF backboard layout will be provided by the District's IT Department.

j. Provide power strip for typical classroom laptop charging cart at room entrance.

k. Provide power for IDF Room/Closet, typical classroom in-room audio system and other technology equipment. Refer to Appendix A, B, C, and D.

3. Computer/Data Network

a. Each building on a school campus and all floors within each building shall be provided with an Intermediate Distribution Frame (IDF) that is directly connected to the Main Distribution Frame (MDF) with fiber optic cabling. The MDF shall be placed at the same location as the incoming telephone and/or cable TV services or other main signal services.

b. All data network cabling for new buildings shall be Cat 6 between IDF's and terminated ports or jacks in rooms throughout the school. For modernizations, all such cabling shall be Cat 5e.

c. Cable trays in corridors with stub-outs in each classroom, office or other room to be served in Wiremold G-4000 series will accommodate both the power and data lines.

d. Data shall be installed in approved raceways. PVC is not allowed.

e. Perimeter wall-mounted surface raceways are preferred. Floor-mounted outlets and power poles shall be avoided whenever possible and are only allowed with prior approval by the District.

f. Conduit run to instructional areas shall stub into each room in a consistent location.

g. The contractor for each project shall include the installation and testing of all "passive" cabling systems and all "active" data equipment such as routers, servers, switches, hubs, and fiber transceivers, to be ready for use by the District.

h. Security measures shall be provided with all purchase orders for equipment. The District's IT Department will review PO's for inclusion of security measures.

4. Labeling

a. Fiber – request convention at time of construction project review.

b. Cat 6 Copper– request convention at time of construction project review.

c. Multi-Pair Copper – request convention at time of construction project review.

5. Data Rack

a. Wall Mount

1) Sized according to amount of cabling and equipment.

2) Two feet depth.

3) Swing-gate style.

4) Open rack if in closet.

5) Locked enclosure if in classroom or office.

b. Floor Mount

1) Only use if located in closet.

2) Can be open or enclosed four-post rack.

3) Orientation will be determined by building/closet design (sideways against wall, or front facing away from wall).

6. Fiber Cabling

a. Feeders - between data centers (IDF and IDF, or IDF and MDF) – 24 strand multi-mode (50/125 micrometer, OM3), and 24 strand single-mode.

b. Patch panels - all fiber will be terminated to rack mounted enclosure with 12 fiber SC adapter plates.

7. Copper Cabling

a. Multi-pair phone cabling - will be 22 gauge if over 300 feet in length, and terminated to 110 rack-mounted patch panel in IDF, and wall mounted 110 patch panel in MDF. Pair count will be determined by number of classrooms and offices served by IDF.

b. Classroom/Office Workstation – blue Cat 6 solid core (three cables each), terminated to blue Cat 6 jack/wall plate at workstation end, and patch panel at data center (IDF or MDF).

c. Wireless Access Point – green Cat 6 solid core (two cables each), terminated to green Cat 6, 8-pin modular data jack at WAP end, and patch panel end at data center (IDF or MDF).

d. Camera – yellow Cat 6 solid core (two cables each), terminated to yellow Cat 6, 8-pin modular data jack at camera end, and patch panel end at data center (IDF or MDF).

e. Patch panels – all copper data patch panels will be "Keystone" based, allowing the same 8 pin modular jacks to be installed as used in other data outlets. All "Keystones" should be colored to match their respective cabling – blue/data, green/wireless, and yellow/camera.

8. Camera Outlets

a. Locations – determined during building design, and selected by site administrative staff, and district technical staff.

b. Outdoor – 4"x4" recessed outlet (where possible), weather-rated as applicable, to accept two Cat 6 data cables/jacks, and capped with a weather tight blank cover.

c. Indoor /wall or ceiling mount – 4"x4" recessed outlet to accept two Cat 6 data cables/jacks, and capped with blank cover.

d. Indoor/dropped ceiling mount – based on camera type and location, will be determined at time of building design review.

9. Typical Classroom Layout for Technology

a. Provide data outlets including, but not limited to, data jacks; plates; recessed boxes; conduits; and horizontal cabling for typical classrooms. Refer to Appendix A "Typical Classroom Layout for Technology".

b. Provide in-room audio. Provide (furnish and install) for each classroom basic wireless components, including all-in-one in-ceiling audio system with integrated amplifier, speaker, and wireless receiver/transmitter; two wireless microphones for whole room instruction team – teacher/student sharing; and wireless media connector. Refer to Appendix A "Typical Classroom Layout for Technology" and Appendix D "TopCat (Access) Specifications".

c. Provide learning wall technology infrastructure. Refer to Appendix C "Learning Wall Example"

10. Typical IDF Room/Closet for Technology

a. Provide technology system headend infrastructure in IDF Room/Closet including, but not limited to, rack; fiber and copper backbone; patch panels; UPS; backboards; and technology round bar (TMGB). Refer to Appendix B "Typical IDF Layout", which shows the minimum required number and sizes.

11. Cable TV Service

a. After TV cabling installation, verify that all FCC standards are met.

b. Co-axial cable is the current required standard. RG-6 quad shield horizontal cables to each outlet, with RG-11 or 0.5" quad shield cable for trunk runs between buildings or wings (as required to provide at least 10dB of signal strength at each outlet jack location).

c. Cable TV service is targeted for libraries, auditoriums, multi-purpose areas, staff lounges, classrooms and other suitable areas of assembly.

12. Leroy Greene Funding

1) Installation of the conduit is considered a building improvement and can be funded by the modernization budget from the State.

2) Hardware for the computer network can be funded by the State furniture/equipment allowance.

3) Cabling, if specified in the contract docs before bid, will be considered a building improvement. If it is not part of the building improvement contract and is specified and

installed at the time of the hardware/software purchase, it may qualify for furniture/equipment funds.

DIVISION 32 – EXTERIOR IMPROVEMENTS

A. Paving

1. General

a. Cross-slopes on ramps, accessible parking spaces, access aisles, and paths of travel are not to exceed 2%.

b. New construction and modernization projects may not increase storm water runoff and, where feasible, reduce runoff as much as possible.

c. New and existing schools: For sites with an existing imperviousness of less than or equal to 50%, limit the post-development peak storm water runoff discharge rate so that it does not exceed the estimated pre-development rate.

d. New campuses: For sites with an existing imperviousness of more than 50%, implement a storm water management plan that results in a 25% reduction in the rate and quantity of storm water runoff.

e. For all sites, design trash and recycling storage areas to provide appropriate drainage from adjoining roofs and pavement to divert storm water runoff around the storage areas. The trash container areas must be securely screened or walled to prevent scavenging of trash.

f. At all electrical boxes, design paving around to drain runoff away from the boxes. Architect should include bringing all existing/new electrical and other boxes to be flush with ne/w existing paving.

g. Consider alternatives to AC paving that provide greater permeability to reduce storm water runoff:

h. Unbonded open-grid concrete block pavers for walkways

i. Decomposed granite: See guidelines and requirements later in this section.

j. Previous concrete – for more information, contact:

Central Concrete Supply Company, Inc.
755 Stockton Avenue, San Jose, CA 95126
[W] www.us-concrete.com
[T] 408-293-6272

g. Consider higher albedo paving materials than traditional asphaltic concrete in order to reduce the urban heat island effect, recognizing the potential impacts of glare.

2. Asphaltic Concrete (AC) Paving – Playground Surfaces

a. Refinement courses are required to seal asphaltic concrete (AC) surface and to provide a relatively smooth and uniform surface. Two coats emulsified asphalt with sand and two coats without sand are required to seal AC.

h. Use painted colors over asphalt rather than integral colored asphalt. Color coats and game line striping may be applied on top of AC refinement courses. Two filler coats and one sealer coat of color are required. Consider lighter colors to reduce heat island effect, taking care to avoid excessive glare. See Division 09 Painting section for paint product requirements and contact the SUHSD Maintenance and Operations Department for standard game line templates.

i. New asphalt, placed in minimum lifts of 1½" to 2", can be placed over existing AC that has minor structural damage. Geotextiles or paving mats made of recyclable or millable fabric should be considered to prevent cracks from telegraphing through new surfaces.

j. Acceptable manufacturers/products include:

- Ternate 'Mirafi' line of products (www.tencate.com)
- Saint-Gobain 'GlasPave 25' (www.sgtf.com), distributed by TensarPetromat by Propex or Amoco

k. When replacing the asphalt layer at existing areas, redesign of the asphalt thickness shall be considered to accommodate vehicular traffic. A minimum thickness of 4-inches of new hot mixed asphalt shall be placed over compacted gravel base 4-inches thick minimum. Provide required adjustments in slopes for proper drainage and raising existing area drain boxes if necessary. Conform to existing door landings and driveway approaches to repaved play yard. Execute and restore painted gamelines on new paving as directed by the school.

3. Decomposed Granite Paving

Decomposed granite (DG) is recommended as a paving material for paths and gathering areas in gardens, green schoolyards, and other landscaped areas where permeability is desired while maintaining a stable surface for pedestrian traffic. A resinous binder should be added for greater stability and cohesion on paths and in areas that require access for persons with disabilities, including wheelchair traffic.

B. Site Drainage

1. All new site grading and drainage systems shall be designed to keep surface water from entering buildings. New campuses and existing campuses at which all buildings have been replaced shall comply with Section 5.106.10 of the California Green Building Standards Code.
2. Yard clean-outs and catch basins are to be maintained. Clean-outs and catch basins are to be cleaned before and after work is done in the area. Unless the Contractor identifies inoperative components and/or fouled lines exist prior to the start of work, all components shall be assumed to be operating normally and the Contractor shall be held responsible for any damage or fouling present at the completion of work.
3. Rainwater leaders are to be cleaned before and after roofing work.

C. Playground Equipment / Structures

1. General Requirements

a. Provide factory-painted aluminum structures only. Galvanized steel and wood structures are not allowed.

2. Basketball Standard (Outdoor)

a. Support post galvanized steel schedule 40 tubing with 4-1/2 inch diameter minimum. Post shall be buried 48-inches minimum into the ground.

b. Minimum of 2 diagonal braces from post to backside of upper backboard

c. Rectangular backboard to be 42 inches high x 72 inches wide minimum, gel-coat sealant coating, white fiberglass with double 3/16" shell over resin treated honeycomb core; orange border stripe and official shooter's square above goal ring. Mount backboard 48-inches from center of post. Backboard shall be properly braced and supported with steel frame.

d. 18 inches inside diameter double ring type with 5/8" galvanized high strength steel ring welded together at a minimum of six places; powdercoated orange. Pre-punched mounting plate to backboard 3/16" thick minimum.

e. Netting to be heavy-duty nylon braided and attached to goal ring by means of continuous netlocking system

f. 10-year warranty for post, backboard and ring

g. Acceptable manufacturers: LA Steelcraft, Draper.

D. Site Accessories

1. Trash Enclosures

a. New construction and major modernization projects shall designate a curb-accessible, screened, area for the collection of recyclables, compostable, and landfill waste. Screening may consist of galvanized metal chain link fencing with integrated slats or perforated galvanized metal sheets or with the use of solid masonry walls.

b. Review capacity and design requirements and proposed solutions with SUHSD Maintenance and Operations Department and School Administration. Concerns include:

1) Easy access to compactors, disposal boxes etc. for both custodians and disposal company vehicles.

2) Consideration of neighboring property (aesthetics).

3) Adequate capacity for recyclables, compost, and landfill

4) Infringement on play space

5) Preventing the entry of storm water.

2. Flagpole

a. Fiber-reinforced plastic with internal polyester halyard, fiberglass truck, polyester wire core retaining ring, vinyl-covered counterweight, stainless steel and nylon internal cam lock, brass swivel snaps with vinyl covers and gold anodized aluminum ball to withstand winds of 120 mph unflagged.

b. Standard height of flagpoles is 30 feet.

c. Base to allow flagpole to pivot down for maintenance.

3. Sidewalk Curb Marking

a. Sidewalk curbs will be painted as appropriate

4. Anti- skateboard devices

a. Anti-skate board devices are to be considered at all sites. Please confirm with the District if the site requires a program to be implemented.

b. If possible, Architect should include design features that do not encourage skateboards.

c. The standard anti-skateboard devices:

1) The “GrinderMinder “ by Grind To A Halt (www.grindtoahalt.com) spaced at 3-feet apart embedded along edges of concrete retaining walls, planters, or benches. Deterrent is a solid stainless steel ball measuring 1-inch in diameter.

2) The “FA-FR Series” from Skatestopppers (www.skatestoppers.com), extruded aluminum edge deterrents, spaced at 3-feet o.c. with manufacturer-supplied fasteners, appropriate for existing conditions such as wood benches, plastic-coated steel benches, planter boxes, etc., FR0.25PC, or FR0.12BC are preferred.

5. Site Benches

a. SUHSD encourages the use of recycled plastic for site or play area benches with powder-coated steel frame and legs, embedded into the ground with concrete footings.

b. In certain cases, when existing wood benches need to be replaced, due to dry rot, vinyl bleacher covers can be used to repair them, re-suing the existing legs or posts.

c. Acceptable manufacturers: "PERMA-CAP", Hussey Seating Company, (www.husseyseating.com)

6. Bicycle Racks

a. Bicycle racks shall be inverted U-shaped racks made of galvanized steel square tubing, 2" x 2" in section. Racks shall be welded to two rails of appropriate length and bolted (surface-mounted) to concrete paving.

b. Acceptable products: 'Welle Series Flat Top' from Palmer Group (www.bikeparking.com)

c. Equal products manufactured locally (within 500 miles of project site) will be considered

d. Finish: Galvanized or powder-coated to match other site metalwork

e. Quantity: No less than two four-rack (8-bicycle capacity each) groups, for a total of 16 bicycles, shall be provided on each site. A/E shall discuss the need for additional racks with the school principal and provide more, as needed with concurrence of the SUHSD Maintenance and Operations Department.

f. Dimensions: 108" long, installed per the manufacturer's recommended clearances (not the minimum clearances unless specifically approved by the District for a specific condition)

g. Location: Provide the District with a recommended location or locations for each bicycle rack for review and approval by the school principal. Locate each group of racks to allow flexibility for the addition of future racks.

h. Provide enclosure (chain link or decorative fencing as requested by the User and District) around bicycle racks with lockable gate.

E. Landscaping (see SUHSD Grounds Shop, Site Administration, and District)

1. General Information

a. Submit Landscape Plans and plant list to the SUHSD Grounds Department for review and approval.

b. The project specifications and drawings shall require the contractor to locate and protect existing utilities during demolition and trenching Operations and to repair all above and below-ground utilities removed or damaged by the contractor's Operations.

2. Tree Planting

a. Consider planting trees to shade hardscape areas in order to minimize the urban heat island effect and to provide children with protection from the sun. At all new campuses and whenever possible at existing school sites, provide trees to shade new outdoor seating areas.

b. Falling leaves can block roof gutters and drains and create additional work for the District's limited staff of custodians and gardeners. Maintenance problems need to be considered along with the inherent benefits of window shading that can be accomplished with them.

c. Sidewalk trees should be carefully chosen from varieties that are not likely to raise or crack the concrete sidewalks or grow into overhead wires.

d. Large trees such as pines should not be planted in locations where they will become a nuisance (e.g. rubbing against a building, blocking natural light from windows, causing security problems, clogging roof gutters).

e. Consult SUHSD Grounds Shop, District and Site Administration for selection of appropriate tree species.

3. Planting in Lawn Areas

Planting in lawn areas is discouraged because it is difficult to cut the grass and not damage the planted areas, making cutting the grass more labor intensive.

4. Planting Next to Buildings

When planting next to a building, plants should be sufficiently spaced to ensure that the mature plant will not grow closer than 18 inches to the side of the building and trees not more 3 feet to the side of the building, in order not to impede routine maintenance (e.g. painting, repairing windows etc.).

5. Planting Selections

a. Consider native, low-maintenance, and drought-tolerant plants suitable for Peninsula climate and soil conditions.

b. Ground cover should be chosen and planted so as not to attract rodents or trap garbage and debris.

c. Vines and other climbing/crawling plants are prohibited, especially on building walls and property fences, because they block views and give rodents access to schools and administrative buildings.

6. Maintenance Plan

All new plantings should have the underpinning of a maintenance plan to ensure their upkeep and survival (i.e. weeding, pruning, trimming, fertilizing, watering and the division of labor etc.) for a period of two years. The plan should explain in detail the maintenance requirements for planting and lawn areas.

7. Landscaping Irrigation

~~a.~~ Where possible, use high-efficiency irrigation technology, drip irrigation, and rainwater harvesting in order to reduce the use of potable water for irrigation.

b. Irrigation systems shall be designed to prevent spray on building walls

c. Use Rain Bird Quick Coupler #44K (two-piece body), or approved equal, with locking cover every 100 feet: [W] www.rainbird.com/landscape/products/valves/quickcoupling.htm

c. For athletic fields, use Hunter I Series, or approved equal; http://www.hunterindustries.com/products

d. An approved reduced-pressure principal device or pressure vacuum breaker shall be installed and tested on all irrigation work. Results of the backflow device test report shall be given to the SUHSD Maintenance and Operations Department.

F. Fencing and Gates

1. Fencing Framework

a. Line and terminal posts and gate frames to be minimum schedule 40 pipe, hot-dipped galvanized.

b. Posts are to be set in concrete, minimum of 2-feet deep. Depth of footings shall be proportionate to height of fence post.

c. Provide top and bottom rails.

d. Truss bracing at terminal and adjacent posts.

e. Chain Link Fabric

f. Fabric to be min. 9 gauge, 1 inch x 1 inch galvanized, ensure that there are no sharp edges due to the galvanization process.

g. Consider galvanized non-climbable wire mesh where access is to be restricted or where fence vandalism is prevalent.

h. Provide vinyl slats to screen trash enclosures and other service areas. The district may consider other applications on a case-by-case basis.

2. Gates

a. Pedestrian gates must have access-compliant smooth, minimum 10" high kick plates, lever handles, and gate closers

b. When panic devices are required, specify a solid or perforated steel panel to prohibit unauthorized entry by reaching through the gate from the outside to activate the panic device.

c. Specify removable cylinders at exterior pedestrian gate locksets and cylinder locks for exterior panic devices at gates. Hex keys are not allowed.

d. Confirm that vehicular gates are wide enough to meet Fire Department standards for fire truck access where required. Minimum width: 20-feet.

e. Vehicular gates shall have drop rods and closing hasps. District will provide padlock and chain to secure the gate.

G. Interim Housing Units

1. General

a. Interim housing units include structures used for the temporary relocation of classrooms or other uses during construction, and are often referred to as portables, relocatables, or temporary buildings, and do not include permanent modular buildings.

b. For further instruction, contact the SUHSD Maintenance and Operations Department**.**

c. Acceptable manufacturer/modular building supplier:

- Mobile Modular Corporation
- [T] 800-944-3442
- [W] www.mobilemodularrents.com

d. State Allocation Board approval is required.

2. Site Placement

a. Provide required spacing between interim housing units and required fire separations between interim housing units and existing buildings per CBC, Fire Department, and modular building supplier requirements. With prior approval from the District, interim housing units with one-hour fire-rated exterior wall construction are available when limited space does not allow for required fire separation between interim housing units and existing buildings. Ensure that placement of interim housing units provides adequate fire department access to the site and both permanent buildings and interim housing units. Review interim housing layout with local Fire Department.

b. Consider impact of interim housing placement on school site, including play yard and athletic facilities, and review with school administration.

c. Coordinate layout of interim housing units, including orientation of entrances/exits, ramps, stairs, and electrical and HVAC equipment with modular building supplier's standard models pre-approved for use by the District.

3. Scope Definition, Division of Work, and Utilities

a. Placement, installation, and removal at the end of construction of interim housing units shall be performed by the District's modular building supplier. The contractor shall coordinate with the modular building supplier and provide any required re-grading and re-paving for placement of units and to provide required level landings (maximum 2% slope in all directions) at the bottom of ramps and stairs. In addition, the contractor shall patch, repair, and restore the site after removal of the interim housing units. Ensure an accessible path of travel complying with CBC and ADAAG requirements is provided to and between all interim housing units, permanent buildings, and site features that are required to be accessible.

b. The modular building supplier typically provides units with lighting, electrical outlets, one wall-mounted clock, thermostat, and HVAC equipment. The contractor shall install one phone and one data jacks, security, and fire alarm system components within the interim housing units, and extend power and low-voltage service to the interim housing units. It is SUHSD policy to avoid trenching and provide overhead utilities whenever possible. The contractor's scope of work shall include connection of all utilities upon placement of units and disconnection of all utilities upon removal. Confirm and coordinate with modular building supplier's drawings on connections and limit of work.

c. Electrical layout shall include:

d. Two electrical sub-panels per each 24'x60' (2 units) with locks

e. Each sub-panel requires 100 amperes and 220 volts

f. Single phase electrical service

g. Locations of manual pull stations, horn/strobes (maintain a minimum 15 dba audibility and 85 candela visibility each building),

h. Emergency light locations.

i. Location of phones in each building or two-way intercom. Phones need access to main office and "911"

j. Data drops if applicable for student computer and internet use, in addition to the basic single phone and data jack as noted above.

k. Contractor's scope of work shall include providing fencing between and around units in order to restrict access to areas required to be off-limits for security and safety. Review with school administration and modular building supplier.

l. Avoid providing water and drainage service to interim classroom units whenever possible.

m. Avoid using restroom portables whenever possible. Review the possible need for restroom portables with the SUHSD Maintenance and Operations Department. When required, the contractor's scope of work shall include providing domestic water service and sanitary sewer. Coordinate with plumbing work provided by modular building supplier.

n. Interim housing units are provided with rainwater gutters and downspouts. Do not connect downspouts to storm drain lines.

4. DSA and LOCAL FIRE DEPARTMENT Approval

a. DSA and the Fire Departments require that all interim housing units meet the requirements listed below and have both plan review and inspection approval before occupancy. Approval by Fire Departments is required prior to submitting to DSA. Over-the-counter approval by DSA is available for projects involving interim housing work only. Applications to DSA must include drawings of DSA pre-approved interim housing units and ramps for reference only, to be supplied by modular building supplier.

b. A letter shall be sent to the address below requesting temporary use for the interim housing and, if applicable approved in advance by the District, for permission to have a local stand-alone fire alarm system not connected to the school fire alarm system.

c. Plans shall be submitted to the local Fire Department Plan Check Division and DSA for review and approval. The plans shall contain the following:

d. A copy of any correspondence pertaining to the request

e. Details on how the interim housing structure will be anchored to the ground/foundation with the structural engineer's stamp

f. Closures between the adjacent landings and ramps and the buildings to prevent trash build-up under the ramps and interim housing units.

g. Details for ramps and stairs, including anchoring of ramps and stairs to the interim housing units. Comply with CBC requirements.

h. Exiting compliant with the CBC.

i. Design compliant with ADA and CBC accessibility requirements.

j. Site plan for entire school property, indicating fire department access to school grounds, all permanent buildings, and interim housing units, including vehicular and pedestrian gates, roadways, driveways, fire truck access and turnaround area where required, fire hydrants (on both sides of the streets), building entrances, and fire alarm annunciator and control panels.

5. Fire Alarm System

a. Review plans with DSA and LOCAL FIRE DEPARTMENT.

b. Printed hard copy and electronic CAD drawings for evacuation plans are required to be submitted to the District.

c. A/E shall design and contractor shall install one combination horn/strobe, one manual pull station, and hardwired automatic detection devices (smoke and heat detectors) linked to the fire alarm control panel. A fully automatic and addressable fire alarm system is not required for interim housing units. Protective covers shall be installed over manual pull stations.

d. Fire sprinklers are not required for interim housing units.

e. Interim housing fire alarm system shall be connected to the school's fire alarm system unless stand-alone system is approved by the District in advance.

f. DSA inspection prior to occupation is required. Contractor shall pay for all inspections.

g. Maintenance for alarm of main facility to include system for interim housing.

6. Access for Persons with Disabilities

a. Accessible ramps, landings, and handrails, including modular and temporary ramps, shall be designed and installed per DSA regulations and to comply with ADAAG and CBC.

b. When designing ramps, DO NOT DESIGN TO THE MAXIMUM SLOPES. Allow for construction tolerance. For example, ramps may be designed with a slope of 1:13 instead of the maximum allowed slope of 1:12.

c. Cross-slopes on ramps, accessible parking spaces, access aisles, and paths of travel are not to exceed 2% per CBC and ADAAG requirements.

d. Steel modular ramps shall be provided with plywood skirts painted to match the railings.

7. Security

a. Review security requirements with SUHSD Maintenance and Operations Department**.**

b. Equip windows with 3/4-inch diamond pattern 9 gauge expanded metal screens with emergency releases.

c. Provide locks for electrical panel boxes, HVAC units, and main power switches.

d. Provide security alarm devices and systems.

e. Provide security lights with automatic timers. Do not use photo-cells.

f. Doors shall be fitted with galvanized astragal plates for security.

8. Equipment Noise and Vibration Considerations

Refer to DIVISION 00, Acoustical Requirements, for Equipment Noise and Vibration considerations

9. Ventilation Requirements

a. At the time of delivery it should be verified that all mechanical ventilation units are equipped with outside air intakes (not barometric relief assemblies), and that the intakes are open and operation. A representative of the supplier of the modular units would be the best person to verify that the units are so configured.

b. As soon as possible after delivery the mechanical ventilation units should be equipped with power and activated. Activation should be performed before touch-up painting, installation and/or repair of flooring, and other activities making use of chemicals such as paints, adhesives, and cleaners. If it is not possible to activate the ventilation units prior to such work, temporary fans must be used to increase outdoor air exchange. Opening available doors and windows is not sufficient to provide adequate air exchange and remove added volatiles.

c. During setup work and until classes are held in the, portables controls on ventilation units should be overridden and set to operate continuously, 24/7 to allow for volatiles and particulates stirred up by installation to be flushed out of the portable. To save on energy costs temperature settings should be lowered to the mid-50s, just above the point where condensation on surfaces is a concern. This continuous ventilation should continue during the moving of furniture and educational supplies into the portable as these activities can release additional dust and particulates.

d. When ventilation controllers are configured for normal operations, fans should be programmed to start at least an hour and a half (1.5 hours) prior to the start of classes and continuously operate throughout the entire school day and beyond, until at least one and a half hours after the end of the school day.

e. A note should be conspicuously posted explaining how the heating in the portable can be adjusted. If it is possible for classroom occupants to manually switch fans off the note should indicate that fans need to be kept operating continuously during school hours.

f. Within the first week of classroom occupancy, filters in the ventilation units should be replaced.

DIVISION 33 – UTILITIES

(see Plumbing and Electrical Divisions)

SUHSD CONTACTS

Enrique Navas
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Mitch Dolezal
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ABBREVIATIONS

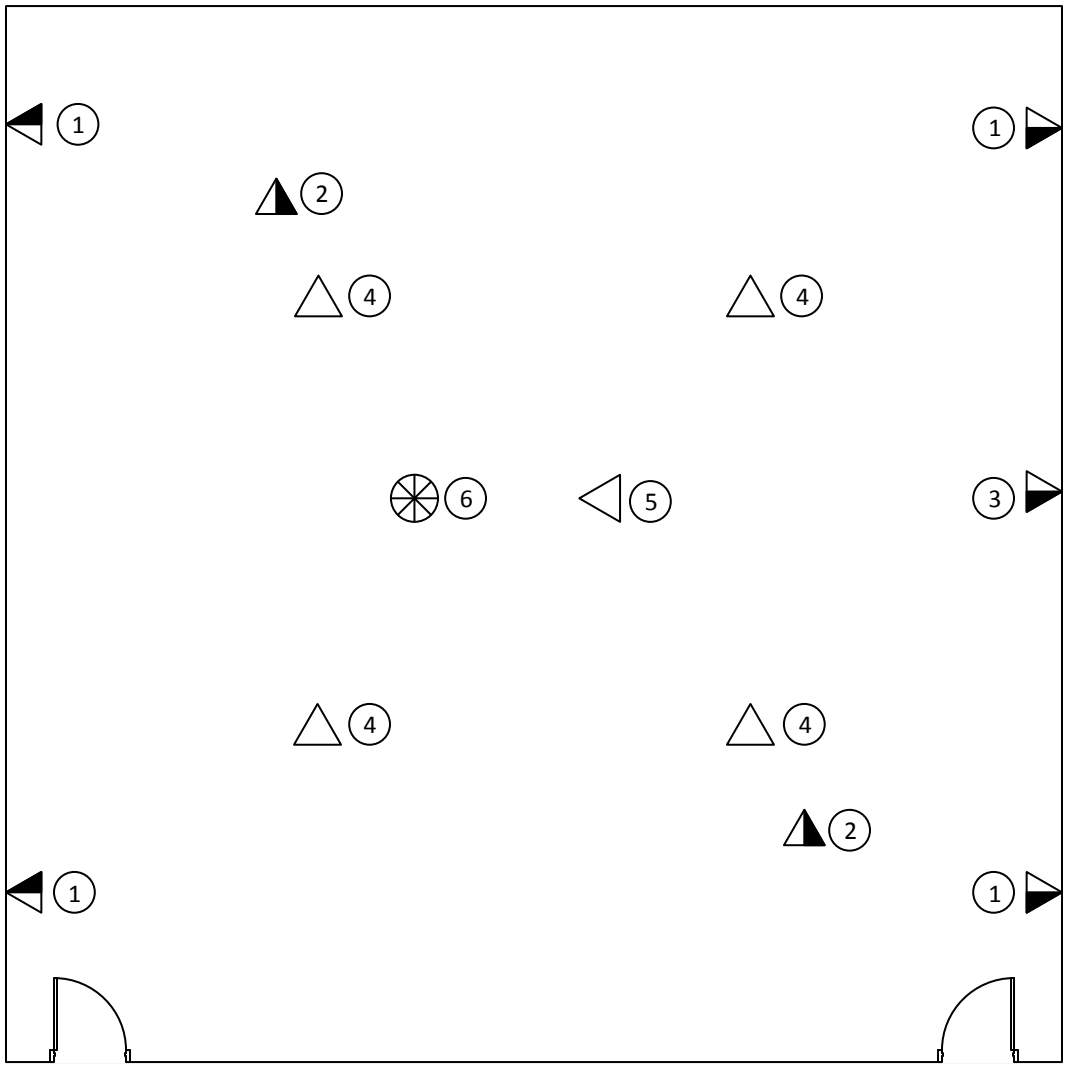
AC ..... Asphaltic Concrete
ADA..... Americans with Disabilities Act
ADAAG ..... ADA Accessibility Guidelines
A/E ..... Architect and/or Engineer
AHERA... Asbestos Hazard Emergency Response Act
AOR ..... Architect of Record
ASCE ..... American Society of Civil Engineers
ASHRAE ..... ASHRAE
ASME..... American Society of Mechanical Engineers
BMS ..... Building Management System
CAD ..... Computer Aided Drawings
CARB..... California Air Resources Board
CBC ..... California Building Code
CCR ..... California Code of Regulations
CDE ..... California Department of Education
CEC ..... California Education Code
CERTA..... Certified Roofing Torch Applicator
CHPS..... Collaborative for High Performing Schools
CHSC..... California Health and Safety Code
CRRC..... Cool Roof Rating Council
CSFM..... California State Fire Marshal
CSI..... Construction Specifications Institute
DOSH..... Division of Occupational Safety & Health
DSA..... Division of the State Architect
DT or D/T ..... Destructive Testing
EMS ..... Emergency Management System
FAAP..... Fire Alarm Annunciator Panel
FACP ..... Fire Alarm Control Panel
FM..... Fire Marshal or Factory Mutual
FPC..... Fire Protection Contractor
FSD..... Fire Safety Director
GANA..... Glass Association of North America
HPI..... High Performance Incentive
HVAC..... Heating Ventilation and Cooling
IIC..... Impact Insulation Class
IOR ..... Inspector of Record
MEP..... Mechanical, Electrical and Plumbing
NC ..... Noise Criteria
NFPA..... National Fire Protection Association
NRC..... Noise Reduction Coefficient
NRCA ..... National Roofing Contractors Assn
OSB..... Oriented Strand Board
OSHA ..... Occupational Safety & Health Admin
PVC ..... Poly Vinyl Chloride
SHGC ..... Solar Heat Gain Coefficient
SMACNA ..... SMACNA
STC ..... Sound Transmission Class
SUHSD..... Sequoia Union High School District
UL..... Underwriters Laboratory
WI ..... Architectural Woodwork Institute

Typical Classroom Layout for Technology

Appendix A

- Data Outlet
- Electrical Outlet
- In-Room Audio (Example – Lightspeed Topcat)

(Assumed dimensions - 32' x 32')



1 - Data outlet with three RJ45 Cat 6 outlets – Blue

2 - Data outlet mounted in dropped ceiling/T-Bar tile with two RJ45 Cat 6 outlets – Green

3 - Data outlet with one RJ45 Cat 6 outlet, above projector on "learning wall" – Blue

4 - Duplex electrical floor outlet

5 - Duplex electrical outlet above dropped ceiling, where applicable

6 - Audio system mounted in dropped ceiling/T-Bar grid

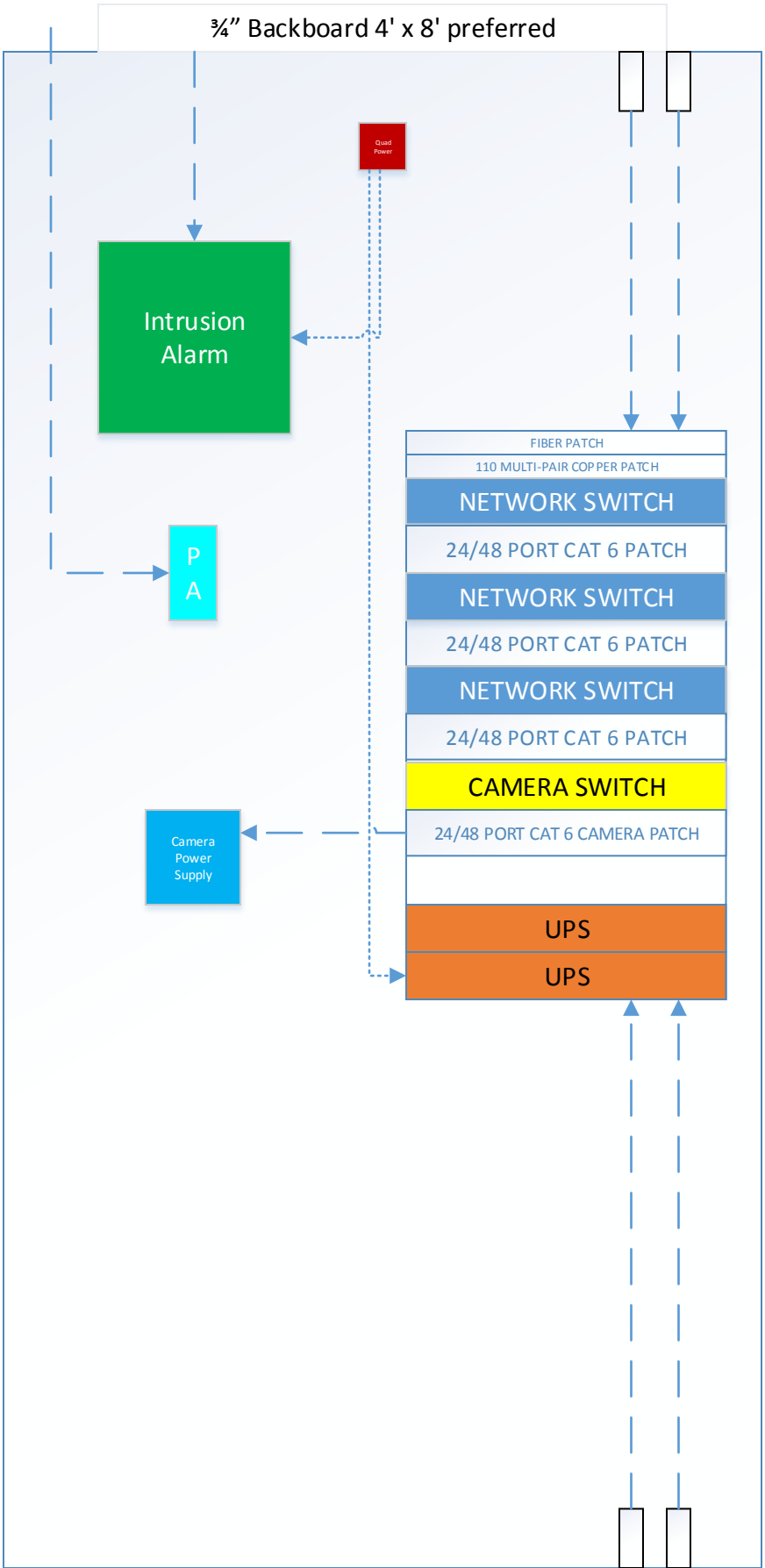
* - all wall mounted data outlets will have an associated duplex eletrical outlet.

** - all dimensions and locations are approximate, and will yield to the final design of the classroom.

Note: Provide additional electrical outlets in classroom in conformance with the Educational Specifications and building codes.

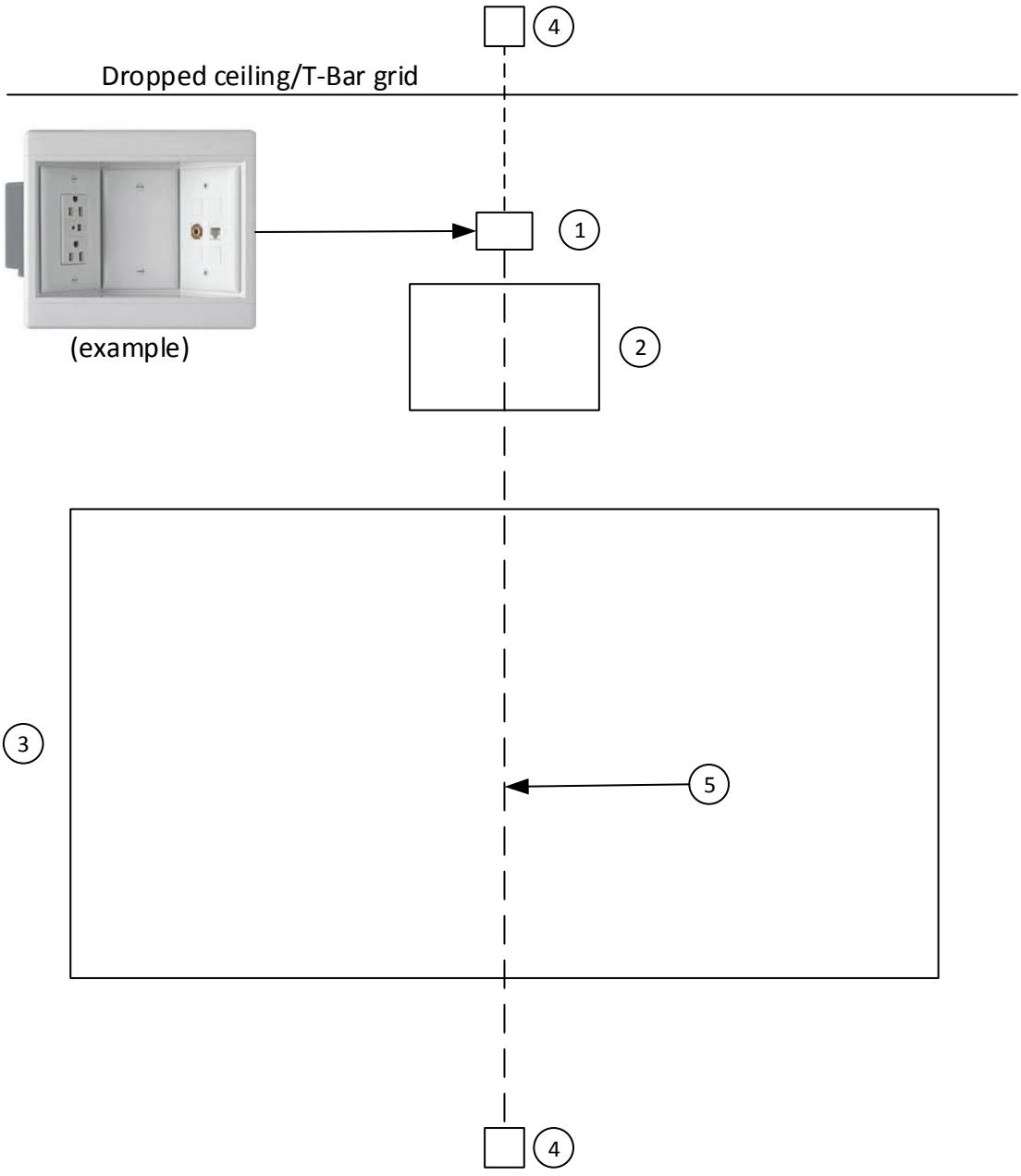
Typical IDF Layout

Appendix B



Learning Wall Example

Appendix C



(1) - Three gang recessed multi-outlet for power, data, and multi-media cabling needs

(2) - Short-throw video projector – Example: Epson 585wi

(3) - Matt finish enamel coated steel white board – typical dimensions 8' wide by 4' high

(4) - Two gang recessed outlet – deep enough for 2" conduit

(5) - 2" EMT conduit run behind wall between outlets for general low-voltage cabling needs

* - All dimensions and locations are approximate, and will yield to final design of the classroom.

Note: Provide additional electrical outlets in classroom in conformance with the Education Specification and Building Code.

TOPCAT (ACCESS) SPECIFICATIONS
Appendix D
IN-CEILING CLASSROOM AUDIO SYSTEM

1.1 REGULATORY REQUIREMENTS

A. Conform to (applicable) (specify specific citations) building code for requirements applicable to work specified herein.

B. Conform to appropriate sections of (specify) with regard to applicable requirements (specify).

1.2 QUALITY ASSURANCE

A. Qualifications

1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
   a. Certificate: when requested, submit certificate indicating qualification.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

B. Acceptable Manufacturers

1. Basis of Design: Lightspeed Technologies, 11509 SW Herman Road, Tualatin, OR 97062, PH 800-732-8999, FAX 503-684-3197

C. Manufacturer Testing: Manufacturer to provide quality assurance certification for each system and all of its components. A report for each system will be available upon request. Report will include serial numbers and pertinent testing data for all of the system functions.

D. Successful third party installation (when needed) will be supplied with necessary training to allow for product installation certification by Manufacturer and will be installed according to Lightspeed recommendations.

1.3 SUBMITTALS

A. General: Submit listed submittals in accordance with “Conditions of the Contract”.

B. Manufacturer’s data on all products including but not limited to:

1. Catalog cut sheets
2. Installation instructions
3. Typical wiring diagrams
4. Drawings showing speaker locations
5. Operation and maintenance manuals
6. Manufacturer’s warranty documents
7. Manufacturer’s parts lists
8. Product serial numbers

1.4 WARRANTY

A. Warranty: Refer to “Conditions of the Contract” for warranty and repair provisions.

B. Repair: Manufacturer shall offer repair service on all Classroom Audio components. Owner shall pre-pay shipping for all items returned to manufacturer for repair. The

Manufacturer shall repair or replace system components as specified under warranty. Manufacturer shall ship repaired components within five (5) working days of receipt. Items returned to Owner are shipped via the same method in which they were received.

C. Manufacturer's Warranty: All the major system components (transmitters, receiver-amplifier, sensor, and speakers) must be warranted for five years against defects occurring while used in normal classroom instruction. The warranty shall be equivalent to a Lightspeed Technologies' Five-Year Warranty.

1. Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.

1.5 OVERALL SYSTEM DESCRIPTION

A. The system must have specifications and features that are equivalent to the Lightspeed Topcat® In-Ceiling Classroom Audio System including the following:

1. All-in-one, in-ceiling audio system with integrated amplifier, speakers and wireless audio receiver/transmitter
2. Two-way hybrid speaker system with exciter technology sound panel and low frequency cone driver
3. Cross over technology to deliver high speech intelligibility and full range sound with even distribution throughout the classroom
4. Up to 2 microphones for whole room instruction, team-teaching or student sharing
5. Pendant-style Flexmike® classroom microphone with audio input utilizing Access Technology (1.9 GHz) for transmission. IR not acceptable
6. Wireless Media Connector utilizing Access Technology (1.9 GHz) to integrate with and wirelessly transmit all classroom multimedia to be played through the Topcat
   a. Includes 4 audio inputs with volume control
   b. 2 audio outputs for ALD and/or recording with volume control
   c. Tone control to remotely adjust bass/treble of Topcat
7. Optional PageFirst emergency page priority
8. In-Ceiling mounted
9. Suitable for use in air-handling spaces (plenum-rated)
10. Compatible with Flexcat speaker pods with 2-way audio communication

B. The system must produce high speech intelligibility and full-range multimedia quality sound with excellent distribution throughout a classroom.

C. The system must be capable to be installed in a classroom with no wires installed in or on the walls. The system must be fully operational without speaker wires or sensor cables.

D. The system must be compatible and expandable to operate with 2-way small group speaker pods allowing interoperability between both small group and whole group instruction.

E. The system shall carry a "No Audio Dropout Guarantee" between the wireless microphone and the sound system. The guarantee applies to operation in any room up to its expected range of 200 feet (assuming no walls). The guarantee does not extend into other rooms separated by walls as this can limit transmission range significantly. Should any dropout in audio transmission occur, the manufacturer will correct it at no additional charge.

F. The system shall carry a standard warranty equivalent to the Lightspeed 5-year Warranty.

1.6 OWNER INSTRUCTION

A. Owner's Instruction: user-training will be performed by the manufacturer's local representative. The training will include the research and benefits of classroom amplification, system operation, simple troubleshooting guidelines, and incorporating the classroom amplification into teaching styles. The manufacturer will also provide additional training in trouble-shooting techniques and product return procedures to one specified person per campus. This service shall be rendered to the Owner at no additional cost.

B. Instruction materials and detailed Owner's manual shall be provided to cover operational and basic maintenance procedures.

PART 2. PRODUCTS

2.1 IN-CELING CLASSROOM AUDIO SYSTEM SPECIFICATIONS

A. Overall System:

1. Power output: 20 Watts rms
2. Acoustic Frequency response: 60 Hz to 18 kHz -10dB
3. AC Mains Power Input: 100-240V ~ 50/60Hz 1.5A
4. DC Power Input: 24V/2.5A
5. Signal-to-noise: 60 dB
6. Total Harmonic Distortion: <1%, 10 W
7. Wireless Communication: Access Technology (1.9 GHz + RF4CE)
8. Automatic power down after 2 hour of inactivity
9. Automatic power on when Flexmike is powered on and linked
10. Dimensions (W x D x H): 24" x 12" x 3.7" (Removable side spacers to fit international ceiling grids; 595mm x 295mm x 94mm)
11. Weight: 13.5 lbs (6.1 kg)
12. Controls:
    a. (1) Microphone volume control
    b. (1) Tone control
    c. (1) Audio input volume control
    d. (1) PageFirst sensitivity adjustment
13. Connections:
    a. (1) Direct AC mains power input
    b. (1) Optional DC Power Input
    c. (1) Audio input
    d. (1) Optional Page mute (PageFirst™) input (Euro-block)
14. Device Registration: push button for transmitter(s), remote(s), speaker pods
15. Wireless audio range: up to 200 feet
16. Integrated 2-Way Hybrid Speaker System:
    a. Description: exciter technology sound panel plus low frequency cone driver
    b. Integrated cross-over technology

c. Panel Size: 13.75” x 6.75”
d. Cone Driver Size: 5.25”
e. Overall Frequency Response: 60 Hz to 18 kHz -10dB
f. Impedance: 8 Ω
g. Power Handling: 25 W

B. The in-ceiling classroom audio system shall use bi-directional wireless Access Technology to communicate with up to two wireless microphones.

C. The in-ceiling classroom audio system shall use bi-directional wireless Access Technology to integrate with other audio sources in the classroom.

D. The in-ceiling classroom audio system shall use bi-directional wireless Access Technology to send a mixed audio output to a media connector located at a convenient/student accessible location in the classroom.

E. The in-ceiling classroom audio system shall use bi-directional wireless Access Technology to communicate with up to 6 optional tabletop speaker pods available to facilitate small group instruction.

F. The all-in-one system must contain a Page mute function (PageFirst™) that passively detects the audio signal of a page coming through the PA system without compromising system performance or voiding warranties. As an audio signal is sent to the PA speaker, the PageFirst passive sensor clip detects that signal and immediately mutes the Topcat.

2.2 WIRELESS MEDIA CONNECTOR

A. Description: Wireless audio transmitter/receiver to itegrate with classroom audio sources and send/receive the wireless to the Topcat system in the ceiling.

B. Wireless Communication: Access Technology (1.9 GHz)

C. Audio Inputs: (4) 3.5mm stereo jacks connect to classroom audio sources.

D. Audio Outputs: (2) 3.5mm jack with volume control

E. (1) Microphone volume control

F. (1) Audio input volume control

G. (1) Audio output volume control

H. (1) Power button with LED

I. (1) Tone control

J. (1) Registration button with Registration LED and linked LED

K. Audio frequency response: 80 Hz to 7 kHz ±3 dB

L. Audio distortion: <1%

M. DC Power Input: USB 5V/0.2A (type micro-B)

N. Mounting: table-top or wall

O. Dimensions (W x D x H): 7.6”x 4.1”x 1.1” (193 x 104 x 28mm)

2.3 FLEXMIKE PENDANT-STYLE MICROPHONE / TRANSMITTER

A. Description: the pendant-style wireless microphone
B. Lanyard: adjustable length with magnetic clasp
C. Wireless communication: bi-directional Access Technology (1.9 GHz)
D. Audio distortion: <1%
E. Integrated microphone type: uni-directional electret
F. Audio input: 3.5mm
G. Earbud output: 3.5mm (for to monitor optional Flexcat pods)
H. Push button volume control: +/- 6dB (total range = 12 dB)
I. Power: on/off/mute button
J. Battery Power: 2.4V NiMH battery pack
K. Battery run time: 8 hours (fully charged)
L. Charging: 5V USB; type micro B connector
M. Alkaline Charge Protection: Yes
N. USB Audio: interface with computer USB audio while charging
O. Registration: push button for registration with Topcat
P. Dimensions (L x W x H): 2.9” x 1.1” x 1.0” (74 x 28 x 25mm)
Q. Weight: 1.8 oz (51g)

2.4 OPTIONAL SHAREMIKE HANDHELD MICROPHONE / TRANSMITTER

A. Description: handheld wireless microphone
B. Wireless communication: Access Technology (1.9 GHz)
C. Audio distortion: <1%
D. Integrated microphone type: uni-directional electret
E. Auxiliary Input: 3.5mm
F. Power: on/off/mute button
G. Battery Power: 2 AA NiMH rechargeable battery pack
H. Battery run time: up to 8 hours (fully charged)
I. Charging: 5V USB; 3.5mm DC jack
J. Alkaline Charge Protection: Yes
K. Registration: push button for registration with Topcat
L. Dimensions (L x W x H): 8.25” x 1.3” x 1.3”
M. Weight (with batteries): 7.9 oz

2.5 REGULATORY AND CERTIFICATIONS

A. The classroom audio system and its components shall be manufactured using lead-free processes and free of other materials harmful to the environment (RoHS and WEEE compliant).

B. The classroom audio system and its components shall be listed to UL/CUL standards and requirements for electrical safety by Underwriters Laboratories Inc.

C. The classroom audio system must be suitable for use in air handling spaces and carry appropriate certifications (UL 2043).

D. The classroom audio system and its components shall be CE Certified and conform with the essential requirements of the following European Union Directives: 2004/108/EC Electromagnetic Compatibility (EMC) and 2006/95/EC Low Voltage Directive (LVD).

E. The classroom audio system and its components shall comply with Part 15 of the FCC rules as a Class B digital device (FCC Certified).

PART 3. EXECUTION

3.1 SYSTEM PERFORMANCE

A. Install in accordance with Manufacturer's installation instructions.

B. Final adjustment: Upon completion, the system shall be clean, adjusted and left in perfect operating condition. Transmitters shall be plugged in and charging and user manual should be left in a conspicuous place.

C. Provisions: There shall be no audible components of hum, noise, or distortion.

3.2 INSTALLATION

A. Provide and install Sound Reinforcement System in the locations shown on drawings as required.

B. All equipment and enclosures described in this specification shall be permanently attached to the structure and held firmly in place. Supports shall be adequate to support their loads per manufacturers specifications.

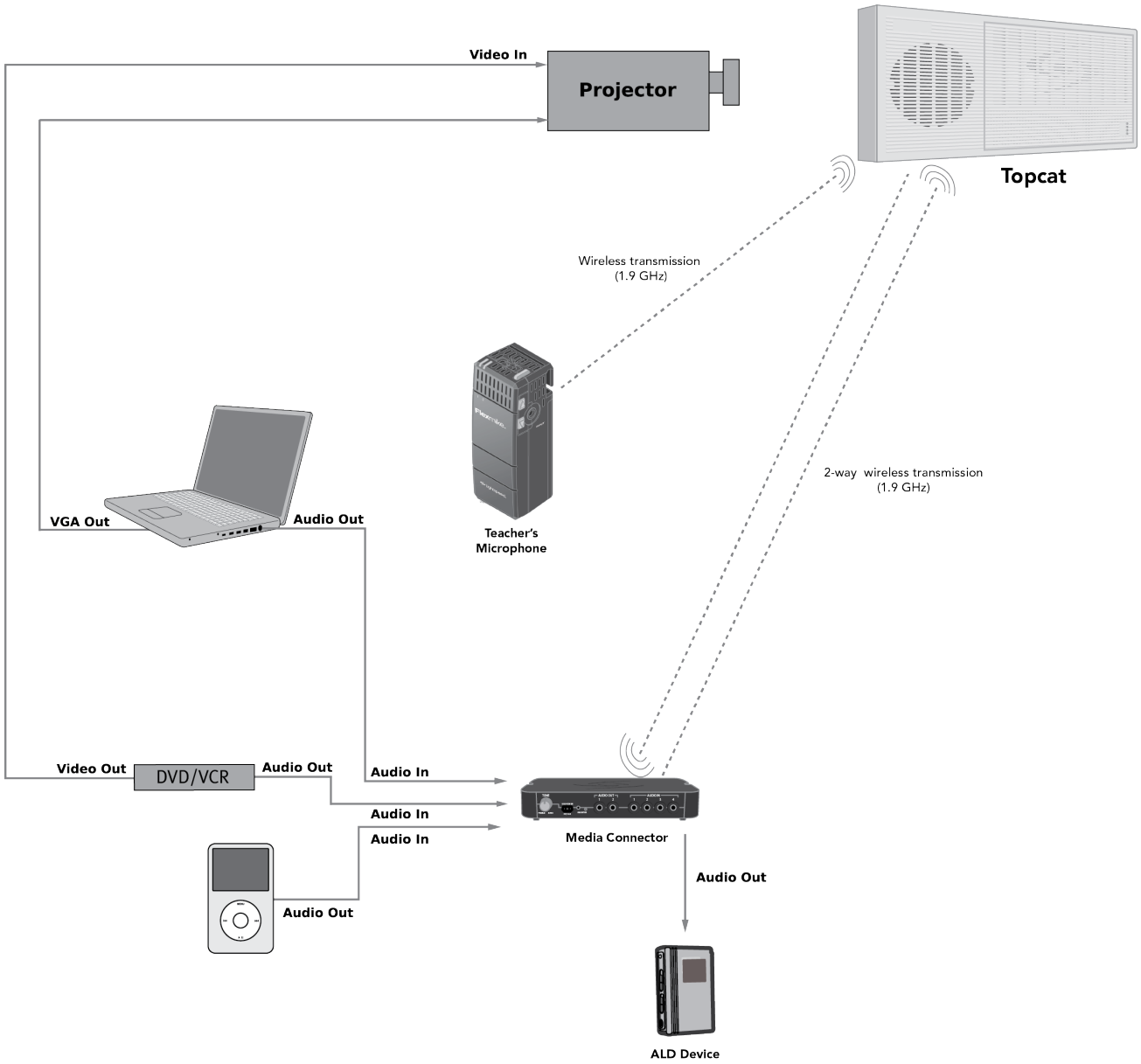
C. The process of testing the Audio Sound System may necessitate moving and adjusting certain component parts (ex. loud speakers). Contractor shall provide at no additional cost to the owner.

D. Take precautions as necessary to prevent and guard against electromagnetic and electrostatic noise interference.

E. Wireless Media Connector to be located per Owner's request. Contractor to ensure all Media Connectors are properly registered and all volume controls are set properly via a field test in every classroom. Ensure power is available for Media Connector.

3.3 INTEGRATING THE TOPCAT WITH OTHER AUDIO SOURCES

The wireless Media Connector must have four audio inputs to allow other audio sources to be wirelessly transmitted and played through the Topcat system. Computers, DVD/VCR's, TV's, CD's, MP3's etc. may be connected into the Media Connector using appropriate patch cords. The Media Connector must also receive audio back from the Topcate to output the mixed audio signal of both microphone channels and multimedia for recording purposes and interface with assistive listening devices. See the systems integration chart below.

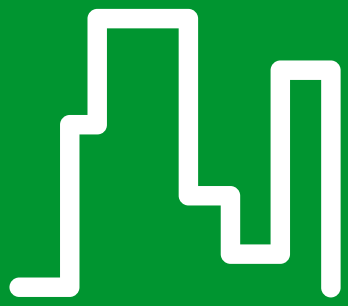


Appendix E

Guide Specification for a SmartStruxure™ solution

powered by StruxureWare™ Building Operation software

Division 23



Schneider Electric – Buildings
2015.02.23

Schneider Electric

Contents

PART 1 - General

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Related Sections

A. This Section includes the Building Management System (BMS) control equipment for HVAC systems and components, including open protocol control components for terminal heating and cooling units. Depending on the scope of the project, the complete specification may have numerous sections that interface to this section, including several from Division 25.

B. Additional related sections and sub-sections can apply.

1. 25 01 00 Operation and Maintenance of Integrated Automation
2. 25 08 00 Commissioning of Integrated Automation
3. 25 08 01 Automated Monitoring Based Commissioning Systems
4. 25 11 00 Integrated Automation Network Devices
5. 25 13 00 Integrated Automation Control and Monitoring Network
6. 25 13 13 Automated Predictive Energy Optimization
7. 26 09 13 Embedded Power and Energy Management Software
8. Add additional sections as required.

1.3 Standard Terms

A. Standard

1. ASHRAE: American Society Heating, Refrigeration, Air Conditioning Engineers
2. AHU: Air Handling Unit
3. BACnet: Building Automation Controls Network
4. BMS: Building Management System
5. DDC: Direct Digital Control
6. EIA: Electronic Industries Alliance
7. GUI: Graphical User Interface
8. HVAC: Heating, Ventilation, and Air Conditioning
9. IEEE: Institute Electrical Electronic Engineers
10. MER: Mechanical Equipment Room
11. PID: Proportional, Integral, Derivative
12. VAV: Variable Air Volume Box

B. Communications and protocols

1. ARP: Address Resolution Protocol
2. CORBA: Common Object Request Broker Architecture
3. CSMA/CD: Carrier Sense Multiple Access/Collision Detect
4. DDE: Dynamic Data Exchange
5. FTT: Free Topology Transceivers
6. HTTP: Hyper Text Transfer Protocol
7. IIOP: Internet Inter-ORB Protocol
8. LAN: Local Area Network
9. LON: Echelon Communication – Local Operating Network
10. MS/TP: Master Slave Token Passing
11. ODBC: Open Database Connectivity
12. ORB: Object Request Broker
13. SNVT: Standard Network Variables Types
14. SQL: Structured Query Language
15. UDP: User Datagram Protocol
16. XML: eXtensible Markup Language

C. Controllers

1. ASD: Application Specific Device
2. AAC: Advanced Application Controller
3. ASC: Application Specific Controller.
4. CAC: Custom Application Controller.
5. DCU: Distributed Control Unit
6. LCM: Local Control Module
7. MC: MicroControllers
8. MCI: MicroInterface
9. MN-II: Microzone II direct digital controller
10. MN-FLO: Micronet 2000 Pressure Independent VAV Controller
11. NSC: Network Server Controller
12. PEM: Package Equipment Module
13. PPC: Programmable Process Controller
14. SDCU: Standalone Digital Control Units
15. SLC: Supervisory Logic Controller
16. UEC: Unitary Equipment Controller
17. VAVDDC: Variable Air Volume Direct Digital Controller

D. Tools and Software

1. AMBCx: Automated Monitoring Based Commissioning
2. APEO: Automated Predictive Energy Optimization
3. DR: Demand Response
4. CCDT: Configuration, Commissioning and Diagnostic Tool
5. BPES: BACnet Portable Engineering Station
6. LPES: LON Portable Engineering Station
7. POT: Portable Operator's Terminal
8. PEMS: Power and Energy Management Software

1.4 Qualifications of Bidder and Pre-bid Submittal

A. All bidders must be building automation contractors in the business of installing direct digital control building automation systems for a minimum of 3 years.

B. The Building Management System contractor shall have a full service facility within 100 miles of the project that is staffed with engineers trained and certified by the manufacturer in the configuration, programming and service of the automation system. The contractor's technicians shall be fully capable of providing instructions and routine emergency maintenance service on all system components.
    1. Any installing contractor, not listed as prequalified in the Approved Manufacturer's section, shall submit credentials as detailed in the Pre-bid Submittal section for the engineer's review 2 weeks prior to bid date. Failure to follow the attached formats shall disqualify potential alternate bidders. Credentials must attest that the contractor meets all requirements of the specification and the Engineers judgment regarding approval to bid as an acceptable installer after reviewing the data will be final.

C. All bidders must be authorized distributors or branch offices of the manufacturers specified.

D. The following bidders have been pre-qualified:
    1. Schneider Electric
    2. Or as approved by Owners.

E. Any installing contractors or manufacturers interested in participating as acceptable bidders for this project that are not pre-qualified shall furnish a detailed technical pre-bid submittal to the consulting engineer. All information must be submitted 2 weeks prior to the published bid date to allow the engineer adequate time to review the bidder's credentials.

F. The Pre-Bid submittal shall contain the following information as a minimum:
    1. A profile of the manufacturer and the local installation and service/organization.
    2. Description of how the system meets and achieves all the specified criteria in terms of configuration, operation, and control.
    3. System Architecture with single line riser diagram showing all major components (digital controllers, routers, hubs, etc.) that will be required for this project.
    4. Procedure for commissioning and time required to startup and commission each of the systems for this project.
    5. Contractors approach for the project planning and management.
    6. Product Data Sheets for all components, DDC panels, and all accessories listed per the appropriate specification sections herein.
    7. Examples of actual graphic screens for other similar projects.
    8. Number and types of DDC panels required for this installation.
    9. Number and types of spare points provided with the proposed system.
    10. Recommended spare parts list for components with list price schedule.
    11. List of 2 similar systems in size, point capacity, total installed value, installed and commissioned by the local office with a list of the installers/manufacturers design team members for each project and the owners contact information.
    12. Samples of service offerings and a list of current similar service contracts with contact information.
    13. Resumes for the management team and all employees who will be involved with the project design, commissioning, project management, and after installation service. Resumes should include copies of manufacturer's certifications for the proposed product line.
    14. Copy of this Control Specification in its entirety with a check mark beside each paragraph to signify that the manufacturer's equipment and software shall fully conform to the specified requirement. If the requirement cannot be met, indicate the reasons/limitations and the alternative proposed.

15. An interview may be conducted and the bidder will be requested to make a formal presentation concerning the proposed system and possibly provide an installed project tour prior to a final decision.

1.5 Scope of Work

A. The Contractor shall furnish and install a complete building automation system including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification. All components of the system – workstations, servers, application controllers, unitary controllers, etc. shall communicate using the EIA standard 709.1, the LonTalk™ protocol, or Modbus protocol. No gateways shall be used for communication to controllers furnished under this section. At a minimum, provide controls for the following:
    1. Air handling units
    2. Return air fans
    3. Exhaust and supply fans
    4. Chilled water system including pumps, chillers, and cooling towers
    5. Boilers including hot water pumps
    6. Computer room air handling units
    7. Refrigerant leak detection system
    8. Smoke evacuation sequence of AHUs and return fans including smoke control dampers and fire command override panel.
    9. Finned tube radiation control
    10. Variable volume and constant volume box control including interlocks with finned tube radiation.
    11. Cabinet unit heater controls
    12. Monitoring points for packaged equipment such as emergency generators,
    13. Power wiring to DDC devices, smoke control dampers and BAS panels except as otherwise specified.

B. Except as otherwise noted, the control system shall consist of all necessary Ethernet Network Controllers, Standalone Digital Control Units, workstations, software, sensors, transducers, relays, valves, dampers, damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system. Except as otherwise specified, provide operators for equipment such as dampers if the equipment manufacturer does not provide these. Coordinate requirements with the various Contractors.
C. The BAS contractor shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.
D. All interlocking wiring, wiring and installation of control devices associated with the equipment listed below shall be provided under this Contract. When the BAS system is fully installed and operational, the BAS Contractor and representatives of the Owner will review and check out the system – see System Acceptance and Testing section of this document. At that time, the BAS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.
E. Provide services and manpower necessary for commissioning of the system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative.

F. All work performed under this section of the specifications will comply with all governing codes, laws and governing bodies. If the drawings and/or specifications are in conflict with governing codes, the Contractor, with guidance from the engineer, shall submit a proposal with appropriate modifications to the project to meet code restrictions. If this specification and associated drawings exceed governing code requirements, the specification will govern. The Contractor shall obtain and pay for all necessary construction permits and licenses.

1.6 System Description

A. In accordance to the scope of work, the system shall also provide a graphical, web-based, operator interface that allows for instant access to any system through a standard browser. The contractor must provide PC-based programming workstations, operator workstations and microcomputer controllers of modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions.

For this project, the system shall consist of the following components:

1. Administration and Programming Workstation(s): The BAS Contractor shall furnish (1 ea.) Administration and Programming Workstation Computers as described in Part 2 of the specification. These workstations must be running the standard workstation software developed and tested by the manufacturer of the network server controllers and the standalone controllers. No third party front-end workstation software will be acceptable.
2. Web-Based Operator Workstations: The BAS Contractor shall furnish licenses for web connection to the BAS system. Web-based users shall have access to all system points and graphics, shall be able to receive and acknowledge alarms, and shall be able to control setpoints and other parameters. All engineering work, such as trends, reports, graphics, etc. that are accomplished from the WorkStation shall be available for viewing through the web browser interface without additional changes. There will be no need for any additional computer based hardware to support the web-based user interface.
3. Ethernet-based Network Router and/or Network Server Controller(s): The BAS Contractor shall furnish Ethernet-based Network Server Controllers as described in Part 2 of the specification. These controllers will connect directly to the Operator Workstation over Ethernet at a minimum of 100mbps, and provide communication to the Standalone Digital Control Units and/or other Input/Output Modules. Network controllers that utilize RS232 serial communications or ARCNET to communicate with the workstations will not be accepted.

4. Standalone Digital Control Units (SDCUs): Provide the necessary quantity and types of SDCUs to meet the requirements of the project for mechanical equipment control including air handlers, central plant control, and terminal unit control. Each SDCU will operate completely standalone, containing all of the I/O and programs to control its associated equipment.

B. The Local Area Network (LAN) shall be either a 10 or 100 Mpbs Ethernet network supporting Modbus, Java, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Server Controllers (NSCs), user workstations and a local host computer system.

C. The Enterprise Ethernet (IEEE 802.3) LAN shall utilize Carrier Sense Multiple/Access/Collision Detect (CSMA/CD), Address Resolution Protocol (ARP) and User Datagram Protocol (UDP) operating at 10 or 100 Mbps.
D. The system shall enable an open architecture that utilizes EIA standard 709.1, the LonTalk™ protocol.
E. LonTalk™ packets may be encapsulated into TCP/IP messages to take advantage of existing infrastructure or to increase network bandwidth where necessary or desired.
    1. Any such encapsulation of the LonTalk™ protocol into IP datagrams shall conform to existing LonMark™ guide functionality lines for such encapsulation and shall be based on industry standard protocols.
    2. The products used in constructing the BMS shall be LonMark™ compliant.
    3. In those instances in which Lon-Mark™ devices are not available, the BMS contractor shall provide device resource files and external interface definitions for LonMark devices.
F. The software tools required for network management of the LonTalk™ protocol must be provided with the system. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans and are required to meet the functional intent, shall be provided without additional cost to the Owner. Physical connection of LonWorks devices shall be via Ethernet IP or FTT-10A.
G. The system shall support Modbus TCP and RTU protocols natively, and not require the use of gateways.
H. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation of Mechanical Equipment Room (MER) valves and dampers and electronic actuation of terminal equipment valves and actuators as specified herein. The BMS is intended to seamlessly connect devices throughout the building regardless of subsystem type, i.e. variable frequency drives, low voltage lighting systems, electrical circuit breakers, power metering and card access should easily coexist on the same network channel.
    1. The supplied system must incorporate the ability to access all data using Java and HTML5 enabled browsers without requiring proprietary operator interface and configuration programs.
    2. Data shall reside on a supplier-installed server for all database access.
    3. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network.
I. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the approved manufacturer's local field office. The approved manufacturer's local field office shall have a minimum of 3 years of installation experience with the manufacturer and shall provide documentation in the bid and submittal package verifying longevity of the installing company's relationship with the manufacturer when requested. Supervision, hardware and software engineering, calibration and checkout of the system shall be by the employees of the approved manufacturer's local field office and shall not be subcontracted. The control contractor shall have an in place support facility within 100 miles of the site with factory certified technicians and engineers, spare parts inventory and all necessary test and diagnostic equipment for the installed system, and the control contractor shall have 24 hours/day, 7 days/week emergency service available.

J. The system shall have the optional capability to provide a web-based APEO (automated predictive energy optimization) system and enable effective participation in local utility Demand Response (DR) programs. The vendor shall provide software and ongoing services that will identify actionable energy saving and peak reduction opportunities to assist the facility in achieving its energy and sustainability objectives, and automatically and continuously operate the systems necessary to achieve the targeted savings and reductions. Pricing is to be a separate line item from the BAS proposal. See specification section 25 13 13 for exact requirements.
K. The system shall have the optional capability to provide a web-enabled PEMS (power and energy management system) monitoring system intended to monitor an entire electrical distribution infrastructure, from incoming utility feeds down to low voltage distribution points. It shall be designed to monitor and manage energy consumption throughout an enterprise, whether within a single facility or across a network of facilities, to improve energy availability and reliability, and to measure and manage energy efficiency. It shall be a standard product offering with no custom programming required. It shall provide a seamless user experience ("Single pane of glass") for managing the mechanical systems (HVAC and lighting) and monitoring the power distribution system (transformers, breakers, relays, switches, capacitors, UPS, invertors, etc.) Pricing is to be a separate line item from the BAS proposal. See specification 26 09 13 for exact requirements.

1.7 Work by Others

A. The BAS Contractor shall cooperate with other contractors performing work on this project necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work.
B. The BAS Contractor shall furnish all control valves, sensor wells, flow meters and other similar equipment for installation by the Mechanical Contractor.
C. The BAS Contractor shall provide field supervision to the designated contractor for the installation of the following:
    1. Automatic control dampers
    2. Blank-off plates for dampers that are smaller than duct size.
    3. Sheet metal baffles plates to eliminate stratification.
    4. The Electrical Contractor shall provide:
        a. All power wiring to motors, heat trace, junction boxes for power to BAS panels.
        b. Furnish smoke detectors and wire to the building fire alarm system. HVAC Contractor to mount devices. BAS Contractor to hardwire to fan shut down.
        c. Auxiliary contact (pulse initiator) on the electric meter for central monitoring of kWh and KW. Electrical Contractor shall provide the pulse rate for remote readout to the BAS. BAS contractor to coordinate this with the electrical contractor.

1.8 Code Compliance

A. Provide BAS components and ancillary equipment, which are UL-916 listed and labeled.
B. All equipment or piping used in conditioned air streams, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable building codes or requirements.
C. All wiring shall conform to the National Electrical Code.

D. All smoke dampers shall be rated in accordance with UL 555S.
E. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.
F. Comply with FCC, Part 68 rules for telephone modems and data sets.

1.9 Submittals

A. All shop drawings shall be prepared in Visio Professional or AutoCAD software. In addition to the drawings, the Contractor shall furnish a CD or Thumb Drive containing the identical information. Drawings shall be B size or larger.
B. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typicals will be allowed where appropriate.
C. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification. Valve, damper and air flow station schedules shall indicate size, configuration, capacity and location of all equipment.
D. Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. Information shall be bound or in a three ring binder with an index and tabs. Diagrams shall be on 11” by 17” foldouts. If color has been used to differentiate information, the printed copies shall be in color.
E. Submit five (5) copies of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor, prior to submitting, shall check all documents for accuracy.
F. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.
G. The following is a list of post construction submittals that shall be updated to reflect any changes during construction and re-submitted as “As-Built”.
    1. System architecture drawing.
    2. Layout drawing for each control panel
    3. Wiring diagram for individual components
    4. System flow diagram for each controlled system
    5. Instrumentation list for each controlled system
    6. Sequence of control
    7. Binding map
    8. Operation and Maintenance Manuals
H. Information common to the entire system shall be provided. This shall include but not be limited to the following.
    1. Product manuals for the key software tasks.
    2. Operating the system.
    3. Administrating the system.
    4. Engineering the operator workstation.
    5. Application programming.
    6. Engineering the network.
    7. Setting up the web server.
    8. Report creation.

9. Graphics creation.
10. All other engineering tasks.
11. System Architecture Diagram.
12. List of recommended maintenance tasks associated with the system servers, operator workstations, data servers, web servers and web clients.
13. Define the task.
14. Recommend a frequency for the task.
15. Reference the product manual that includes instructions on executing the task.
16. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
17. Licenses, guarantees, and warranty documents for equipment and systems.
18. Submit one copy for each building, plus two extra copies.

I. Information common to the systems in a single building shall be provided.
1. System architecture diagram for components within the building annotated with specific location information.
2. As-built drawing for each control panel.
3. As-built wiring design diagram for all components.
4. Installation design details for each I/O device.
5. As-built system flow diagram for each system.
6. Sequence of control for each system.
7. Binding map for the building.
8. Product data sheet for each component.
9. Installation data sheet for each component.
10. Submit two copies for each building and two extra copies.

J. Software shall be provided:
1. Submit a copy of all software installed on the servers and workstations.
2. Submit all licensing information for all software installed on the servers and workstations.
3. Submit a copy of all software used to execute the project even if the software was not installed on the servers and workstations.
4. Submit all licensing information for all of the software used to execute the project.
5. All software revisions shall be as installed at the time of the system acceptance.
6. Firmware Files
7. Submit a copy of all firmware files that were downloaded to or pre-installed on any devices installed as part of this project.
8. This does not apply to firmware that is permanently burned on a chip at the factory and can only be replaced by replacing the chip.
9. Submit a copy of all application files that were created during the execution of the project.
10. Submit a copy of all graphic page files created during the execution of the project.

1.10 Coordination

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
B. Coordinate equipment from other divisions including "Intrusion Detection," "Lighting Controls," "Motor Control Centers," "Panel boards," and "Fire Alarm" to achieve compatibility with equipment that interfaces with those systems.
C. Coordinate supply of conditioned electrical circuits for control units and operator workstation.

D. Coordinate location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete".

1.11 Ownership

A. The Owner shall retain licenses to software for this project.
B. The licensing agreement shall not preclude the use of the software by individuals under contract to the owner for commissioning, servicing or altering the system in the future. Use of the software by individuals under contract to the owner shall be restricted to use on the owner's computers and only for the purpose of commissioning, servicing, or altering the installed system.
C. All project developed software, files and documentation shall become the property of the Owner. These include but are not limited to:
    1. Server and workstation software
    2. Application programming tools
    3. Configuration tools
    4. Network diagnostic tools
    5. Addressing tools
    6. Application files
    7. Configuration files
    8. Graphic files
    9. Report files
    10. Graphic symbol libraries
    11. All documentation

1.12 Quality Assurance - System Startup and Commissioning

A. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.
B. The BAS contractor shall commission and set in operating condition all major equipment and systems, such as the chilled water, hot water and all air handling systems, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Architect's representatives.
C. The BAS Contractor shall provide a technician for ____ days manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract.
D. Startup Testing shall be performed for each task on the startup test checklist, which shall be initialed by the technician and dated upon test was completion along with any recorded data such as voltages, offsets or tuning parameters. Any deviations from the submitted installation plan shall also be recorded.
E. Required elements of the startup testing include:
    1. Measurement of voltage sources, primary and secondary

2. Verification of proper controller power wiring.
3. Verification of component inventory when compared to the submittals.
4. Verification of labeling on components and wiring.
5. Verification of connection integrity and quality (loose strands and tight connections).
6. Verification of bus topology, grounding of shields and installation of termination devices.
7. Verification of point checkout.
8. Each I/O device is landed per the submittals and functions per the sequence of control.
9. Analog sensors are properly scaled and a value is reported
10. Binary sensors have the correct normal position and the state is correctly reported.
11. Analog outputs have the correct normal position and move full stroke when so commanded.
12. Binary outputs have the correct normal state and respond appropriately to energize/de-energize commands.
13. Documentation of analog sensor calibration (measured value, reported value and calculated offset).
14. Documentation of Loop tuning (sample rate, gain and integral time constant).

F. A performance verification test shall also be completed for the operator interaction with the system. Test elements shall be written to require the verification of all operator interaction tasks including, but not limited to the following.
   1. Graphics navigation.
   2. Trend data collection and presentation.
   3. Alarm handling, acknowledgement and routing.
   4. Time schedule editing.
   5. Application parameter adjustment.
   6. Manual control.
   7. Report execution.
   8. Automatic backups.
   9. Web Client access.

G. A Startup Testing Report and a Performance Verification Testing Report shall be provided upon test completion.

1.13 Warranty and Maintenance

A. All components, system software, and parts furnished and installed by the BMS contractor shall be guaranteed against defects in materials and workmanship for 1 year of substantial completion. Labor to repair, reprogram, or replace these components shall be furnished by the BMS contractor at no charge during normal working hours during the warranty period. Materials furnished but not installed by the BMS contractor shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 standard working hours.

1.14 Training

A. The BAS Contractor shall provide both on-site and classroom training to the Owner's representative and maintenance personnel per the following description:
B. On-site training shall consist of a minimum of (40) hours of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include
    1. System Overview
    2. System Software and Operation
    3. System access
    4. Software features overview
    5. Changing setpoints and other attributes
    6. Scheduling
    7. Editing programmed variables
    8. Displaying color graphics
    9. Running reports
    10. Workstation maintenance
    11. Viewing application programming
    12. Operational sequences including start-up, shutdown, adjusting and balancing.
    13. Equipment maintenance.
    14. Factory, classroom training will include a minimum of (2) training reservation for a 3 day course with material covering workstation operation tuition free with travel expense responsibility of the owner. The option for 2-3 weeks of system engineering and controller programming shall be possible if necessary and desired.

PART 2 - Products

2.1 Pre-approved Manufacturers

A. Subject to compliance with requirements, provide products by one of the following pre-qualified manufacturers:
    1. Electric Components
        a. Schneider-Electric Field Devices
    2. Electronic Components
        a. Schneider-Electric Field Devices
    3. Direct Digital Control Systems Devices:
        a. Schneider Electric TAC Xenta LON series, installed by approved manufacturer's local field office.

2.2 System Architecture

A. General
    1. The Building Automation System (BAS) shall consist of Network Server/Controllers (NSCs), a family of Standalone Digital Control Units (SDCUs), Administration and Programming Workstations (APWs), and Web-based Operator Workstations (WOWs). The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, and Wide Area Network (WAN) if applicable.
    2. An Enterprise Level BAS shall consist of an Enterprise Server, which enables multiple NSCs (including all graphics, alarms, schedules, trends, programming,

and configuration) to be accessible from a single Workstation simultaneously for operations and engineering tasks.

3. The Enterprise Level BAS shall be able to host up to 250 servers, or NSCs, beneath it.
4. For Enterprise reporting capability and robust reporting capability outside of the trend chart and listing ability of the Workstation, a Reports Server shall be installed on a Microsoft Windows Server based computer. The Reports Server can be installed on the same computer as the Enterprise Server.
5. The system shall be designed with a top-level 10/100bT Ethernet network, using the LonWorks IP, and Modbus TCP protocol.
6. Modbus RTU/ASCII (and J-bus), Modbus TCP, LonTalk FTT-10A, and WebServices shall be native to the NSCs. There shall not be a need to provide multiple NSCs to support all the network protocols, nor should there be a need to supply additional software to allow all three protocols to be natively supported. A sub-network of SDCUs using the LonTalk FTT-10A, and/or Modbus RTU protocol shall connect the local, stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers.

B. TCP/IP Level

1. The TCP/IP layer connects all of the buildings on a single Wide Area Network (WAN) isolated behind the campus firewall. Fixed IP addresses for connections to the campus WAN shall be used for each device that connects to the WAN.

C. Fieldbus Level with Standalone Digital Control Units (SDCUs)

1. The fieldbus layer shall support all of the following types of SDCUs:
   a. LonWorks SDCU requirements: The system shall consist of one or more LonWorks FTT-10A field buses managed by the Network Server Controller. Minimum speed shall be 76.8kbps. The field bus layer shall consist of up to 64 Lonworks SDCUs using peer-to-peer, event-driven communication for operation of HVAC and lighting equipment. Using TAC Xenta controllers, a total combination of Xenta and LonWorks SDCUs should consist of up to 64 in total, with a maximum of 30 for the Xenta line.
   b. Modbus SDCU requirements: The system shall consist of one or more Modbus RTU (RS-485 or RS-232) field buses managed by the Network Server Controller. The field bus layer shall consist of up to 31 SDCUs for operation of HVAC, power metering, and lighting equipment. If utilizing Modbus TCP, the field bus layer shall consist of up to 100 SDCUs for operation of HVAC, power metering, and lighting equipment. The NSCs shall be capable of at least two Modbus RTU field buses for a total capability of 62 SDCUs per NSC.

D. BAS LAN Segmentation

1. The BAS shall be capable of being segmented, through software, into multiple local area networks (LANs) distributed over a wide area network (WAN). Workstations can manage a single LAN (or building), and/or the entire system with all portions of that LAN maintaining its own, current database.

E. Standard Network Support

1. All NSCs, Workstation(s) and Servers shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore, the NSC's, Workstation(s), and Server(s) shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also

allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Systems Department as all devices utilize standard TCP/IP components.

F. System Expansion
   1. The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same TCP/IP level and fieldbus level controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.
   2. Web-based operation shall be supported directly by the NSCs and require no additional software.
   3. The system shall be capable of using graphical and/or line application programming language for the Network Server Controllers.

G. Support For Open Systems Protocols
   1. All Network Server Controllers must natively support the BACnet IP, BACnet MS/TP, LonWorks FTT-10, Modbus TCP, Modbus RTU (RS-485 and RS-232), and Modbus ASCII protocols.

2.3 Operator Workstation Requirements

A. General
   1. The operator workstation portion of the BAS shall consist of one or more full-powered configuration and programming workstations, and one or more web-based operator workstations. For this project provide a minimum of 10 concurrent operator users and/or 2 concurrent engineering users within the enterprise server.
   2. The programming and configuration workstation software shall allow any user with adequate permission to create and/or modify any or all parts of the NSC and/or Enterprise Server database.
   3. All configuration workstations shall be personal computers operating under the Microsoft Windows operating system. The application software shall be capable of communication to all Network Server Controllers and shall feature high-resolution color graphics, alarming, trend charting. It shall be user configurable for all data collection and data presentation functions.
   4. A minimum of 1 Workstation shall be allowed on the Ethernet network. In this client/server configuration, any changes or additions made from one workstation will automatically appear on all other workstations since the changes are accomplished to the databases within the NSC. Systems with a central database will not be acceptable.

B. Administration/Programming Workstation & Enterprise Server Requirements
   1. The Enterprise Server shall consist of the following:
      a. Processor
         a) Minimum: 2.0 GHz
         b) Recommended: 2.6 GHz or higher
      b. Memory
         a) Minimum: 4GB
         b) Recommended: 4GB or higher
      c. Operating systems:

a) Microsoft Windows 7 32-bit (Professional, Enterprise, or Ultimate)
b) Microsoft Windows 7 64-bit (Professional, Enterprise, or Ultimate)
c) Microsoft Windows 8.1 32-bit (Pro, Pro N, Enterprise, or Enterprise N)
d) Microsoft Windows 8.1 64-bit (Pro, Pro N, Enterprise, or Enterprise N)
e) Microsoft Windows Server 2008 R2 64-bit (Standard, Enterprise, Datacenter, Web, or Itanium)
f) Microsoft Windows Server 2012 64-bit (Standard, Datacenter, Essentials, or Foundation)
g) Microsoft Windows Server 2012 R2 64-bit (Standard, Datacenter, Essentials, or Foundation)

d. 10/100MBPS Ethernet NIC
e. 250 GB hard disk
f. Required additional software:
a) Microsoft .Net 4.5
g. License agreement for all applicable software

2. The workstation shall consist of the following:
a. Processor
a) Minimum: 1.0 GHz
b) Recommended: 2.0 GHz or higher
b. Memory
a) Minimum: 2GB
b) Recommended: 4GB or higher
c. Operating systems:
a) Microsoft Windows 7 32-bit (Professional, Enterprise, or Ultimate)
b) Microsoft Windows 7 64-bit (Professional, Enterprise, or Ultimate)
c) Microsoft Windows 8.1 32-bit (Pro, Pro N, Enterprise, or Enterprise N)
d) Microsoft Windows 8.1 64-bit (Pro, Pro N, Enterprise, or Enterprise N)
e) Microsoft Windows Server 2008 R2 64-bit (Standard, Enterprise, Datacenter, Web, or Itanium)
f) Microsoft Windows Server 2012 64-bit (Standard, Datacenter, Essentials, or Foundation)
g) Microsoft Windows Server 2012 R2 64-bit (Standard, Datacenter, Essentials, or Foundation)
d. Serial port, parallel port, USB port
e. 10/100MBPS Ethernet NIC
f. 20 GB hard disk
g. DVD drive
h. High resolution (minimum 1280 x 1024), 17” flat panel display
i. Optical mouse and full function keyboard
j. Audio sound card and speakers
k. Required additional software:
a) Microsoft .Net 4.5
l. License agreement for all applicable software.

C. Web-Based Operator PC Requirements
1. Any user on the network can access the system, using the following software:
a. Internet Explorer 11
b. Mozilla Firefox
c. Java Version 7.0 (32-bit)
d. Google Chrome

D. General Administration and Programming Workstation Software
   1. System architecture shall be truly client server in that the Workstation shall operate as the client while the NSCs shall operate as the servers. The client is responsible for the data presentation and validation of inputs while the server is responsible for data gathering and delivery.
   2. The workstation functions shall include monitoring and programming of all DDC controllers. Monitoring consists of alarming, reporting, graphic displays, long term data storage, automatic data collection, and operator-initiated control actions such as schedule and setpoint adjustments.
   3. Programming of SDCUs shall be capable of being done either off-line or on-line from any operator workstation. All information will be available in graphic or text displays stored at the NSC. Graphic displays will feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the DDC system. All operator functions shall be selectable through a mouse.

E. User Interface:
   1. The BAS workstation software shall allow the creation of a custom, browser-style interface linked to the user when logging into any workstation. Additionally, it shall be possible to create customized workspaces that can be assigned to user groups. This interface shall support the creation of “hot-spots” that the user may link to view/edit any object in the system or run any object editor or configuration tool contained in the software. Furthermore, this interface must be able to be configured to become a user’s “PC Desktop” – with all the links that a user needs to run other applications. This, along with the Windows user security capabilities, will enable a system administrator to setup workstation accounts that not only limit the capabilities of the user within the BAS software, but may also limit what a user can do on the PC and/or LAN/WAN. This might be used to ensure, for example, that the user of an alarm monitoring workstation is unable to shutdown the active alarm viewer and/or unable to load software onto the PC.
   2. System shall be able to automatically switch between displayed metric vs. imperial units based on the workstation/webstations localization.
   3. The BMS workstation/webstations shall be capable of multiple language display, including English, Spanish, German, French, Japanese, Italian, Finnish, Portuguese, Swedish, Russian, and traditional and simplified Chinese. The multiple languages shall not require additional add on software from the standard workstation installer and shall be selectable within said workstation.
   4. Webstations shall have the capability to automatically re-direct to an HTTPS connection to ensure more secure communications.
   5. Personalized layouts and panels within workstations shall be extended to webstations to ensure consistent user experiences between the two user interfaces.
   6. Servers and clients shall have the ability to be located in different time zones, which are then synchronized via the NTP server.

F. User Security
   1. The software shall be designed so that each user of the software can have a unique username and password. This username/password combination shall be linked to a set of capabilities within the software, set by and editable only by, a system administrator. The sets of capabilities shall range from View only, Acknowledge alarms, Enable/disable and change values, Program, and

Administer. The system shall allow the above capabilities to be applied independently to each and every class of object in the system. The system must allow a minimum of 256 users to be configured per workstation. Additionally, the software shall enable the ability to add/remove users based upon Microsoft Windows Security Domains that enable the customer IT department to assist in user access.

G. Configuration Interface

1. The workstation software shall use a familiar Windows Explorer®-style interface for an operator or programmer to view and/or edit any object (controller, point, alarm, report, schedule, etc.) in the entire system. In addition, this interface shall present a "network map" of all controllers and their associated points, programs, graphics, alarms, and reports in an easy to understand structure. All object names shall be alphanumeric and use Windows long filename conventions.
2. The configuration interface shall also include support for user defined object types. These object types shall be used as building blocks for the creation of the BAS database. They shall be created form the base object types within the system input, output, string variables, setpoints, etc., alarm algorithms, alarm notification objects, reports, graphics displays, schedules, and programs. Groups of user defined object types shall be able to be set up as a predefined aggregate of subsystems and systems. The configuration interface shall support copying/pasting and exporting/importing portions of the database for additional efficiency. The system shall also maintain a link to all "child" objects created. If a user wishes to make a change to a parent object, the software shall ask the user if he/she wants to update all of the child objects with the change.

H. Color Graphic Displays

1. The system shall allow for the creation of user defined, color graphic displays for the viewing of mechanical and electrical systems, or building schematics. These graphics shall contain point information from the database including any attributes associated with the point (engineering units, etc.). In addition operators shall be able to command equipment or change setpoints from a graphic through the use of the mouse.
2. Requirements of the color graphic subsystem include:
    a. At a minimum, the user shall have the ability to import .gif, .png, .bmp, .jpeg, .tif, and CAD generated picture files as background displays, and layering shall be possible.
    b. The system shall support both Java and HTML5 enabled graphics.
    c. It shall be possible for the user to use JavaScript to customize the behavior of each graphic.
    d. The editor shall use Scalable Vector Graphics (SVG) technology.
    e. The system shall incorporate the use of Standard Graphic Components Library. A built-in library of animated objects such as dampers, fans, pumps, buttons, knobs, gauges, ad graphs which can be "dropped" on a graphic through the use of a software configuration "wizard". These objects shall enable operators to interact with the graphic displays in a manner that mimics their mechanical equivalents found on field installed control panels.
    f. The names and values of items on graphic pages shall be in accordance to the American Naming Standard as defined by the manufacture.
    g. Using the mouse, operators shall be able to adjust setpoints, start or stop equipment, modify PID loop parameters, or change schedules.

h. Status changes or alarm conditions must be able to be highlighted by objects changing screen location, size, color, text, blinking or changing from one display to another.
i. Ability to link graphic displays through user defined objects, alarm testing, or the result of a mathematical expression. Operators must be able to change from one graphic to another by selecting an object with a mouse - no menus will be required.
j. It shall be possible to create and save graphical components and JavaScript code in reusable and transferrable, customized libraries.
k. Graphics should rescale based on whatever monitor or viewing device is being used.
l. Be able to create graphics on varying layers the can be moved and repeated.
m. Be able to create graphics within varying window panes that can be moved and/or re-referenced. For example, creating the graphical menu within a pane and referencing it on every graphics page, therefore not rebuilding thus allowing for a single spot for updates that get pushed to all the pages that reference it.

3. Additionally, the Graphics Editor portion of the Engineering Software shall provide the following capabilities:
   a. Create and save pages.
   b. Group and ungroup symbols.
   c. Modify an existing symbol.
   d. Modify an existing graphic page.
   e. Rotate and mirror a symbol.
   f. Place a symbol on a page.
   g. Place analog dynamic data in decimal format on a page.
   h. Place binary dynamic data using state descriptors on a page.
   i. Create motion through the use of animated .gif files or JavaScript.
   j. Place test mode indication on a page.
   k. Place manual mode indication on a page.
   l. Place links using a fixed symbol or flyover on a page.
   m. Links to other graphics.
   n. Links to web sites.
   o. Links to notes.
   p. Links to time schedules.
   q. Links to any .exe file on the operator work station.
   r. Links to .doc files.
   s. Assign a background color.
   t. Assign a foreground color.
   u. Place alarm indicators on a page.
   v. Change symbol/text/value color as a function of an analog variable.
   w. Change a symbol/text/value color as a function of a binary state.
   x. Change symbol/text/value as a function of a binary state.
   y. All symbols used by Schneider Electric EcoBuilding Business in the creation of graphic pages shall be saved to a library file for use by the owner.

I. Automatic monitoring
   1. The software shall allow for the automatic collection of data and reporting from any controller or NSC. The frequency of data collection shall be user-configurable.

J. Alarm Management

1. The software shall be capable of accepting alarms directly from NSCs or controllers, or generating alarms based on evaluation of data in controllers and comparing to limits or conditional equations configured through the software. Any alarm (regardless of its origination) will be integrated into the overall alarm management system and will appear in all standard alarm reports, be available for operator acknowledgment, and have the option for displaying graphics, or reports.
2. Alarm management features shall include:
    a. A minimum of 1000 alarm notification levels at the NSC, workstation, and webstation levels. At the Enterprise level the minimum number of active and viewable alarms shall be 10,000. Each notification level will establish a unique set of parameters for controlling alarm display, distribution, acknowledgment, keyboard annunciation, and record keeping.
    b. Automatic logging in the database of the alarm message, point name, point value, source device, timestamp of alarm, username and time of acknowledgement, username and time of alarm silence (soft acknowledgement).
    c. Playing an audible sound on alarm initiation or return to normal.
    d. Sending an email page to anyone specifically listed on the initial occurrence of an alarm. The ability to utilize email paging of alarms shall be a standard feature of the software integrated with the operating system's mail application interface (MAPI). No special software interfaces shall be required and no email client software must be running in order for email to be distributed. The email notification shall be able to be sent to an individual user or a user group.
    e. Individual alarms shall be able to be re-routed to a user at user-specified times and dates. For example, a critical high temp alarm can be configured to be routed to a Facilities Dept. workstation during normal working hours (7am-6pm, Mon-Fri) and to a Central Alarming workstation at all other times.
    f. An active alarm viewer shall be included which can be customized for each user or user type to hide or display any alarm attributes.
    g. The active alarm viewer can be configured such that an operator must type in text in an alarm entry and/or pick from a drop-down list of user actions for certain alarms.
    h. The active alarm viewer can be configured such that an operator must type in text in an alarm entry and/or pick from a drop-down list of causes for certain alarms. This ensures accountability (audit trail) for the response to critical alarms.
    i. The active alarm viewer can be configured such that an operator must confirm that all of the steps in a check list have been accomplished prior to acknowledging the alarm.
    j. The active alarm viewer shall, if filtered, show the quantity of visible and total number of alarms that are not equal to 'normal' and the quantity of disabled and hidden alarms.
    k. An operator shall have the capability to assign an alarm to another user of the system.
    l. Time schedules shall be able to be used to set control notifications to users.

K. Report Generation

1. The Reports Server shall be able to process large amounts of data and produce meaningful reports to facilitate analysis and optimization of each installation.

2. Reports shall be possible to generate and view from the operator Workstation, and/or Webstation, and/or directly from a reports-only web interface.
3. A library of predefined automatically generated reports that prompt users for input prior to generation shall be available. The properties and configurations made to these reports shall be possible to save as Dashboard reports, so that the configurations are saved for future used.
4. It shall be possible to create reports standard tools, such as Microsoft Report Builder 2.0 or Visual Studio, shall be used for customized reports.
5. Additional reports or sets of reports shall be downloadable, transferrable, and importable
6. All reports shall be able to be set up to automatically run or be generated on demand.
7. Each report shall be capable of being automatically emailed to a recipient in Microsoft Word, Excel, and/or Adobe .pdf format.
8. Reports can be of any length and contain any point attributes from any controller on the network.
9. Image management functionality shall be possible to enable the system administrators to easily upload new logos or images to the system.
10. It shall be possible to run other executable programs whenever a report is initiated.
11. Report Generator activity can be tied to the alarm management system, so that any of the configured reports can be displayed in response to an alarm condition.
12. Minimum supplied reports shall include:
    a. Activities Per Server Report
    b. Activities Per User Report
    c. Alarm Amount by Category Report
    d. Alarm Amount by Type Report
    e. Alarms Per Sever Report
    f. Current Alarm Report
    g. Most Active Alarm Report
    h. System Errors Per Server Report
    i. Top Activities Report
    j. Top Alarms Report
    k. Top System Errors Report
    l. Trend Log Comparison Report
    m. User Logins Report
    n. Users and Groups Reports
13. Minimum Energy Reports shall include:
    a. Energy Monitoring Calendar Consumption Report: Shall provide an interactive report that shows the energy usage on one or multiple selected days.
    b. Energy Monitoring Consumption Breakdown Report: Shall provide a report on energy consumption broken down using sub-metering.
    c. Energy Monitoring Consumption Report: Shall show the energy consumption against a specified target value.
14. Reports Server Hardware Requirements
    a. Processor
        a) Minimum: 2.0 GHz
        b) Recommended: 2.0 GHz or higher
    b. Memory

a) Minimum: 6 GB
b) Recommended: 8GB or higher

c. Hard Disk: 500 GB

15. Reports Server Software Requirements
    a. Operating System:
        a) Microsoft Windows Server 2008 R2 64-bit (Standard, Enterprise, Datacenter, Web, or Itanium)
        b) Microsoft Windows Server 2012 64-bit (Standard)
        c) Microsoft Windows Server 2012 R2 64-bit (Standard, Datacenter)
    b. SQL Versions:
        a) Microsoft SQL Server 2008 R2 64-bit SP2 (Standard and Express with Advanced Services)
        b) Microsoft SQL Server 2012 64-bit (Standard and Express with Advanced Services)
    c. Additional required software"
        a) Microsoft .Net 4.5

L. Scheduling
1. From the workstation or webstation, it shall be possible to configure and download schedules for any of the controllers on the network.
2. Time of day schedules shall be in a calendar style and viewable in both a graphical and tabular view.
3. Schedules shall be programmable for a minimum of one year in advance.
4. To change the schedule for a particular day, a user shall simply select the day and make the desired modifications.
5. Additionally, from the operator webstations, each schedule will appear on the screen viewable as the entire year, monthly, week and day. A simple mouse click shall allow switching between views. It shall also be possible to scroll from one month to the next and view or alter any of the schedule times.
6. Schedules will be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation will be automatically updated to the corresponding schedule in the controller.
7. It shall be possible to assign a lead schedule such that shadow/local schedules are updated based upon changes in the Lead.
8. It shall be possible to assign a list(s) of exception event days, dates, date ranges to a schedule.
9. It shall be possible to view combined views showing the calendar and all prioritized exemptions on one screen.
10. It should accommodate a minimum of 16 priority levels.
11. Values should be able to be controlled directly from a schedule, without the need for special program logic.

M. Programmer's Environment
1. Programming in the NSC shall be either in graphical block format or line-programming format or both.
2. Programming of the NSC shall be available offline from system prior to deployment into the field. All engineering tasks shall be possible, except, of course, the viewing of live tasks or values.
3. The programmer's environment will include access to a superset of the same programming language supported in the SDCUs.

4. NSC devices will support both script programming language as well as the graphical function block programming language. For both languages, the programmer will be able to configure application software for custom program development, and write global control programs. Both languages will have debugging capabilities in their editors.
5. It shall be possible to save custom programs as libraries for reuse throughout the system. A wizard tool shall be available for loading programs from a library file in the program editor.
6. It shall be possible to view graphical programming live and real-time from the Workstation.
7. The system shall be capable of creating 'binding templates' allowing the user to bind multiple points to multiple objects all at once.
8. Key terms should appear when typing (IntelliType).
9. Applications should be able to be assigned different priorities and cycle times for a prioritized execution of different function.
10. The system shall be able to create objects that allow common objects such as power meters, VFD drives, etc. to be integrated into the system with simple import actions without the need of complicated programming or configuration setups.

N. Saving/Reloading
1. The workstation software shall have an application to save and restore NSC and field controller memory files.
2. For the NSC, this application shall not be limited to saving and reloading an entire controller – it must also be able to save/reload individual objects in the controller. This allows off-line debugging of control programs, for example, and then reloading of just the modified information.

O. Audit Trail
1. The workstation software shall automatically log and timestamp every operation that a user performs at a workstation, from logging on and off a workstation to changing a point value, modifying a program, enabling/disabling an object, viewing a graphic display, running a report, modifying a schedule, etc.
2. It shall be possible to view a history of alarms, user actions, and commands for any system object individually or at least the last 5000 records of all events for the entire system from Workstation.
3. It shall be possible to save custom filtered views of event information that are viewable and configurable in Workstation.
4. It shall be capable to search and view all forced values within the system.

P. Fault Tolerant Enterprise Server Operation (Top level NSC)
1. A single component failure in the system shall not cause the entire system to fail. All system users shall be informed of any detectable component failure via an alarm event. System users shall not be logged off as a result of a system failure or switchover.

Q. Web-based Operator Software
1. General:
   a. Day-to-day operation of the system shall be accessible through a standard web browser interface, allowing technicians and operators to view any part of the system from anywhere on the network.
   b. The system shall be able to be accessed on site via a mobile device environment with, at a minimum, access to overwrite and view system values.
2. Graphic Displays

a. The browser-based interface must share the same graphical displays as the Administration and Programming Workstations, presenting dynamic data on site layouts, floor plans, and equipment graphics. The browser's graphics shall support commands to change setpoints, enable/disable equipment and start/stop equipment.
b. Through the browser interface, operators must be able to navigate through the entire system, and change the value or status of any point in any controller. Changes are effective immediately to the controller, with a record of the change stored in the system database.

3. Alarm Management
   a. Systems requiring additional client software to be installed on a PC for viewing the webstation from that PC will not be considered.
   b. Through the browser interface, a live alarm viewer identical to the alarm viewer on the Administration and Programming workstation shall be presented, if the user's password allows it. Users must be able to receive alarms, silence alarms, and acknowledge alarms through a browser. If desired, specific operator text must be able to be added to the alarm record before acknowledgement, attachments shall be viewable, and alarm checklists shall be available.

R. Groups and Schedules
   1. Through the browser interface, operators must be able to view pre-defined groups of points, with their values updated automatically.
   2. Through the browser interface, operators must be able to change schedules – change start and stop times, add new times to a schedule, and modify calendars.

S. User Accounts and Audit Trail
   1. The same user accounts shall be used for the browser interface and for the operator workstations. Operators must not be forced to memorize multiple passwords.
   2. All commands and user activity through the browser interface shall be recorded in the system's activity log, which can be later searched and retrieved by user, date, or both.

T. Web Services
   1. The installed system shall be able to use web services to "consume" information within the Network Server/Controllers (NSCs) with other products and systems. Inability to perform web services within the NSCs will be unacceptable.
      a. Shall be able to "consume" data into the system via SOAP and REST web services.
      b. Shall be able to "serve" and "consume" data from other Schneider Electric systems such as: StruxureWare Data Center Expert

2.4 Network Server Controllers (NSCs)

A. Network Router Controllers shall combine both network routing functions, control functions, and server functions into a single unit.

B. The Network Server Controller shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NRS.

C. The NSCs shall be capable of whitelisting IPs to restrict access to a pre-defined list of hosts or devices.
D. They shall also be responsible for monitoring and controlling their own HVAC equipment such as an AHU or boiler.
E. They shall also contain graphics, trends, trend charts, alarm views, and other similar presentation objects that can be served to workstations or web-based interfaces. A sufficient number of NSCs shall be supplied to fully meet the requirements of this specification and the attached point list.
F. It shall be capable of executing application control programs to provide:
    1. Calendar functions
    2. Scheduling
    3. Trending
    4. Alarm monitoring and routing
    5. Time synchronization by means of an Internet site including automatic synchronization
    6. Native integration of LonWorks controller data and Modbus controller data or BACnet controller data and Modbus controller data
    7. Network Management functions for all LonWorks based devices
G. Hardware Specifications
    1. Memory:
        a. The operating system of the controller, application programs, and all other portions of the configuration database, shall be stored in non-volatile, FLASH memory. Servers/Controllers shall contain enough memory for the current application, plus required history logging, plus a minimum of 20% additional free memory.
    2. Each NRC shall provide the following on-board hardware for communication:
        a. One 10/100bT Ethernet for communication to Workstations, other NRCs and onto the Internet
        b. Two RS-485 ports for communication to BACnet MSTP bus or serial Modbus (software configurable)
        c. One TP/FT port for communication to LonWorks devices.
        d. One Device USB port
        e. Two host USB Ports
    3. The NSC shall conform to a small footprint no larger than 100W x 125H x 75D mm (3.94W x 4.92H x 2.95D in).
H. Modular Expandability:
    1. The system shall employ a modular I/O design to allow expansion. Input and output capacity is to be provided through plug-in modules of various types. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.
    2. One shall be able to “hot-change” (hot-swap) the I/O modules preserving the system on-line without any intervention on the software; addressing and configuration shall be automatic.
    3. If for any reason the backplane of the modular I/O system were to fail, I/O module addresses will be protected.
I. Hardware Override Switches:
    1. All digital outputs shall, optionally, include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of

the override switch can be obtained through software. In addition each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.

J. Universal Input Temperatures
   1. All universal inputs directly connected to the NSC via modular expansion shall be capable of using the following thermistors for use in the system without any external converters needed.
      1) 10 kohm Type I (Continuum)
      2) 10 kohm Type II (I/NET)
      3) 10 kohm Type III (Satchwell)
      4) 10 kohm Type IV (FD)
      5) Linearized 10 kohm Type V (FD w/11k shunt)
      6) Linearized 10 kohm (Satchwell)
      7) 1.8 kohm (Xenta)
      8) 1 kohm (Balco)
      9) 20 kohm (Honeywell)
      10) 2.2 kohm (Johnson)

K. Local Status Indicator Lamps:
   1. The NSC shall provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each input or output, provide LED indication of the value of the point (On/Off). The LED indication shall support software configuration to set whether the illumination of the LED corresponds to On or Off or whether the color when illuminated is Red or Green.

L. Real Time Clock (RTC):
   1. Each NSC shall include a battery-backed, real time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. Each NSC will allow for its own UTC offset, depending upon the time zone. When the time zone is set, the NSC will also store the appropriate times for daylight savings time.

M. Power Supply:
   1. The 24 VDC power supply for the NSCs shall provide 30 watts of available power for the NSC and associated IO modules. The system shall support the use of more than one power supply if heavily power consuming modules are required.
   2. The power supply, NSC, and I/O modules shall connect power wise and communication wise via the separate terminal base allowing for ease of replacement and no separate or loose wiring.

N. Automatic Restart After Power Failure:
   1. Upon restoration of power after an outage, the NSC shall automatically and without human intervention update all monitored functions, resume operation based on current, synchronize time and status, and implement special start-up strategies as required.

O. Battery backup:
   1. The NSC shall include an on-board battery to back up the controller's RAM memory. The battery shall provide accumulated backup of all RAM and clock functions for at least 30 days. In the case of a power failure, the NSC shall first try to restart from the RAM memory. If that memory is corrupted or unusable, then the NSC shall restart itself from its application program stored in its FLASH memory.

P. Software Specifications

1. The operating system of the controller, application programs, and all other portions of the configuration database such as graphics, trends, alarms, views, etc., shall be stored in non-volatile, FLASH memory. There will be no restrictions placed on the type of application programs in the system. Each NSC shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.
2. Each NSC shall have an available capacity of 4 GB of memory. This shall represent 2 GB for application and historical data and 2 GB dedicated for backup storage.

Q. User Programming Language:

1. The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be either a script-based structured text or graphical function block based and fully programmable by the user. The language shall be structured to allow for the configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, and histories. Users shall be able to place comments anywhere in the body of either script or function block programs.
2. Network Server Controllers that use a “canned” program method will not be accepted.

R. Control Software:

1. The NSC shall have the ability to perform the following pre-tested control algorithms:
   a. Proportional, Integral plus Derivative Control (PID)
   b. Two Position Control
   c. Digital Filter
   d. Ratio Calculator
   e. Equipment Cycling Protection

S. Mathematical Functions:

1. Each controller shall be capable of performing basic mathematical functions (+, -, *, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.

T. NSCs shall have the ability to perform any or all of the following energy management routines:

1. Time of Day Scheduling
2. Calendar Based Scheduling
3. Holiday Scheduling
4. Temporary Schedule Overrides
5. Optimal Start
6. Optimal Stop
7. Night Setback Control
8. Enthalpy Switchover (Economizer)
9. Peak Demand Limiting
10. Temperature Compensated Duty Cycling

11. CFM Tracking
12. Heating/Cooling Interlock
13. Hot/Cold Deck Reset
14. Hot Water Reset
15. Chilled Water Reset
16. Condenser Water Reset
17. Chiller Sequencing

U. History Logging:

1. Each NSC controller shall be capable of LOCALLY logging any input, output, calculated value or other system variable either over user defined time intervals ranging from 1 second to 1440 minutes or based upon a user configurable change of value. A minimum of 1000 logs, with a minimum of 100,000 records, shall be stored. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logged data shall be downloadable to a higher level NSC long term archiving based upon user-defined time intervals, or manual command.
2. For extended trend logging a minimum of 1500 trends shall be capable, with a minimum number of 600,000 records within.
3. Management of a power meter replacement to ensure meter log data is accurate shall be possible in the NSC.
4. Every hardware input and output point, hosted within the NSC and attached I/O modules, shall be trended automatically without the requirement for manual creation, and each of these logs shall log values based upon a change of value and store at least 500 trend samples before replacing the oldest sample with new data.
5. The presentation of logged data shall be built into the server capabilities of the NSC Presentation can be in time stamped list formats or in a chart format with fully configurable pen colors, weights, scales and time spans.

V. Alarm Management:

1. For each system point, alarms can be created based on high/low limits or in comparison to other point values. All alarms will be tested each scan of the NSC and can result in the display of one or more alarm messages or reports.
2. There is no limit to the number of alarms that can be created for any point
3. Alarms can be configured to be generated based upon a single system condition or multiple system conditions.
4. Alarms will be generated based on an evaluation of the alarm conditions and can be presented to the user in a fully configurable order, by priority, by time, by category, etc. These configurable alarm views will be presented to a user upon logging into the system regardless of whether the log in takes place at a WorkStation or a Webstation.
5. The alarm management system shall support the ability to create and select cause and action notes to be selected and associated with an alarm event. Checklists shall also be possible in order to present to an operator a suggested mode of troubleshooting. When acknowledging an alarm, it shall be possible to assign it to a user of the system such that the user is notified of the assignment and is made responsible for the alarm resolution.

W. Embedded Web Server

1. Each NSC must have the ability to serve out web pages containing the same information that is available from the WorkStation. The development of the

screens to accomplish shall not require any additional engineering labor over that required to show them at the WorkStation itself.

2.5 LON Fieldbus and LON SDCUs

A. IP Network
   1. All devices that connect to the WAN shall be capable of operating at 10 megabits per second and 100 megabits per second

B. Field Bus
   1. The field busses shall be FTT-10A operating at 78 kilobits per second.
   2. The wiring of components shall use a bus or daisy chain concept with no tees, stubs or free topology.
   3. The wiring type and length limitations shall conform to Echelon's Junction Box and Wiring Guideline for Twisted Pair LonWorks Networks.
   4. Each field bus shall have a termination device at both ends of each segment.

C. IP to Field Bus Router
   1. These devices shall perform layer 3 routing of ANSI/EIA 709.1B packets onto the IP network.
   2. These devices shall be configurable locally without the use of the IP network (local cross over cable connection is acceptable) and configurable via the IP network.
   3. These devices shall be configurable as routers such that only data packets from the field bus devices that need to travel over the IP level of the architecture are forwarded.

D. Network Server Controller
   1. These devices shall perform layer 3 routing of ANSI/EIA 709.1B packets onto the IP network.
   2. These devices shall be configurable locally without the use of the IP network (local cross over cable connection is acceptable) and configurable via the IP network.
   3. These devices shall be configurable as routers such that only data packets from the field bus devices that need to travel over the IP level of the architecture are forwarded.
   4. These devices shall provide the following support for the field bus devices that are connected below the Network Server Controller.
      a. Time schedules
      b. Trend logging
      c. Alarm message generation and handling
   5. These devices may provide supervisory logic support for the field bus devices that are connected below the Network Server Controller.
   6. These devices may have physical inputs and outputs and provide process control for systems using these inputs and outputs.
   7. If a Network Server Controller has physical inputs and outputs, it shall also comply with all of the requirements for programmable process controllers.

E. Physical Layer Repeaters (PLR)
   1. PLRs are required to connect two segments to create a channel.
   2. The design of the PLRs shall conform to LonMark standards.

3. LON to LON routers configured as repeaters may be used as a PLR.
4. Physical layer repeaters shall be installed in an enclosure. The enclosure may be in an interstitial space.

F. Standalone Digital Control Units (SDCUs)

1. General Requirements
   a. Devices shall incorporate a service pin which, when pressed, will cause the device to broadcast its 48 bit node ID and its program ID over the network. The service pin shall be distinguishable and accessible.
   b. Devices shall have a light indicating that they are powered.
   c. Devices shall incorporate a TP/FT-10A transceiver in accordance with ANSI/EIA 709.3 and connections for TP/FT control network wiring.
   d. Devices shall be locally powered. Link powered devices are not acceptable.
   e. Application programs shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration parameter settings.

2. Programmable Process Controllers (PPC)
   a. The key characteristics of a PPC are:
      1) They have physical input and output circuits for the connection of analog input devices, binary input devices, pulse input devices, analog output devices and binary output devices. The number and type of input and output devices supported will vary by model.
      2) They may or may not provide support for additional input and output devices beyond the number of circuits that are provided on the basic circuit board. Support for additional I/O may be by additional circuit boards that physically connect to the basic controller or by a standalone device that communicates with the basic controller via the FTT-10A field bus.
      3) The application to be executed by a PPC is created by an application engineer using the vendor's application programming tool.
      4) PPCs shall, may support embedded time schedules. When time schedules are not embedded in a PPC, an occupancy command shall be an input network variable when time based control is required by the sequence of control. Systems that use a Network Server Controller shall provide time schedule support in the Network Server Controller and the PPCs are not required to support for time schedules. Systems that use LON to IP routers require that PPCs support embedded time schedules.
      5) PPCs shall support trend data storage with periodic upload to the data server. When trend data storage is not supported, the variables to be trended shall be broadcast over the field bus to another device that does support embedded trend data storage. Systems that use a Network Server Controller shall provide trend logging support in the Network Server Controller and the PPCs are not required to support trend logging. Systems that use LON to IP routers require that PPCs support embedded trend logging.
      6) PPCs shall support the initiation of an alarm message to the system server. When alarm message initiation is not supported, binary alarm indication variables shall be broadcast over the field bus to another

device that does support the initiation of alarm messages to the system server. Systems that use a Network Server Controller shall provide alarm message initiation support in the Network Server Controller and the PPCs are not required to support alarm message initiation. Systems that use LON to IP routers require that PPCs support alarm messaging initiation.

b. Analog Input Circuits
   1) The electrical signals from analog sensors shall be processed by an analog to digital (A/D) converter chip. The output of the A/D chip shall then be processed mathematically to produce data within the controller that has the required engineering units.
   2) The resolution of the A/D chip shall not be greater than 0.01 Volts per increment. For an A/D converter that has a measurement range of 0 to 10 VDC and is 10 bit, the resolution is 10/1024 or 0.00976 Volts per increment.
   3) For non-flow sensors, the control logic shall provide support for the use of a calibration offset such that the raw measured value is added to the (+/-) offset to create a calibration value to be used by the control logic and reported to the Operator Workstation (OWS).
   4) For flow sensors, the control logic shall provide support for the use of an adjustable gain and an adjustable offset such that a two point calibration concept can be executed (both a low range value and a high range value are adjusted to match values determined by a calibration instrument).
   5) For non-linear sensors such as thermistors and flow sensors the PPC shall provide software support for the linearization of the input signal.

c. Binary Input Circuits
   1) Dry contact sensors shall wire to the controller with two wires.
   2) An external power supply in the sensor circuit shall not be required.

d. Pulse Input Circuits
   1) Pulse input sensors shall wire to the controller with two wires.
   2) An external power supply in the sensor circuit shall not be required.
   3) The pulse input circuit shall be able to process up to 50 pulses per second.

e. True Analog Output Circuits
   1) The logical commands shall be processed by a digital to analog (D/A) converter chip. The 0% to 100% control signal shall be scalable to the full output range which shall be either 0 to 10 VDC, 4 to 20 milliamps or 0 to 20 milliamps or to ranges within the full output range (Example: 0 to 100% creates 3 to 6 VDC where the full output range is 0 to 10 VDC).
   2) The resolution of the D/A chip shall not be greater than 0.04 Volts per increment or 0.08 milliamps per increment.

f. Pulse Width Modulation Outputs with PWM transducers
   1) The controller shall be able to generate incremental pulses as small as 0.1 seconds.

g. Binary Output Circuits
   1) Single pole single throw or single pole double throw relays with support for up to 230 VAC and a maximum current of 2 amps.
   2) Voltage sourcing or externally powered triacs with support for up to 30 VAC and 0.8 amps.

h. Program Execution
   1) Process control loops shall operate in parallel and not in sequence unless specifically required to operate in sequence by the sequence of control.
   2) The sample rate for a process control loop shall be adjustable and shall support a minimum sample rate of 1 second.
   3) The sample rate for process variables shall be adjustable and shall support a minimum sample rate of 1 second.
   4) The sample rate for algorithm updates shall be adjustable and shall support a minimum sample rate of 1 second.
   5) The application shall have the ability to determine if a power cycle to the controller has occurred, and the application programmer shall be able to use the indication of a power cycle to modify the sequence of control immediately following a power cycle.

i. Local Interface: The controller shall support the connection of a portable interface device such as a laptop computer or vendor unique hand-held device. The ability to execute any tasks other than viewing data shall be password protected. Via this local interface, an operator shall be able to:
   1) Adjust application parameters.
   2) Edit time schedule parameters if time schedules are embedded in the controller.
   3) Execute manual control of input and output points.
   4) View dynamic data.
   5) View alarm messages if alarm messaging is embedded in the controller.

j. Each PPC shall have a network interface port that allows for an external device to connect to the FTT-10A network by plugging into the port. This port shall be built into the controller.

3. Supervisory Logic Controller (SLC)
   a. The key characteristics of an SLC are:
      1) The application to be executed by as SLC is created by an application engineer using the vendor's application programming tool.
      2) SLCs shall support embedded time schedules. When time schedules are not embedded in a SLC, an occupancy command shall be an input network variable when time based control is required by the sequence of control. Systems that use a Network Server Controller shall provide time schedule support in the Network Server Controller and the SLCs do not have to support for time schedules. Systems that use a LON to IP router will provide time schedule support in the SLCs.
      3) SLCs shall support trend data storage with periodic upload to the data server. When trend data storage is not supported, the variables to be trended shall be broadcast over the field bus to another device that does support embedded trend data storage. Systems that use a Network Server Controller shall provide trend logging support in the Network Server Controller and the SLCs are not required to support trend logging. Systems that use LON to IP routers require that SLCs support embedded trend logging.
      4) SLCs shall support the initiation of an alarm message to the system server. When alarm message initiation is not supported, binary alarm

indication variables shall be broadcast over the field bus to another device that does support the initiation of alarm messages to the system server. Systems that use a Network Server Controller shall provide alarm message initiation support in the Network Server Controller and the SLCs are not required to support alarm message initiation. Systems that use LON to IP routers require that SLCs support alarm messaging initiation.

b. Program Execution
   1) Control algorithms shall operate in parallel and not in sequence unless specifically required to operate in sequence by the sequence of control.
   2) The sample rate for algorithm updates shall be adjustable and shall support a minimum sample rate of 1 second.
   3) The application shall have the ability to determine if a power cycle to the controller has occurred and the application programmer shall be able to use the indication of a power cycle to modify the sequence of control immediately following a power cycle.

c. Local Interface
   1) The controller shall support the connection of a portable interface device such as a laptop computer or vendor unique hand-held device. The ability to execute any tasks other than viewing data shall be password protected. Via this local interface, an operator shall be able to:
      a) Adjust application parameters.
      b) Edit time schedule parameters if time schedules are embedded in the controller.
      c) Execute manual control of input and output network variables.
      d) View dynamic data.
      e) View alarm messages if alarm messaging is embedded in the controller.

d. Each SLC shall have a network interface port that allows for an external device to connect to the FTT-10A network by plugging into the port. This port shall be built into the controller.

e. Programmable Process Controllers (PPCs) with un-used I/O may be used as Supervisory Logic Controllers provided they meet all other requirements.

f. Supervisory logic controllers shall have support a minimum of 200 input network variables and 70 output network variables.
   1) The SNVT for each of the 200 input network variables shall be selectable.
   2) The SNVT for each of the 70 output network variables shall be selectable.

g. For the input and output network variables there shall not be any limitations as to the SNVT selected. (Example: SNVT_temp_p can only be used on 10 input network variables.)

4. Application Specific Devices (ASD)
   a. ASD shall have fixed function configurable applications.

b. If the application can be altered by the vendor's application programming tool, the device is a programmable controller and not an application specific device.
c. All input and output network variables shall be formatted with SNVTs.
d. All input configuration parameters shall be formatted with SNVTs or SCPTs. If UNVTs or UCPTs are used, the device resource files that allow these custom parameters to be read shall be provided to the owner.
e. The network interface shall conform to the LonMark profile for the application provided by the ASD.
f. Each ASD shall have a network interface port that allows for an external device to connect to the FTT-10A network by plugging into the port. This port shall be built into the controller.

5. Portable Operating Terminals (POT)
   a. Laptop Computer
   b. Software Requirements: The software requirements for a POT are identical to those for an operator workstation.
   c. Hardware Requirements: The hardware requirements for a POT are identical to those for an operator workstation.

2.6 DDC Sensors and Point Hardware

A. Temperature Sensors
1. Acceptable Manufacturers: Veris Industries or Equal
2. All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of –30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.
3. Room Sensor: Standard space sensors shall be available in an off white enclosure made of high impact ABS plastic for mounting on a standard electrical box. Basis of Design: Veris TW Series

   1) Where manual overrides are required, the sensor housing shall feature both an optional sliding mechanism for adjusting the space temperature setpoint, as well as a push button for selecting after hours operation.
   2) Where a local display is specified, the sensor shall incorporate an LCD display for viewing the space temperature, setpoint and other operator selectable parameters. Using built in buttons, operators shall be able to adjust setpoints directly from the sensor.
4. Duct Probe Sensor: Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Useable in air handling applications where the coil or duct area is less than 14 square feet. Basis of Design: Veris TD Series
5. Duct Averaging Sensor: Averaging sensors shall be employed in ducts which are larger than 14 square feet. The averaging sensor tube shall contain at least one thermistor for every 3 feet, with a minimum tube length of 6 feet. The averaging sensor shall be constructed of rigid or flexible copper tubing. Basis of Design: Veris TA Series
6. Pipe Immersion Sensor: Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Provide sensor probe length suitable for application. Provide each

sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel for non-corrosive fluids below 250 degrees F and 300 series stainless steel for all other applications. Basis of Design: Veris TI Series

7. Outside Air Sensor: Provide the sensing element on the building's north side. Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure. Operating range -40 to 122 F, Basis of Design: Veris TO Series
8. A pneumatic signal shall not be allowed for sensing temperature.

B. Humidity Wall Transmitter
   1. Acceptable Manufacturer: Veris Industries or Equal
   2. Transmitters shall be accurate to +/- 2 % at full scale.
   3. Transmitter shall have replaceable sensing element.
   4. Sensor type shall be thin-film capacitive.
   5. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
   6. Operating range shall be 0 - 100% RH noncondensing, 50 to 95 F
   7. Output shall be field selectable 4-20 mA or 0-5/0-10 VDC.
   8. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
   9. Transmitter shall be available in an **[**off white**] [**black**]** enclosure made of high impact ABS plastic for mounting on a standard electrical box.
   10. Transmitter shall have LCD display
   11. Transmitter shall be available with a certification of NIST calibration
   12. Basis of Design: Veris HWL Series

C. Humidity Duct Transmitter
   1. Acceptable Manufacturer: Veris Industries
   2. Transmitters shall be accurate to +/- 2 % at full scale.
   3. Transmitter shall be fully encapsulated in potting material within a stainless steel probe.
   4. Transmitter shall have replaceable sensing element.
   5. Sensor type shall be thin-film capacitive.
   6. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
   7. Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F
   8. Output shall be 4-20 mA or 0-5/0-10 VDC.
   9. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
   10. Transmitter shall be available with a certification of NIST calibration
   11. Basis of Design: Veris HD Series

D. Humidity Outdoor Transmitter
   1. Acceptable Manufacturer: Veris Industries or Equal
   2. Transmitters shall be accurate to +/- 2% at full scale.
   3. Transmitter shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure.
   4. Transmitter shall have replaceable sensing element.
   5. Sensor type shall be thin-film capacitive.
   6. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
   7. Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F
   8. Output shall be 4-20 mA or 0-5/0-10 VDC.
   9. Transmitter shall accept 12-30 VDC or 24 VAC supply power.

10. Transmitter shall be available with a certification of NIST calibration
11. Basis of Design: Veris HO Series

E. Carbon Dioxide Wall Transmitter:

1. Acceptable Manufacturer: Veris Industries or Equal
2. Sensor type shall be Non-dispersive infrared (NDIR).
3. Accuracy shall be ±30 ppm ±2% of measured value with annual drift of ±10 ppm. Minimum five year recommended calibration interval.
4. Repeatability shall be ±20 ppm ±1% of measured value
5. Response Time shall be <60 seconds for 90% step change
6. Outputs shall be field selectable **[**Analog: 4-20mA or 0-5/0-10VDC**]** Modbus with **[**SPDT Relay 1A@30VDC**] [**temperature setpoint slider**]**
7. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
8. Temperature Range: **[**32° to 122°F (CO2 only)**] [**50° to 95°F (with humidity option)**]**
9. Output range shall be programmable 0-2000 or 0-5000 ppm
10. Transmitter shall be available in an **[**off white**] [**black**]** enclosure for mounting on a standard electrical box.
11. Transmitter shall have LCD display for commissioning and provide additional faceplate to conceal LCD display where occupants may misinterpret CO2 readings.
12. **[**Transmitter shall have integrated **[**humidity sensor**] [**temperature sensor**]]**
13. Basis of Design: Veris CWL

F. Carbon Dioxide Duct Transmitter:

1. Acceptable Manufacturer: Veris Industries or Equal
2. Sensor type shall be Non-dispersive infrared (NDIR).
3. Accuracy shall be ±30 ppm ±2% of measured value with annual drift of ±10 ppm. Minimum five year recommended calibration interval.
4. Repeatability shall be ±20 ppm ±1% of measured value
5. Response Time shall be <60 seconds for 90% step change
6. Outputs shall be field selectable Analog: 4-20mA or 0-5/0-10VDC with SPDT Relay 1A@30VDC
7. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
8. Temperature Range: 32° to 122°F
9. Output range shall be programmable 0-2000 or 0-5000 ppm
10. Enclosure shall not require remote pickup tubes and make use of integrated H-beam probe to channel air flow to sensor.
11. Enclosure lid shall require no screws and make use of snap on features for attachment
12. Enclosure shall be made of high impact ABS plastic
13. Transmitter shall have LCD display
14. **[**Transmitter shall have integrated **[**humidity sensor**] [**temperature sensor**]]**
15. Basis of Design: Veris CDL

G. Air Pressure Transmitters.

1. Acceptable Manufacturers: Veris Industries or Equal
2. Sensor shall be microprocessor profiled ceramic capacitive sensing element
3. Transmitter shall have 14 selectable ranges from 0.1 – 10” WC
4. Transmitter shall be +/- 1% accurate in each selected range including linearity, repeatability, hysteresis, stability, and temperature compensation.
5. Transmitter shall be field configurable to mount on wall or duct with static probe

6. Transmitter shall be field selectable for Unidirectional or Bidirectional
7. Maximum operating pressure shall be 200% of design pressure.
8. Output shall be field selectable 4-20 mA or 0-5/0-10 VDC linear.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power
10. Response time shall be field selectable T95 in 20 sec or T95 in 2 sec
11. Transmitter shall have an LCD display
12. Units shall be field selectable for WC or PA
13. Transmitter shall have provision for zeroing by pushbutton or digital input.
14. Transmitter shall be available with a certification of NIST calibration
15. Basis of Design: Veris model PXU.

H. Liquid Differential Pressure Transmitters:

1. Acceptable Manufacturer: Veris Industries or Equal
2. Transmitter shall be microprocessor based
3. Transmitter shall use two independent gauge pressure sensors to measure and calculate differential pressure
4. Transmitter shall have 4 switch selectable ranges
5. Transmitter shall have test mode to produce full-scale output automatically.
6. Transmitter shall have provision for zeroing by pushbutton or digital input.
7. Transmitter shall have field selectable outputs of 0-5V, 0-10V, and 4-20mA.
8. Transmitter shall have field selectable electronic surge damping
9. Transmitter shall have an electronic port swap feature
10. Transmitter shall accept 12-30 VDC or 24 VAC supply power
11. Sensor shall be 17-4 PH stainless steel where it contacts the working fluid.
12. Performance:

a. Accuracy shall be ±1% F.S. and ±2% F.S. for lowest selectable range
b. Long term stability shall be ±0.25%
c. Sensor temperature operating range shall be -4° to 185°F
d. Operating environment shall be 14° to 131°F; 10-90% RH noncondensing
e. Proof pressure shall be 2x max. F.S. range
f. Burst pressure shall be 5x max. F.S. range

13. Transmitter shall be encased in a NEMA 4 enclosure
14. Enclosure shall be white powder-coated aluminum
15. Transmitter shall be available with a certification of NIST calibration
16. **[**Transmitter shall be preinstalled on a bypass valve manifold**]**
17. Basis of Design: Veris PW

I. Current Sensors

1. Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in split core models, and offer either a digital or an analog signal to the automation system. Acceptable manufacturer is Veris Industries or Equal

J. Current Status Switches for Constant Load Devices

1. Acceptable Manufacturer: Veris Industries or Equal
2. General: Factory programmed current sensor to detect motor undercurrent situations such as belt or coupling loss on constant loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory.
3. Visual LED indicator for status.
4. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 0.5 A to 175 A.

5. Normally open current sensor output. 0.1A at 30 VAC/DC.
6. Basis of Design: Veris Model H608.

K. Current Status Switches for Constant Load Devices (Auto Calibration)
1. Acceptable Manufacturer: Veris Industries or Equal
2. General: Microprocessor based, self-learning, self-calibrating current switch. Calibration-free status for both under and overcurrent, LCD display, and slide-switch selectable trip point limits. At initial power-up automatically learns average current on the line with no action required by the installer
3. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 2.5 A to 200 A.
4. Display: Backlit LCD; illuminates when monitored current exceeds 4.5A
5. Nominal Trip Point: ±40%, ±60%, or on/off (user selectable)
6. Normally open current sensor output. 0.1A at 30 VAC/DC.
7. Basis of Design: Veris Model H11D.

L. Current Status Switches for Variable Frequency Drive Application
1. Acceptable Manufacturer: Veris Industries or Equal.
2. General: Microprocessor controlled, self-learning, self-calibrating current sensor to detect motor undercurrent and overcurrent situations such as belt loss, coupling shear, and mechanical failure on variable loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory and relearn.
3. Visual LED indicator for status.
4. Alarm Limits: ±20% of learned current in every 5 Hz freq. band
5. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 1.5 A to 150 A and from 12 to 115 Hz.
6. Normally open current sensor output. 0.1A at 30 VAC/DC.
7. Basis of Design: Veris Model H614.

M. Liquid Flow, Insertion Type Turbine Flowmeter:
1. Acceptable Manufacturer: Veris Industries or Equal
2. General: Turbine-type insertion flow meter designed for use in pipe sizes 1 1/2” and greater. Available in hot tap configuration with isolation valves and mounting hardware to install or remove the sensor from pipeline that is difficult to shut down or drain
3. Performance:
    1) Accuracy ±1% of rate over optimum flow range; ≥10 upstream and ≥5 downstream straight pipe diameters, uninterrupted flow
    2) Repeatability ±0.5%
    3) Velocity Range: 0.3 to 20 FPS
    4) Pressure Drop 0.5 psi or less @ 10 ft/sec for all pipe sizes 1.5” dia and up
    5) Pressure Rating: 1000 psi @ 70°F
4. Maximum Temperature Rating: 300°F
5. Materials: Stainless Steel or Brass body; Stainless steel impeller
6. Transmitter:
    1) Power Supply: 12 - 30VAC or 8 - 35VDC.
        a) Output: [Frequency] [4-20 mA] [Scaled Pulse]
    2) Temperature Range: 14° to 150°F
    3) Display: 8 character 3/8" LCD (Optional)
    4) Enclosure: NEMA 4, Polypropylene with Viton® sealed acrylic cover
7. Basis of Design: Veris SDI series

N. Liquid Flow/Energy Transmitter, Non-invasive Ultrasonic (Clamp-on):
1. Acceptable Manufacturer: Veris Industries or Equal
2. General: Clamp-on digital correlation transit-time ultrasonic flow meter designed for clean liquids or liquids containing small amounts of suspended solids or aeration. Optional temperature sensors for BTU calculations.
3. Liquid: water, brine, raw sewage, ethylene, glycol, glycerin, others. Contact manufacturer for other fluid compatibility
4. Pipe Surface Temperature: Pipe dia 1/2" to 2":-40-185°F; Pipe dia > 2": -40-250°F
5. Performance:
    1) Flow Accuracy:
        a) Pipe dia 1/2" to 3/4" 1% of full scale
        b) Pipe dia 1" to 2" 1% of reading from 4-40 FPS
        c) Pipe dia 2" to 100" 1% of reading from 1-40 FPS
    2) Flow Repeatability ±0.01% of reading
    3) Velocity Range: (Bidirectional flow)
        a) Pipe dia 1/2" to 2" 2 to 40 FPS
        b) Pipe dia 2" to 100" 1 to 40 FPS
    4) Flow Sensitivity 0.001 FPS
    5) Temperature Accuracy (energy): 32-212°F; Absolute 0.45°F; Difference 0.18°F
    6) Temperature Sensitivity: 0.05°F
    7) Temperature Repeatability: ±0.05% of reading
6. Transmitter:
    1) Power Supply: 95 to 264 VAC, 47 to 63 Hz or 10 to 28 VDC.
    2) Output: [RJ45] [Modbus TCP/IP] [Ethernet/IP] [BACnet/IP] [Pulse] [4-20 mA] [RS-485 Modbus RTU}
    3) Temperature Range: -40 to +185°F
    4) Display: 2 line backlit LCD with keypad
    5) Enclosure: NEMA 4, (IP65), Powder-coated aluminum, polycarbonate
7. Agency Rating: UL 1604, EN 60079-0/15, CSA C22.2, CSA Class 1 (Pipe > 2")
8. Basis of Design: Veris FST & FSR series

O. Analog Electric/Pneumatic Transducer:
1. Acceptable Manufacturer: Veris Industries or Equal
2. General: Micro-controlled poppet valve for high accuracy and with no air loss in the system. Field configurable for pressure sensing in multiple applications.
3. Power Supply: 22-30VDC, 20-30VAC
4. Control Input: 4-20mA, 0-10V, 0-5V; jumper selectable
5. Performance:
    1) Accuracy: 1% full scale; combined linearity, hysteresis, repeatability
    2) Compensated Temperature Range: 25° to 140°F
    3) Temp Coefficient: ±0.05%°C
    4) Operating Environment: 10-90% RH, non-condensing; 25° to 140°F
6. Supply Pressure: 45 psig max.
7. Manual Override: Jumper selectable mode, digital pushbutton adjust
8. Alarm Contact: 100mA@30VAC/DC (Optional)
9. Control Range 0-20 psig or 3-15 psig; jumper selectable
10. Pressure Differential 0.1 psig (supply to branch)
11. Pressure Indication Electronic, 3-1/2 digit LCD
12. Housing: Mounted on standard SnapTrack; Optional clear dust cover

13. Basis of Design: Veris EP Series

P. Control Valves

1. Provide automatic control valves suitable for the specified controlled media (steam, water or glycol). Provide valves which mate and match the material of the connected piping. Equip control valves with the actuators of required input power type and control signal type to accurately position the flow control element and provide sufficient force to achieve required leakage specification.
2. Control valves shall meet the heating and cooling loads specified, and close off against the differential pressure conditions within the application. Valves should be sized to operate accurately and with stability from 10 to 100% of the maximum design flow.
3. Trim material shall be stainless steel for steam and high differential pressure applications.
4. Electric actuation should be provided on all terminal unit reheat applications unless electric heat is provided.

Q. Dampers

1. Automatic dampers, furnished by the Building Automation Contractor shall be single or multiple blade as required. Dampers are to be installed by the HVAC Contractor under the supervision of the BAS Contractor. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the Sheet Metal Contractor.
2. Damper frames are to be constructed of 13 gauge galvanized sheet steel mechanically joined with linkage concealed in the side channel to eliminate noise as friction. Compressible spring stainless steel side seals and acetyl or bronze bearings shall also be provided.
3. Damper blade width shall not exceed eight inches. Seals and 3/8 inch square steel zinc plated pins are required. Blade rotation is to be parallel or opposed as shown on the schedules.
4. For high performance applications, control dampers will meet or exceed the UL Class I leakage rating.
5. Control and smoke dampers shall be Ruskin, or approved equal.
6. Provide opposed blade dampers for modulating applications and parallel blade for two position control.

R. Damper Actuators

1. Damper actuators shall be electronic, and shall be direct coupled over the shaft, without the need for connecting linkage. The actuator shall have electronic overload circuitry to prevent damage. For power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing. Non-spring return actuators shall have an external manual gear release to allow positioning of the damper when the actuator is not powered.

S. Smoke Detectors

1. Air duct smoke detectors shall be by Air Products & Controls or approved equal. The detectors shall operate at air velocities from 300 feet per minute to 4000 feet per minute.
2. The smoke detector shall utilize a photoelectric detector head.
3. The housing shall permit mechanical installation without removal of the detector cover.
4. The detectors shall be listed by Underwriters Laboratories and meet the requirements of UL 268A.

T. Airflow Measuring Stations
1. Provide a thermal anemometer using instrument grade self heated thermistor sensors with thermistor temperature sensors.
2. The flow station shall operate over a range of 0 to 5,000 feet/min with an accuracy of +/- 2% over 500 feet/min and +/- 10 ft/min for reading less than 500 feet/min.

2.7 Electrical Power Measurement

A. Electrical Power Monitors, Single Point (Easy Install):
1. Acceptable Manufacturer: Veris Industries or Equal.
1. General: Consist of three split-core CTs, factory calibrated as a system, hinged at both axes with the electronics embedded inside the master CT. The transducer shall measure true (rms.RMS) power demand real power (kW) consumption (kWh). Conform to ANSI C12.1 metering accuracy standards.
2. Voltage Input: Load capacity as shown on drawings. 208-480 VAC, 60 Hz
3. Maximum Current Input: Up to 2400A
4. Performance:
    1) Accuracy: +/- 1% system from 10% to 100% of the rated current of the CT's
    2) Operating Temperature Range: 32-140°F, 122°F for 2400A.
5. Output: 4 to 20 mA, Pulse. or Modbus RTU
6. Ratings:
    1) Agency: UL508 or equivalent
    2) Transducer internally isolated to 2000 VAC.
    3) Case isolation shall be 600 VAC.
7. Basis of Design: Similar to Hawkeye Veris H80xx40 series
8. Accessories: [BACnet] [LON] communications gateway

B. Electrical Power Monitors, Single Point (High Accuracy):
1. Acceptable Manufacturer: Veris Industries or Equal.
2. General: Revenue grade meter. Measures voltage, amperage, real power (kW), consumption (kWh), and reactive power (kVARar), and power factor (PF) per phase and total load for a single load. Factory calibrated as a system using split core CT's. Neutral voltage connection is required.
3. Voltage Input: 208-480 VAC, 60 Hz
4. Current Input: Up to 2400A
5. Performance:
    1) Accuracy: +/- 1% system from 2% to 100% of the rated current of the CT's
    2) Operating Temperature Range: 32-122°F
6. Output: Pulse, BACnet, Modbus RTU
7. Display: Backlit LCD
8. Enclosure: NEMA 1
9. Agency Rating: UL508 or equivalent
10. Basis of Design: Veris Industries H81xx00 series.

C. Electrical Power Monitors, Single Point (High Accuracy/Versatility):
1. Acceptable Manufacturer: Veris Industries or Equal.
2. General: Revenue grade meter. Measures voltage, amperage, real power (kW), consumption (kWh), reactive power (kVAR), apparent power (kVA) and power factor (PF) per phase and total load for a single load. Available with data logging , Bi-directional (4-quadrant) metering, and pulse contact accumulator inputs.
3. Voltage Input: 90-600 VAC, 50/60 Hz, 125-300 VDC
4. Current Input: 5A – 32,000A, selectable 1/3V or 1V CT inputs

5. Performance:
    1) Accuracy shall be +/- [0.2%] [0.5%] revenue grade
    2) Operating Temperature Range: -22-158°F
6. Output shall be [Pulse] [BACnet] [Modbus RTU] [LON]
7. Display: Backlit LCD
8. Enclosure: NEMA 4x optional
9. Agency Rating: UL508, ANSI C12.20
10. Basis of Design: Veris E5xxx series.

D. Electrical Power Monitors, Multiple Point (92 loads, High Accuracy):
1. Acceptable Manufacturer: Veris Industries or Equal
2. General: Revenue grade meter. Measures volts, amps, power and energy for each circuit. 1/4 amp to 200 amp monitoring. 4 configurable alarm threshold registers
3. Voltage Input: 90-277 VAC, 60 Hz
4. Current Input: 5A – 32,000A, 1/3V CT inputs
5. Performance:
    1) Accuracy: +/- 0.5% meter (split core), +/- 1% system from 1/4-100A (solid core)
    2) Operating Temperature Range: 32-140°F
6. Output: Modbus RTU
7. Agency Rating: UL508, ANSI C12.10, IEC Class 1
8. Basis of Design: Veris E3xxx series.

PART 3 - Execution

3.1 Contractor Responsibilities

A. General
1. Installation of the building automation system shall be performed by the Contractor or a subcontractor. However, all installation shall be under the personal supervision of the Contractor. The Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor.

B. Demolition
1. Remove controls which do not remain as part of the building automation system, all associated abandoned wiring and conduit, and all associated pneumatic tubing. The Owner will inform the Contractor of any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the Contractor.

C. Access to Site
1. Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the Owner or the Owner’s Representative.

D. Code Compliance
1. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring specifications in Division 17 and Division 16, wiring requirements of Division 17 will prevail for work specified in Division 17.

E. Cleanup

1. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

3.2 Wiring, Conduit, and Cable

A. All wire will be copper and meet the minimum wire size and insulation class listed below:

Wire Class	Wire Size	Isolation Class
Power	12 Gauge	600 Volt
Class One	14 Gauge Std.	600 Volt
Class Two	18 Gauge Std.	300 Volt
Class Three	18 Gauge Std.	300 Volt
Communications	Per Mfr.	Per Mfr.

B. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.
C. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.
D. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.
E. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.
F. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.
G. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.
H. Fiber optic cable shall include the following sizes; 50/125, 62.5/125 or 100/140.
I. Only glass fiber is acceptable, no plastic.
J. Fiber optic cable shall only be installed and terminated by an experienced contractor. The BAS contractor shall submit to the Engineer the name of the intended contractor of the fiber optic cable with his submittal documents.

3.3 Hardware Installation

A. Installation Practices for Wiring
B. All controllers are to be mounted vertically and per the manufacturer's installation documentation.
C. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.

D. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.
E. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.
F. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction. Exception; metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.
G. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.
H. Wires are to be kept a minimum of three (3) inches from hot water, steam, or condensate piping.
I. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.
J. Wire will not be allowed to run across telephone equipment areas.

3.4 Installation Practices for Field Devices

A. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.
B. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.
C. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.
D. Water line mounted sensors shall be removable without shutting down the system in which they are installed.
E. For duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.
F. For building static pressure sensors, the high pressure port shall be inserted into the space via a metal tube. Pipe the low pressure port to the outside of the building.

3.5 Enclosures

A. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.
B. FIPs shall contain power supplies for sensors, interface relays and contactors, and safety circuits.
C. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.
D. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.
E. All outside mounted enclosures shall meet the NEMA-4 rating.
F. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

3.6 Identification

A. Identify all control wires with labeling tape or sleeves using words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
B. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.
C. Junction box covers will be marked to indicate that they are a part of the BAS system.
D. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
E. All I/O field devices inside FIP's shall be labeled.

3.7 Existing Controls.

A. Existing controls which are to be reused must each be tested and calibrated for proper operation. Existing controls which are to be reused and are found to be defective requiring replacement, will be noted to the Owner. The Owner will be responsible for all material and labor costs associated with their repair.

3.8 Control System Switch-over

A. Demolition of the existing control system will occur after the new temperature control system is in place including new sensors and new field interface devices.
B. Switch-over from the existing control system to the new system will be fully coordinated with the Owner. A representative of the Owner will be on site during switch-over.
C. The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on site so that the entire switch-over can be accomplished in a reasonable time frame.

3.9 Location

A. The location of sensors is per mechanical and architectural drawings.
B. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.
C. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.
D. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.10 Software Installation

A. General.
    1. The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.

3.11 Database Configuration.

A. The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.

3.12 Color Graphic Displays.

A. Unless otherwise directed by the owner, the Contractor will provide color graphic displays as depicted in the mechanical drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for setpoint changes as required by the owner.

3.13 Reports.

A. The Contractor will configure a minimum of 4 reports for the owner. These reports shall, at a minimum, be able to provide:
   1. Trend comparison data
   2. Alarm status and prevalence information
   3. Energy Consumption data
   4. System user data

3.14 Documentation

A. As built software documentation will include the following:
   1. Descriptive point lists
   2. Application program listing
   3. Application programs with comments.
   4. Printouts of all reports.
   5. Alarm list.
   6. Printouts of all graphics
   7. Commissioning and System Startup

3.15 Point to Point Checkout.

A. Each I/O device (both field mounted as well as those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the owner or owner's representative.

3.16 Controller and Workstation Checkout.

A. A field checkout of all controllers and front end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the owner or owner's representative by the completion of the project.

3.17 System Acceptance Testing

A. All application software will be verified and compared against the sequences of operation.
   1. Chiller control
   2. Boiler Control
   3. Single Zone Air Handlers
   4. Multi Zone Air Handlers
   5. Packaged Roof Top Control
   6. Cooling Only VAV
   7. Fan Powered VAV
   8. Fan Coil Control
   9. Heat Pump Control

10. Unit Ventilator Control

B. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.
C. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.
D. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.
E. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.