

## Building Component Requirements

*This BCR should reflect FCPS's preferences that are over and above current codes.*

*For questions or comments, contact:*

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### Table of Contents

Division 1	General Requirements (8/23)
Division 2	Existing Conditions (12/21)
Division 3	Concrete (12/21)
Division 4	Masonry (8/22)
Division 5	Metals (12/21)
Division 6	Wood, Plastics & Composites (8/23)
Division 7	Thermal & Moisture Protection (12/21)
Division 8	Openings (8/22)
Division 9	Finishes (8/22)
Division 10	Specialties (8/23)
Division 11	Equipment (8/23)
Division 12	Furnishings (8/23)
Division 13	Special Construction (12/21)
Division 14	Conveying Equipment (12/21)
Division 21	Fire Suppression (12/21)
Division 22	Plumbing (8/23)
Division 23	Heating, Ventilating & Air Conditioning (8/23)
Division 23	Appendix A - HVAC Controls (2/23)
Division 26	Electrical (8/23)
Division 27	Communications (8/23)
Division 28	Electronic Safety & Security (8/23)
Division 31	Earthwork (12/21)
Division 32	Exterior Improvements (12/22)
Division 33	Utilities (12/21)

## DIVISION 1 GENERAL REQUIREMENTS

### 01 05 00 COMMON WORK RESULTS FOR GENERAL REQUIREMENTS

1. This document represents the requirements of Fayette County Public School System (FCPS). Any deviations by the design team will be specifically discussed in review meetings and documented in meeting minutes prepared by the Architect and distributed to FCPS Facility Design & Construction (FD&C) as well as FCPS Maintenance personnel via eComm.
2. FCPS BOARD POLICY establishes priorities for renovation of buildings. Those priorities listed in order of importance are as follows:
  - a. Addressing Health, Safety and Code Compliance issues. This priority shall address any hazards that could cause occupants to become ill or experience injury.
  - b. Addressing Structural and Building Systems Integrity. Buildings must be whole, without leaks, with sound walls and foundations and wiring, HVAC systems that function properly.
  - c. Addressing the Educational Function of the building. This priority shall address renovation / alteration of buildings to enable them to increase efficiency and the effectiveness of the building as a teaching environment.
  - d. Addressing Building Enhancements / Aesthetics. This priority shall include modifying decorative elements or basic structure to improve the aesthetic qualities of the building. This priority level shall involve improvements which are not necessary to carry out the basic services of the building such as building finishes and furnishings. As part of this priority, the Sustainable Buildings Industry Council's High Performance School Buildings Resource and Strategy Guide has been adopted by FCPS to help improve both student achievement and building performance.  
[https://centers.njit.edu/cbk/sites/cbk/files/HPSB\\_RSG.pdf](https://centers.njit.edu/cbk/sites/cbk/files/HPSB_RSG.pdf)
  - e. In all phases of the project, items requiring approval by the Board of Education shall be submitted for review at the Planning Meeting (typically the 2<sup>nd</sup> Monday of each month), with approval at the Regular Meeting (typically the 4<sup>th</sup> Monday of each month). FD&C will provide a Schedule for Submitting Items for Approval at the beginning of each fiscal year noting the specific days items are due to FD&C. The KDE approval process shall be considered in all approval schedules, but that should not hold up the design team.
  - f. In all phases of the project, design team is responsible for submitting plans to appropriate governmental entities for review/approval (e.g., LFUCG, HBC.)
3. DESIGN STAGES. The design team is responsible for reviewing the proposed design submittal requirements with FD&C at the beginning of each project. Depending on the project's size and complexity, the design team is required to prepare submittals for FCPS review for the following stages: (702 KAR 4:160, Capital Construction Process and Guidelines for Best Practices.)  
<https://education.ky.gov/districts/fac/Pages/Construction.aspx>
  - a. PROGRAMMING. The design team is responsible for reviewing KDE programming standards and determine if adjustments should be made prior to meeting with additional design committee members, which will be determined by FCPS, specifically FD&C.

- b. **SCHEMATIC DESIGN.** During the early stages of the schematic design, the Architect shall consult with FD&C to review conceptual solutions. The material can be in 'sketch form' showing possible design solutions that can be expanded on during subsequent development. More than one study should be presented for consideration. The final Schematic Design submittal shall include the following:
- i. A Site Plan indicating proposed bus loop, parent drive, parking configurations and other site improvements as needed.
  - ii. Floor Plans indicating each room name and the actual square footage of the space.
  - iii. Exterior Elevations that indicate proposed material selections and spatial relationships.
  - iv. Building Section(s) as appropriate to represent significant portions of the building that are being developed.
  - v. Program + Area Analysis that compares program areas with actual areas.
  - vi. Preliminary Cost Estimate. A square foot cost estimate is to be prepared at this stage that includes renovated area versus new construction, demolition, site work and utilities.
  - vii. Life Cycle Cost Analysis reports for proposed systems should be included in this section.
  - viii. Narratives for Site, Mechanical, Plumbing, Fire Protection and Electrical.
  - ix. Preliminary Schedule indicating major milestones during design and project construction. Keep Board meeting schedule in mind when considering approval time.
- c. **DESIGN DEVELOPMENT.** Drawings and documents submitted during this phase shall be formatted as partially complete Construction Documents. If variances are needed, then the design team must include those at this phase or at CDs for Board approval. The Design Development submittal shall include the following (10 business days required for review):
- i. Cover Sheet indicating Project Name and Location, Superintendent / School Board Members, and Design Team Information. Include Table of Contents if it will fit.
  - ii. Project Information to include required code information, capacities for gym and auditorium spaces, etc., drawing index, vicinity plan, and any additional information deemed appropriate.
  - iii. Site Survey bearing the stamp and signature of the Surveyor.
  - iv. Site Plans indicating adjacent buildings, proposed site improvements, existing and proposed contours, proposed landscaping improvements, and existing / proposed utilities. Provide separate site plans as necessary that indicate utilities that are to remain, to be removed or to be abandoned in place. Coordinate utilities with Mechanical, Electrical & Plumbing drawings.
  - v. Project Phasing Plans that depict existing building and site conditions. Indicate each subsequent phase with the proposed duration of the phase noted. (Refer to paragraph below for additional phasing requirements.)

- vi. Floor Plans indicating foundations / structural columns, framing plans, structural details, architectural floor plans with room numbers and room names depicted, proposed casework locations, Reflected Ceiling Plans, Finish Plans / Legend, and Furniture Plans as well as appropriate enlarged plans and details.
- vii. Roof Plan indicating different roof materials / systems, proposed slopes, and roof top equipment.
- viii. Exterior Elevations that indicate proposed material selections and spatial relationships.
- ix. Building Section(s) as appropriate to represent significant portions of the building that are being developed.
- x. Interior Elevations as appropriate to indicate typical instructional space casework, toilet rooms and other areas as needed.
- xi. Food Service Plans, Schedules and Details as necessary.
- xii. Plumbing Drawings indicating proposed domestic water, sanitary sewer, fire protection and vent routing.
- xiii. Mechanical Drawings indicating proposed systems, piping, and details.
- xiv. Electrical Drawings indicating proposed lighting, power and communications equipment locations as well as details.
- xv. Updated Program + Area Analysis that compares program areas with actual areas.
- xvi. Detailed Cost Estimate that includes quantity take-offs. (Square foot and lumps sum estimates are not acceptable at this stage.) KDE BG3 form.
  - 1. A revised BG1 is required for approval if construction cost opinion has increased more than 10% per KDE guidelines.
- xvii. Outline Specifications.
- xviii. Updated schedule indicating major milestones during design and project construction.
- xix. Schedules should be discussed with Architect in FD&C if any issues or construction industry news may impact the final occupancy goal.
- d. **50% COMPLETE CONSTRUCTION DOCUMENTS (for FD&C, only.)** The fifty percent complete Construction Document submittal shall be submitted digitally via eComm, broken up by each discipline, and include the following:
  - i. All the required drawings listed above under section 'c' above advanced to 50% Construction Document level as well as any additional drawings needed for a full understanding of the project requirements.
  - ii. Updated detailed cost estimate if significant changes have occurred since Design Development.
  - iii. Updated schedule if any significant changes have occurred since Design Development.
  - iv. In progress Specifications (outline only showing Table of Contents).
- e. **FINAL CONSTRUCTION DOCUMENTS.** Design team to schedule meeting date for FCPS stakeholders review before uploading these documents to eComm. The final Construction Document submittal shall include the following (10 business days required for review):

- i. All the required drawings listed above under section 'b' above advanced to final Construction Document level as well as any additional drawings needed for a full understanding of the project requirements.
    - ii. Updated detailed cost estimate if significant changes have occurred since 50% Construction Documents.
    - iii. Complete Specifications.
  - f. AFTER CONSTRUCTION ADMINISTRATION. The design team will be required to put the facility in the KDE Facility Inventory Software currently known as KFICS on the KDE website ([www.AssetPlanner.com](http://www.AssetPlanner.com))
- 4. REVIEW MEETINGS. The Architect or Engineer is responsible for documenting all review meetings by providing meeting minutes to all in attendance as well as the Director of FD&C and any other FCPS staff that may be involved. FD&C to determine if others need to attend.
  - a. PROGRAM REVIEW MEETING(S): Discuss the following issues; project scope and program, project budget, and projected time frame for design and construction. Meeting is to be with FD&C.
  - b. SCHEMATIC DESIGN REVIEW: Allow five work days for document review once the documents have been submitted to FD&C. Any comments generated will be reviewed with the design team in an informal meeting with FD&C.
  - c. DESIGN DEVELOPMENT REVIEW: Allow ten work days for document review once the documents have been submitted. A formal meeting will be scheduled after the review period that will include FD&C, Child Nutrition, Maintenance, Operations, Risk Management, and Technology as well as additional departments that may be involved.
  - d. 50% CONSTRUCTION DOCUMENT REVIEW: Allow five work days for document review once the documents have been submitted to FD&C. Any comments generated will be reviewed with the design team in an informal meeting with FD&C.
  - e. FINAL CONSTRUCTION DOCUMENT REVIEW: Allow ten work days for document review once the documents have been submitted. A formal meeting will be scheduled after the review period that will include FD&C, Child Nutrition, Maintenance, Operations, Risk Management, and Technology as well as any additional departments that may be involved.
  - f. REVIEW COMMENTS: It is the design team's responsibility to ensure that meeting notes are taken at these meetings and sent to the appropriate staff for review in a timely manner. All comments made during review periods are to be responded to in writing from the design team.
- 5. PROJECT PHASING. The Design Team shall fully describe the proposed phasing of the work to be completed. Particular attention shall be given to remodeling / renovation projects that will remain in operation during construction activities. Considerations should be given to the following items: Temporary facilities and controls, providing and maintaining means of ingress and egress, security of the building, storing of materials and staging areas, construction deliveries, scheduling moves or abatement work by the Owner, dust and noise control, and maintaining services to the occupied portions of the building. It is imperative that student and staff safety be considered during each phase. Students and staff shall not be routed in close proximity to active construction areas under any circumstances unless local building code officials direct otherwise.

6. UTILITY INTERRUPTIONS. The specifications shall require the Contractor to notify the Architect and the Owner of all scheduled and unscheduled interruptions in utility service to include: Electrical, Fire Suppression, Fire Alarm, HVAC, Communications, and Plumbing systems. The Contractor is to provide a detailed plan to return any damaged property / equipment to its original condition and restore normal service. The Contractor shall be required to take photo / video documentation of the affected areas and submit to the Owner. The Owner shall inspect the cause of the interrupted service as well as the repairs before the repairs are permanently repaired and covered.
7. EXTRA MATERIALS. Ensure that the Project Specifications note that FCPS Maintenance shall not accept any overages of any materials, especially those that are considered hazardous or require special storage. This includes but is not limited to paint, cleaners, additives, sealants, adhesives, or paint accessories. Extra materials that are indicated in the specifications are to be maintained by the General Contractor for the duration of the warranty period specified. Once the warranty period expires, the General Contractor is free to dispose of the extra materials in a safe and environmentally responsible manner. Turn in extra materials, such as flooring, ceiling tiles, etc., in an orderly fashion and contact FD&C and FCPS Maintenance to find storage location.
8. PRE-BID MEETING. The Architect shall conduct a pre-bid meeting with the following FCPS staff being invited to attend: FD&C Director, FD&C Project Coordinator, Director of Maintenance and Maintenance Supervisors. Items to be discussed include project description and scope of project, explanation of bid submission requirements, phasing requirements (if any), FCPS policies for safety, security and use of tobacco, contractor behavior, contractor parking, siting of construction materials, salvage items by owner, FCPS authorized representatives, payment requests, activity schedule for building/site during renovation, and any other items deemed relevant. MWVBE goal should also be reviewed. Typically, pre-bid meetings are mandatory for general contractors. A walk-thru of the building / site is usually provided after the pre-bid meeting with another walk-thru scheduled for a later date at the convenience of the owner.

01 21 00 ALLOWANCES

1. Allowances are to be approved by the Director of FD&C prior to bidding.
2. In general, allowances are to be avoided. If circumstances warrant, the Director of FD&C may approve the use of allowances for certain items.

01 22 00 UNIT PRICES

1. The design team shall consult with the Director of FD&C on the number and content of the unit prices that are requested in the Form of Proposal. The design team shall make every effort to limit the number of unit prices requested to fit on one page.

01 23 00 ALTERNATES

1. A limited number of alternates may be used as a means of ensuring that base bids are within the available construction funds. Prior to bidding, the design team shall consult with the Director of FD&C regarding type, quantity and priority of alternates.
2. Additive alternates shall be used in preference to deductive alternates. The number of alternates shall be kept to the minimum necessary.

01 24 00 VALUE ANALYSIS

1. Once bids have been received for a project, FCPS will have the option to begin the value engineering process in order to bring the project in at assigned value, or will, at

its option, revise the assigned value of the project to meet the bid price. All value engineering will be approved by FCPS in writing before any deletions can be made to the project.

01 31 00

#### PROJECT MANAGEMENT AND COORDINATION

1. The Architect will schedule and furnish the agenda for a Preconstruction Meeting after award of the Contract. Attendance requirements and items to be discussed shall be coordinated with FCPS FD&C.
2. The General Contractor shall schedule a twice monthly Progress Meeting. The Architect will prepare an agenda and preside at the meetings. Subsequent meetings shall be held on the same day and hour of the week for the duration of the construction period. Upon instructions from FD&C, the scheduled meetings may be increased or decreased as needed.
  - a. One of the two monthly meetings is the standard progress meeting and can be held virtually in a format that all necessary team members can use. The other meeting does not need to have everyone in attendance as it should be a touch-base meeting with the contractor and design team to see if there are any urgent items in need of attention.
3. The Architect and the Contractor are to make every effort to coordinate all RFIs, PRs, and submittals prior to the scheduled meeting.
4. The Architect shall take minutes at each meeting. Typed copies of the minutes shall be distributed to all concerned parties via electronic format via eComm.

01 32 00

#### CONSTRUCTION PROGRESS DOCUMENTATION

1. The specifications shall require the Contractor to submit the initial critical path schedule within 15 days after date of Notice of Award of Contract to the Architect and the Owner. Revised Progress Schedules shall be submitted with each Application for Payment.
2. Before commencement of any demolition, the Contractor is to take color, digital photographs of the project site and surrounding properties including existing items to remain during construction.
3. The Contractor shall be required to take a minimum of 12 color, digital photographs weekly that depict status of construction and progress since last photographs were taken.
4. All documents outlined above to be submitted to Owner via eComm.

01 33 00

#### SUBMITTAL PROCEDURES

1. Use of eComm software (Lynn Imaging) should be utilized for quicker review by all parties.

01 35 00

#### SPECIAL PROCEDURES

1. The Architect shall include language in the Specifications to the effect that all Contractors and Subcontractors working on FCPS property shall be responsible for notifying the Owner of any personnel doing work on site that have a communicable disease, including, but not limited to: Tuberculosis, measles, mumps, rubella, etc.

01 50 00

#### TEMPORARY FACILITIES AND CONTROLS

1. The utilization of existing HVAC equipment for heating and cooling during construction is to be determined by the Project Engineer during design. It is the Contractor's responsibility to completely maintain the equipment during construction and submit

written reports to FD&C Project Coordinator to show that maintenance has been performed.

2. Water service from existing systems is available for use during construction without metering and without payment of use charges with the understanding that the Contractor's use will not negatively impact the operation of the school and its systems.
3. Electric power service from existing systems is available for use during construction without metering and without payment of use charges with the understanding that the Contractor's use will not negatively impact the operation of the school and its systems.

01 52 00 CONSTRUCTION FACILITIES

1. General Contractor's Office shall be of size suitable for the use of the contractor, subcontractors, FCPS personnel and the design team. The general contractor shall be present at the office, or elsewhere on site, at all times while work is in progress.

01 55 00 VEHICULAR ACCESS AND PARKING

1. If existing streets and roads must be used in order to gain access to the construction site, a detailed plan of the routes to be used must be worked out in cooperation with FCPS personnel. The approved plan shall be shown on the final documents noting that no other streets and roads be used without written consent of the owner.
2. Specifications are to be written to require that the general contractor be responsible for cleanup of mud and spillage caused by construction activities on affected public and owner streets / roads.
3. Contractor shall provide a truck wash area outside to limit the amount of debris on the roads, which is to their benefit.

01 56 00 TEMPORARY BARRIERS AND ENCLOSURES

1. During joint occupancy of buildings, entrances and exits for public use must be provided to meet code requirements. A minimum of one ingress, egress, and path of travel that is accessible to individuals with disabilities must be maintained to all user occupied portions of the building.
2. In occupied buildings the architect shall indicate areas for which noise and dust control must be provided and shall specify methods of control. If details of the installations are involved, specify these in the applicable specification section.
3. A 6' high fence with gates shall be erected in a manner to protect the project site. The extent of the fencing shall be as required to enclose entire project site or portion determined sufficient to accommodate construction operations and as indicated on project drawings. Barbed wire used on any part of the fence is prohibited unless authorized in writing from the owner. 'No Trespassing' signs are to be specified that meet OSHA requirements. Specify that the contractor must maintain a neat appearance at the project site including but limited to those areas inside construction fencing.
4. During construction activities, one gate shall be double locked with a FCPS security padlock and the contractor's padlock in a manner that will allow access by unlocking either padlock. The owner padlock is to be obtained from, and returned to, the owner.

01 60 00 PRODUCT REQUIREMENTS

1. RESERVED.

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS



1. Final cleaning shall be for occupancy and shall exceed daily construction clean up. All surfaces shall be free of dust, clean, and as intended to appear. The Contractor shall employ a professional cleaning company in order to provide the Owner with a clean facility upon completion of the work.
2. Detailed requirements for Operations and Maintenance Data should be noted in the specific section of the Specifications. For items of General Construction, specify that information for care and maintenance be furnished for any item requiring more than ordinary custodial care.
3. Prior to the last filter change, General Contractor shall provide a completed filter schedule to FCPS Maintenance via eComm.
4. Prior to Final Completion, the **Architect of Record** shall provide FCPS Maintenance with the following:
  - a. The Autodesk® DWG files for the floor plans and site utility plans. (Confirm which version of Autodesk DWG file format to provide with the Maintenance.) There will be one DWG file for each drawing sheet with all reference files bound. If fonts are utilized that are not standard, they shall be embedded into the drawing file. The CAD file name shall be the same as the sheet name. Revisions should be indicated with delta reference marks (not clouds), and the drawings should be properly annotated as "Record Drawings" in the revision block of each sheet.
  - b. One (1) complete digital set of full-size drawings utilizing the current version Adobe PDF file format. Each sheet shall be a separate file. It is imperative that the PDF file plot configuration be such that the drawings are the correct size and scale as the original drawings when plotted.
  - c. One (1) printed copy (on 24 lb. bond paper) of the complete set of printed and bound full size Record Drawings which incorporate "as-built" markup information.
  - d. One (1) digital copy of the Record Specifications utilizing the current version Adobe PDF file format.
  - e. One (1) digital copy shall be uploaded to eComm.
5. Prior to Final Completion and according to the Project Specifications, the **General Contractor** shall provide FCPS Maintenance with the following project record documents:
  - a. Two (2) copies - One (1) printed copy and one (1) digital copy utilizing the current version Adobe PDF file format of Operations and Maintenance Data manuals, to include project directory, warranties, certificates, **Certificate of Occupancy**, balance reports, and copies of transmittals of all items delivered direct to project/school location (i.e., stage light accessories, paint, etc.).
    - i. One (1) additional digital copy of Operations and Maintenance Data manuals for kitchen/food service equipment to be delivered to FCPS FD&C.
  - b. One (1) digital copy utilizing the current version Adobe PDF file format of Shop Drawings.
  - c. One (1) digital copy shall be uploaded to eComm.

01 90 00

#### LIFE CYCLE ACTIVITIES

1. During the design phase of the project the Design Team shall consider and take into account the life cycle costs of all major equipment, systems, and materials specified for installation. The design team shall prepare a Life Cycle Cost Analysis for the project when directed and submit these findings and recommendations to the Director of FD&C for consideration. Sustainable design practices / systems shall also be considered during this review.

## **DIVISION 2    EXISTING CONDITIONS**

### **02 05 00    COMMON WORK RESULTS FOR EXISTING CONDITIONS**

1. Information provided by Fayette County Public Schools (FCPS) may or may not be an accurate depiction of existing conditions and therefore in no way shall the Owner be held responsible for their accuracy. It is up to the design professionals to perform field reviews and investigations necessary to get a thorough understanding of the site, utilities, building structure, and building systems during the design phase of the Project.
2. Design professionals are encouraged to photographically document existing conditions / investigations. Specifications shall require that Contractors photographically document existing conditions / investigations prior to commencing work or demolition. Copies, in electronic format, shall be provided to the Owner for record purposes.
3. FCPS Child Nutrition, Maintenance, and Technology shall be responsible for removal of any kitchen equipment, security technology, cameras, fire alarms and notification devices, doors and hardware devices etc., that are to be salvaged
4. In no case shall any Best key cores be disposed of without permission from FCPS.
5. Coordinate with FCPS Risk Management for guidance for the proper removal of any potentially hazardous items including fluorescent light lamps, ballasts, and thermostats, if that is not called in in your demolition spec.

### **02 30 00    SUBSURFACE INVESTIGATION**

1. Existing site / survey information is to be included in the Contract Documents. All boring locations, cross sections, and soil conditions are to be shown as well as existing conduits, drains, utility lines, sewers, tunnels, cables, trees, paving, walks, foundations and other objects or obstructions, whether in use or abandoned.
2. Protect all buildings, drives, parking areas, trees, walks, and planted areas during subsurface investigations. All existing site elements damaged as a result of construction activities shall be repaired to match their original condition.

### **02 41 16    STRUCTURE DEMOLITION**

1. Where new structures will replace existing structures, the entire foundation structure shall be removed unless otherwise approved.

### **02 41 19    SELECTIVE DEMOLITION**

1. The design professional shall clearly delineate on the construction documents the extent of selective demolition. Provide demolition site plans, floor plans, elevations, and / or details as necessary to clearly identify what is to be removed and what is to remain.
2. Identify on the construction documents what items are to be temporarily removed and re-used, and those items which are to be turned over to the Owner. In addition, identify which items are to be appropriately removed for recycling.

### **02 82 00    ASBESTOS REMEDIATION (Coordinate with FCPS Risk Management & Safety)**

1. **CONTRACTOR REMOVAL OF ASBESTOS CONTAINING MATERIAL (ACM):** In most cases, Asbestos-Containing Material (ACM) on roofs will be removed by the wet-removal (misting) method with the ACM immediately placed in approved double bags and in a lined, covered container when placed on ground level. Proper signage is

required. Notices and permits from the State of Kentucky and the Lexington-Fayette Urban County Government are required. Manifests for receipt of ACM at authorized landfills will be presented to the designated FCPS representative no later than the next Progress Review meeting.

2. FCPS REMOVAL OF ASBESTOS-CONTAINING MATERIAL (ACM): Asbestos-Containing Material (ACM) will be removed by EPA and OSHA-approved methods with the ACM immediately placed in a lined, covered container when placed on ground level or removed from building. Proper signage is required. Notices and permits from the State of Kentucky and the Lexington-Fayette Urban County Government are required. FCPS will coordinate removal, manifests and testing. See FCPS Supervisor of Health, Safety and Environmental Compliance.
3. Contractors and Subcontractors involved in asbestos work shall have detailed written operating procedures describing techniques to be used as well as submitting an asbestos abatement plan to FCPS Risk Management for approval prior to commencing work.

## **DIVISION 3    CONCRETE**

### 03 05 00    COMMON WORK RESULTS FOR CONCRETE

1. Design and specifications for concrete shall be based on the recommendations of the American Concrete Institute (ACI) and ASTM testing requirements.
2. Concrete mixes and manufacture shall be appropriate to minimize the water added after leaving the plant. Only in special conditions or extreme weather shall water be added to concrete at the job site.
3. Installation of poured concrete shall be continuous. Cold joints shall be allowed only at the locations identified in the design. Unplanned cold joints are prohibited.
4. All building entrances shall have supported slabs in order to avoid heaving / binding.

### 03 30 00    CAST-IN-PLACE CONCRETE

1. Concrete will not be poured when air temperature is expected to fall below 40 degrees F within the first 72 hours after concrete placement. Comply with the provisions of ACI 306.1-90.
2. Maximum spacing for control joints shall be 20' for slabs. When possible, align joints with structural columns, wall corners, or other significant structural items.
3. At exterior locations, provide expansion joints and sealants at all subsurface structures, or adjacent elements such as bollards, light poles, signs, etc.

### 03 33 00    ARCHITECTURAL CONCRETE

1. Where concrete is intended to be a finish surface that is exposed to view, ensure that the specifications call for a sample panel to be provided for review. The panel shall be constructed in a manner to match actual construction and finish.

### 03 40 00    PRECAST CONCRETE

1. All precast concrete shall conform to the design standards from the ACI, ASTM requirements, and the Precast Prestressed Concrete Institute.

## DIVISION 4 MASONRY

### 04 01 20 MAINTENANCE OF UNIT MASONRY

1. For renovation projects, the existing masonry veneer shall be evaluated during the design phase to determine if cleaning and repointing are needed. Existing expansion and control joints shall be cleaned out and re-sealed as necessary when renovating exterior masonry.
2. The masonry restoration subcontractor shall submit references from a minimum of 5 previous, similar projects and resumes of all employees to be assigned to the project. The Project Foreman for the subcontractor is to have a minimum of ten years' experience with masonry restoration work of a similar type.
3. When exposed existing masonry walls are to remain during a renovation project, pay particular attention to ensure that areas where penetrations and or repairs are to occur match the existing brick and mortar color.

### 04 20 00 UNIT MASONRY

1. Provide a mock up panel of new exterior wall construction type as either a cavity wall as specified by the design team, or as an exterior ICF wall type, or as any other exterior wall type which has been reviewed and approved by the Director of FD&C based on the contract documents. The mock up shall include all pieces and parts as described by the contract documents. This will be used to establish a minimum quality standard for the remaining work. Provide a mock-up drawing in either the drawings or specifications for the general contractor to have a clear understanding. Include/call out all materials to be on the mock-up (not just masonry.)
2. Exterior brick shall conform to the requirements of ASTM C216 and shall be classified grade SW for durability. Exterior brick shall meet the appearance requirements of type FBX or FBS. Exterior brick shall be tested per ASTM C67 and given a rating of "not effloresced".
3. All control / expansion joints in the exterior of the building are to be located such that they are easily accessed for inspection and repairs. Do not locate control / expansion joints behind downspouts.
4. For Mortar, comply with ASTM C270 and Brick Institute of America (BIA) Technical Note 8A Proportion Specification. For masonry below grade or in contact with earth, use Type M mortar. For above grade structural bearing masonry, use Type S. For above grade non-structural brick and stone masonry use Type N. Concave mortar joints are preferred in all locations.
5. Flashing shall be copper, asphalt coated copper, stainless steel, or rubberized asphalt flashing material. Flashing is to be mechanically fastened to substrate for support. Adhesive attachment alone is not sufficient.
6. The use of cast stone is not allowed. Limestone may be used at approved select locations on the building's exterior such as windowsills, etc. Limestone shall be installed per the guidelines of the Indiana Limestone Institute. Ensure that stainless steel dowels, anchors and other accessories are used when detailing limestone.
7. Mortar netting shall be used in all wall cavities to prevent the buildup of mortar.
8. Show FD&C director actual samples of materials during design.
9. Coordinate location of the Knox Box (see Division 10 41 00.)

## **DIVISION 5 METALS**

- 05 05 00 COMMON WORK RESULTS FOR METAL
1. All steel at exterior locations, exposed to weather, or supporting veneers subject to weather shall be hot-dip galvanized. Whenever possible, hot-dip galvanizing shall be done after fabrication is complete.
  2. On all structural construction documents ensure that the weights of mechanical units are shown and coordinated with the Mechanical designer.
- 05 12 00 STRUCTURAL STEEL FRAMING
1. Exposed exterior steel shall be hot-dip galvanized in accordance with Standard Practice for Providing High Quality Zinc Coatings (Hot-Dip) ASTM A 385.
  2. Specify isolation coatings where dissimilar metals are in contact or where aluminum is in contact with concrete or limestone surfaces.
- 05 31 00 STEEL DECKING
1. Steel roof deck shall be designed in conjunction with the supporting structure to allow the roofing system to achieve the desired slope to drain without the use of a tapered insulation package.
  2. Steel roof deck shall be a minimum 20 gauge, G60 galvanized.
  3. Support of building infrastructure, ducts, cabling, piping, ceilings, light fixtures, etc. shall be prohibited from metal deck and shall only be from structural components.
  4. Roof curbs, equipment supports, and stub columns shall not bear directly on the roof deck but extend directly to the building structure or designed bearing member.
  5. All equipment, penetrations, or similar openings in metal deck shall be supported by a structural steel frame sized accordingly. Provide metal closure angles at all deck perimeters and penetrations.
- 05 51 00 METAL STAIRS
1. METAL LADDERS: Refer to Section 07 72 00 ROOF ACCESSORIES for information regarding roof access and roof ladders.
- 05 52 00 METAL RAILINGS
1. PIPE AND TUBE RAILINGS: At decorative railing systems, use of stainless steel and anodized aluminum is encouraged in order to avoid regular maintenance.
  2. All railings and handrails must be 100% welded at all joints and ground smooth. Fillers shall not be allowed unless used to smooth out grinding. All railing corners shall be radiused. Sharp edges, mitered corners or similar edges are not allowed.
  3. Handrails shall be designed to allow each bracket to be tightened or removed without removing the entire section of handrail. All exposed mechanical fastenings shall use flush, countersunk screws and bolts. Return to wall at each end and cap open sections.
  4. Utilize removable railings only where authorized by the Director of FCPS Risk Management and Safety.

## DIVISION 6 WOOD, PLASTICS, AND COMPOSITES

- 06 05 00 COMMON WORK RESULTS FOR WOOD, PLASTICS, AND COMPOSITES
1. Division 6 is **not** to be used for any items that are intended to be bid in the Manufactured Plastic Laminate Clad Casework (12 32 16) Alternate.
  2. Refer to Division 10 of the Building Components Requirements Manual (BCR) for information regarding Display Cases.
  1. Accommodate access to under-sink grease traps and plaster traps.
- 06 10 00 ROUGH CARPENTRY
2. Communications and electrical equipment backing panels are to be  $\frac{3}{4}$ " thick, fire retardant treated plywood. The plywood will be oriented vertically with the bottom edge located 6" above the finished floor. Panels are not to be painted.
  3. Please note that in Type I and Type II construction, concealed wood blocking, nailers, etc. need not be fire retardant treated (FRT). Concealed wood framing however must be fire retardant treated.
  4. All Pressure Treated (PT) wood components shall be separated from contact with adjacent metal components with 15# felt or some other permanent means such as self-adhering membrane flashing material. All anchors, fasteners, etc. in contact with pressure treated wood should be stainless steel or G90 hot-dipped galvanized.
- 06 40 00 ARCHITECTURAL WOODWORK
1. INTERIOR ARCHITECTURAL WOODWORK: This section is used primarily to delineate the requirements for interior standing and running trim, and pencil sharpening blocks (provide one per classroom).
  2. CHAIR RAILS: Use of chair rails on gypsum board in ALL rooms. Review with FD&C.
- 06 60 00 PLASTIC FABRICATIONS
1. SOLID SURFACING FABRICATIONS: The use of solid surfacing material at windowsills and wall caps is recommended where applicable. The material shall be premium grade and a minimum of  $\frac{1}{2}$ " thick with 1" thick built-up bull nose edges typical.

## **DIVISION 7 THERMAL & MOISTURE PROTECTION**

- 07 05 00 COMMON WORK RESULTS FOR THERMAL & MOISTURE PROTECTION
1. For new construction and renovation projects, all roofing shall be installed by a manufacturer's certified installer with a minimum of five years' experience installing the roof system specified. The installer shall be approved by the manufacturer and eligible for the specified manufacturer's warranty.
  2. In addition to the qualifications listed above, the installer's place of business shall be located within a 75-mile radius of Lexington as well as be a member in good standing with the Kentucky Roofing Contractors Association (KRCA) or the National Roofing Contractors Association (NRCA).
  3. Details at roof-to-wall intersections should allow for adequate flashing heights and future maintenance. Minimum flashing heights of 12 inches above the finished roof surface should be maintained at all wall, curb, roof penetrations, and under windows directly adjacent to roof surfaces.
  4. Roof walkway pads are to be provided around all roof top equipment, at roof ladders and adjacent to roof hatches. Providing a walkway pad 'access path' from each individual piece of roof top equipment or access point is not necessary.
  5. Obtain all roofing system components from or approved by roofing manufacturer.
- 07 11 00 DAMP PROOFING
1. CAVITY WALL CONSTRUCTION: Cold applied water-based emulsified asphalt damp proofing conforming to ASTM D 1227, Type II, Class I, Low VOC shall be used on the exterior face of interior walls in cavity wall construction where rigid insulation is being used. Where sprayed polyurethane foam insulation is being used, no separate damp proofing is required.
- 07 13 00 SHEET WATERPROOFING
1. SELF-ADHERING SHEET WATERPROOFING: All below grade exterior vertical and horizontal surfaces (including concrete foundation walls, elevator pits, mechanical pits and other similar below grade rooms) shall be waterproofed using a self-adhering modified bituminous sheet, drain tile system, and waterstops at joints. The warranty period shall be for five years from the date of project substantial completion.
- 07 19 00 WATER REPELLENTS
1. Exposed surfaces of exterior brick, concrete masonry, and precast concrete shall be coated with a penetrating water-based silane/siloxane water repellent. The product shall be colorless, non-staining, low VOC as well as vapor permeable to allow moisture to escape from inside the wall. All sealants are to be in place and thoroughly cured prior to application.
  2. Exposed surfaces of unpolished natural stone shall be coated with a penetrating modified siloxane water repellent. The product shall be colorless, non-staining, as well as vapor permeable to allow moisture to escape. All sealants are to be in place and thoroughly cured prior to application.



- 07 21 00 THERMAL INSULATION
1. ROOF DECK INSULATION: For Membrane Roofing Systems, install a roof cover board between the roofing membrane and the thermal insulation as recommended in the most recent edition of the NRCA Roofing Manual: Membrane Roof Systems. The cover board selected shall conform to the roofing system manufacturer's recommendations for the specific roofing assembly involved.
  2. SPRAYED INSULATION: The use of closed cell spray polyurethane foam in lieu of damp proofing and rigid insulation is encouraged at brick and CMU cavity wall construction. A minimum of 2" foam depth should be utilized in order to achieve an R-value of approximately 13. Areas where the foam was applied at a depth that interferes with the installation of the brick veneer or blocks the drainage plane shall have to be trimmed back as necessary. The cavity depth shall need to be adjusted to take into account the inherent non-uniformity of the spray foam insulation thickness. Architect to verify with current building code as this may change.
- 07 24 00 EXTERIOR INSULATION AND FINISH SYSTEMS
1. These materials are not to be used on FCPS projects without the express written consent of the Director of Facility Design and Construction.
- 07 26 00 VAPOR RETARDERS
1. A vapor barrier (as defined by ASTM F 1249) shall be installed at all below-slab conditions. Products shall provide less than 0.01 Perms as well as meet the requirements for strength under ASTM E 1745 Class A. Examples of acceptable products are: Stego Industries "Stego Wrap Vapor Barrier", W R Meadows "Perminator", and Raven Industries "VaporBlock VB15".
- 07 31 00 SHINGLES AND SHAKES
1. ASPHALT SHINGLES: Composition asphalt shingles shall meet the requirements set forth in ASTM D3462, and shall have a fire-resistant rating of UL Class A.
  2. Shingles shall have algae retardant surfacing material built in.
  3. Shingle underlayment shall be a self-adhering system similar to W.R. Grace Ice and Water Shield.
  4. Design and installation of asphalt composition shingles shall conform to the recommendations set forth in the current edition of the National Roofing Contractor Association's (NRCA) Steep-Slope Roof Systems manual.
  5. The manufacturer's warranty period for shingle roof systems shall be forty years minimum. Provide roofing installers' special project warranty on workmanship for a period of two years from the date of project completion
- 07 52 00 MODIFIED BITUMINOUS MEMBRANE ROOFING
1. A 2-ply SBS modified bituminous membrane roofing system corresponding to Tremco Basis of Design: Tremco Powerply Standard FR Cap Sheet; Comp Ply Base Sheet: Siplast Specification – 2030 IH-A, Johns Manville Specification 2FID / 2FID-SA/HW, Garland Versiply Mineral Cap Sheet with Viking CIF-2HM Base Sheet, or approved equal shall be utilized. ~~Both~~ All specifications require installation over insulation with the base sheet being applied in hot asphalt and the cap sheet being applied by adhesive, with all flashings to be installed with base sheet and cap sheet in cold adhesive.
    - a. Code adhesive systems should be used if buildings are occupied.
  2. Roof system minimum R-Value shall be R-30.

3. Where Polyiso insulation has been previously installed, an IR roof scan is required to determine if existing Polyiso Insulation can be re-used.
4. Minimum slope shall be ¼" per 1'-0". Slope is to be achieved by the roof framing members. On renovation projects where the existing structure is not sloped, the slope shall have to be achieved by tapered insulation.
5. Pitch pans / pockets are to be used only with prior approval from the Director, Facility Design and Construction. Items penetrating roofing must be flashed with a weatherproof sheet metal pitch pan filled with non-shrink grout and a pourable sealant. The detail shall include a sheet metal rain collar overlapping the penetration pocket below. Refer to National Roofing Contractors Association (NRCA) detail BUR-19 Penetration Pocket.
6. Perimeter edge flashing must be cleaned and primed with asphaltic primer as required in order to ensure a good seal between the metal and the roofing membrane.
7. No membrane roofing work shall be performed over areas occupied by students or school staff.
8. Fume recovery systems shall be utilized for all hot asphalt roof work.
9. Care should be taken so that membrane roofing systems do not extend further than 24" up the vertical side of parapets and walls. Vertical surfaces higher than 24" should utilize a rainscreen type wall system.
10. Lightweight insulating concrete roof deck systems are not to be used on FCPS projects without the express written consent of the Director of Facility Design and Construction.
11. Provide part-time roof inspections with corresponding daily field report from Roofing Material Manufacturer certified inspector as an alternate.
12. Provide manufacturer's twenty year no dollar limit full system warranty covering both materials and labor to start at substantial completion of the project.
13. Provide roofing installers' special project warranty on workmanship for a period of two years from the date of project completion.

07 57 00 COATED FOAM ROOFING is NOT allowed on FCPS projects.

07 61 00 SHEET METAL ROOFING

1. Structural standing seam sheet metal roofing shall consist of 22-gauge, aluminum-zinc alloy coated steel sheet pre-finished with a 2-coat fluoropolymer finish. Slopes shall not exceed those recommended by industry standards as well as the product manufacturer.
2. Flashing and trim pieces shall be formed of the same material and thickness as the roof panels.
3. Underlayment shall consist of a butyl-based self-adhering membrane system. Felt underlayment shall not be utilized.
4. Provide manufacturer's twenty-five-year full system warranty covering materials, labor and finish starting at the date of project completion.
5. Provide roofing installers' special project warranty on workmanship for a period of two years from the date of project completion.

07 71 00 ROOF SPECIALTIES

1. Copings shall consist of shop fabricated 22-gauge, aluminum-zinc alloy coated steel pre-finished with a 2-coat fluoropolymer finish.
2. Gutters and downspouts shall consist of shop fabricated 22-gauge, aluminum-zinc alloy coated steel pre-finished with a 2-coat fluoropolymer finish.

3. Downspouts shall be placed into cast iron shoes extending a minimum of 24" above the ground plane. Downspout shoes shall have an integral brass cleanout and a powder coat finish to match the color of the downspout.
4. Downspouts shall not discharge on to sidewalks, loading docks, parking areas, or any other areas of pedestrian traffic.
5. NO Strainers / screens shall be placed at all gutter / downspout junctures.
6. Gutters and downspouts shall be sized to handle an additional 50% capacity based on code requirements.
7. Provide manufacturer's twenty-year warranty covering both materials and finish to start at the date of project completion.

07 72 00

#### ROOF ACCESSORIES

1. **MANUFACTURED CURBS:** All roof top equipment shall be mounted on one-piece, self-flashing, pre-fabricated, insulated curbs. No rails, sleepers or leg supports shall be permitted. All rooftop equipment curbs shall be a minimum of 12" high above the roof surface to allow for proper flashing and shall be detailed such that water ponding does not occur adjacent to the curb. Do not locate roof curbs within 24" of parapets or roof edge. Installation of curbs shall be performed by a roof top equipment manufacturer certified roofing contractor.
2. **ROOF HATCHES:** Pre-fabricated roof hatches shall have double wall, insulated lids, frames, and a fully enclosed curb. Roof hatches shall be a minimum of 30" x 96" when serving an industrial stair and shall have stainless steel hardware as well as a 2-coat fluoropolymer finish.
3. **SNOW GUARDS:** All standing seam metal roofs are to have snow guards. Snow guards are to be non-penetrating and fastened to the seams of the metal roof. Snow guards shall be approved for use by the metal roofing system manufacturer however, plastic / polycarbonate snow guards are not recommended. Snow guards shall not be placed beyond the bearing wall.
4. **ROOF ACCESS:** Where possible, an industrial stair shall be provided for primary roof access. These stairs shall be a minimum of 2'-6" in width and shall not exceed a fifty (50) degree angle above horizontal. Provide a minimum of 6'-8" vertical clearance for the entire stair run. In renovation projects where there is restricted space, a ship's ladder may be used. Vertical ladders shall not be considered as a primary means of gaining roof access.
5. **ROOF LADDERS:** Roof ladders shall be provided where there is a difference in roof elevations of 24" or more. Roof ladders shall have a landing at the top and be a minimum of 24" in width. Roof ladders shall have continuous side rails that extend 42" above the landing. All applicable OSHA standards shall be followed.

07 92 00

#### JOINT SEALANTS

1. **INTERIOR:** Use a one-part silicone single component acrylic latex type suitable for application of paint.
2. **EXTERIOR:** FCPS prefers silicone joint sealants. Provide a one-part, non-sag, neutral cure, medium modulus, UV resistant, high performance silicone sealer for glazing and general weather sealing applications. Provide a one-part, non-sag, neutral cure, low-modulus / ultra-low modulus, UV resistant, high performance silicone sealer for high-movement expansion and control joints.
3. The Designer should include field-adhesion testing in the construction documents to ensure proper quality control of sealant installations.

4. Warranty shall be provided that the installer agrees to replace or repair joint sealants that do not comply with specified performance criteria for a period of five years.

## DIVISION 8 OPENINGS

### 08 05 00 COMMON WORK RESULTS FOR OPENINGS

1. It is important to consider that doors and windows are subject to vandalism and heavy usage. Safety, security and maintenance are the most important criteria for designing and specifying these components. Special consideration should be given to the size as well as location of windows and glazing. Larger sections of glazing are more difficult to maintain or replace than smaller sections.
2. Provide view lites in doors at all public access spaces including the main office, classrooms, cafeterias, media centers, gymnasiums, and corridors. All Classroom doors shall have a 3" x 33" minimum lite and maximum half-lite above hardware.
3. Consideration shall be given to providing "door-less" student ganged restroom entrances where possible. Sight lines shall be studied so that no views into the toilet area are allowed from the corridor.
4. Doors shall be 3'-0" in width by 7'-0" in height unless otherwise approved.
5. Doors at kitchen docks shall be 4'-0" in width by 7'-0" in height unless otherwise approved.
  - a. Provide and coordinate door bells and card readers at the kitchen delivery door.
6. Door frames with two door leaves requiring exit devices shall have key removable mullions.
7. In new construction projects it is preferred that classroom doors be recessed and swing outward from the classroom into a recessed alcove.
8. In renovation projects where it is necessary to install a new door into an existing hollow metal frame, keep the hand and swing of the new door the same as the door being replaced. When it is necessary to change the swing or hand of an existing door, it is recommended that the existing frame be removed and a new knock down frame be installed in its place.
9. Refer to current safety standards.

### 08 11 00 METAL DOORS AND FRAMES

1. HOLLOW METAL DOORS AND FRAMES: Interior metal doors shall be a minimum Level 2 and Physical Performance Level A, Model 2 – Seamless 18-gauge construction. Exterior metal doors shall be a minimum Level 3 and Physical Performance Level A, Model 2 – Seamless 16-gauge construction (based on ANSI/SDI A250.8-2003 Standards.) Both interior and exterior doors shall be composed of metallic coated (galvanized) sheet steel. Exterior metal doors shall be insulated with polystyrene core material.
2. Knock down frames are not acceptable in new construction projects. Their use in renovation projects shall need to be approved by the Director of Facility Design and Construction.
3. Exterior hollow metal frames shall be one-piece, welded frames of not less than 14 gauge hot-dipped zinc coated steel meeting ASTM A653 Commercial Steel, Type B with A60 metallic coating.
4. Interior hollow metal frames shall be one-piece, welded frames of not less than 16 gauge hot-dipped zinc coated steel.
5. In metal stud partitions, solidly pack mineral fiber insulation behind frames. In masonry and concrete walls, solidly fill frames with grout.

6. Acceptable manufacturers: Curries, Steelcraft, Ceco

08 14 00

#### WOOD DOORS

1. All wood doors shall be 1 ¾" thick to accommodate mortise locks. Classroom doors shall be solid-core construction, custom grade, and rotary sliced white birch with solid hardwood styles, lock blocks, and prepped with solid blocking for all thru bolt hardware. Doors shall be factory finished on all six sides and shall include a lifetime warranty for finish and warping. Doors shall meet the requirements of WDMA I.S.1A Performance Grade: Extra Heavy Duty.
2. Acceptable manufacturers: VT Industries, Eggers Industries, Weyerhaeuser, and Marshfield.

08 16 00

#### COMPOSITE DOORS

1. FIBERGLASS DOORS: Fiberglass Reinforced Polyester (FRP) flush doors shall be 1 ¾" thick. Acceptable manufacturers include Oldcastle, Tubelite and Special Lite. They shall be composed of extruded aluminum stiles and rails with a minimum 0.120" thick FRP face sheets with a pebble-like embossed finish and Mylar coating on faces. They shall include special built-in pocket on the strike side of door for a card reader. Provide a removable access panel adjacent to card reader located on the edge of door on the latch side. Color shall be uniform throughout. Core materials shall be poured in place polyurethane.
2. FRP doors shall be warranted against failure in materials, finish and workmanship for a minimum period of ten years.
3. FRP doors shall be used at exterior locations only as approved by the Director, Facility Design and Construction.
4. Samples:
  - a. Door: Submit manufacturer's sample of door showing face sheets, core, framing, and finish.
  - b. Color: Submit manufacturer's samples of standard colors of doors and frames.
5. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.
6. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
7. Door and frame components from same manufacturer.
8. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.
9. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
10. Handling: Protect materials and finish from damage during handling and installation.
11. Warranty doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
12. Warranty Period: Ten years starting on date of shipment. In addition, a limited lifetime (while the door is in its specified application in its original installation) warranty covering failure of corner joinery, core deterioration, delamination or bubbling of door skin.
13. Manufacturers are to be one of the following:
  - a. Special-Lite, Inc., PO Box 6, Decatur, Michigan 49045. Toll Free (800) 821-6531. Web Site [www.special-lite.com](http://www.special-lite.com). E-Mail [info@special-lite.com](mailto:info@special-lite.com).
  - b. Oldcastle

- c. Tubelite
- 14. Bottom of Door: Install bottom weather bar with nylon brush weather stripping into extruded interlocking edge of bottom rail.
- 15. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.
- 16. Face Sheet:
  - a. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout.
  - b. Protective coating: Abuse-resistant engineered surface. Provide FRP with SpecLite3 protective coating, or equal.
  - c. Texture: Pebble.
- 17. Core:
  - a. Material: Poured-in-place polyurethane foam.
  - b. Density: Minimum of 5 pounds per cubic foot.
  - c. R-Value: Minimum of 9.
  - d. ASTM E84: Class A.
- 18. Cutouts:
  - a. Manufacture doors with cutouts for required vision lites, louvers, and panels.
  - b. Factory install vision lites, louvers, and panels.
- 19. Hardware:
  - a. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
  - b. Factory install hardware.
- 20. Welding: Welding of doors or frames is not acceptable.
- 21. Applied Door Stops: 0.625-inch high, with screws and weather stripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
- 22. Field Fabrication: Field fabrication of framing using stick material is not acceptable.
- 23. Applied Stops: For side, transom, and borrowed lites and panels. Applied stops shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.
- 24. Hardware:
  - a. Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
  - b. Factory install hardware.
- 25. Anchors:
  - a. Anchors appropriate for wall conditions to anchor framing to wall materials.
  - b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
  - c. Secure head and sill members of transom, side lites, and similar conditions.
- 26. Side Lites:
  - a. Factory preassemble side lites to greatest extent possible.
  - b. Mark frame assemblies according to location.
- 27. HARDWARE
  - a. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
  - b. Factory install hardware.
  - c. Hardware Schedule: As follows with balance as specified in Section 08710 (08 71 00)
    - i. Hinges: SL-11HD continuous hinges by door manufacturer.
    - ii. Door Pulls: SL-82
    - iii. Mullions at pairs of doors: SL-60K.

- iv. Concealed Prox Reader Prep- one door at each opening.
  - v. Concealed adjustable bottom brush. Install door manufacturer's multidirectional adjustable bottom with double nylon brush weather stripping. Door bottom must be concealed and adjust to accommodate irregular tapered floor conditions.
  - vi. Concealed adjustable meeting stile astragal. Install door manufacturer's adjustable astragal with double pile and weather seal weather stripping
28. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.
  29. Ensure openings to receive frames are plumb, level, square, and in tolerance.
  30. Install doors in accordance with manufacturer's instructions.
  31. Install doors plumb, level, square, true to line, and without warp or rack.
  32. Anchor frames securely in place.
  33. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
  34. Set thresholds in bed of mastic and backseal.
  35. Install exterior doors to be weathertight in closed position.
  36. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
  37. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.
  38. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.
  39. Adjust doors, hinges, and locksets for smooth operation without binding.
  40. Clean doors promptly after installation in accordance with manufacturer's instructions.
  41. Do not use harsh cleaning materials or methods that would damage finish.
  42. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

08 31 00 ACCESS DOORS AND PANELS

1. Flush access panels shall be provided for required access above all gypsum board and other 'hard' ceilings and 'ganged' plumbing chases. Minimum size: 24" x 24". Where a 2' x 7' hollow metal door access is not available (22 05 00-2), provide a chase access panel in ganged restrooms. All access panels shall be provided with a vandal resistant latch.

08 33 00 COILING DOORS AND GRILLES

1. Exterior overhead coiling doors shall be a minimum of 1" thick and insulated to a minimum R value of 8. Doors shall be composed of galvanized sheet steel (minimum 20 gauge) with a baked on polyester finish that has a minimum finish warranty period of ten years. Door shall be rated for a minimum of 10,000 cycles. Architect to verify with current code requirements.
2. Interior overhead coiling door, frame, track, and hood in the Kitchen Dish Wash area shall be 20-gauge Type 304 stainless steel. Hardware to include locking device compatible with Best 7-pin cores with the exception of the Kitchen Dish Wash area grille, which is to have a manual slide locking mechanism.



- 08 41 00 ENTRANCES AND STOREFRONTS
1. ALUMINUM FRAMED ENTRANCES AND STOREFRONTS: Aluminum doors and frames shall be factory finished. Provide thermally broken construction at exterior locations. Wide stile design (over 4" wide) shall be used on entrance doors. Provide a mid rail located at the center of the exit device. Provide heavy duty metal hardware reinforcement. System finish shall be anodized (architectural class I) or a 2-coat fluoropolymer finish. Finish warranty period shall be for twenty years.
- 08 44 00 CURTAIN WALL AND GLAZED ASSEMBLIES
1. GLAZED ALUMINUM CURTAIN WALLS: Provide thermally broken construction at exterior locations. System finish shall be anodized (architectural class I) or a 2-coat fluoropolymer finish. Finish warranty period shall be for twenty years.
- 08 51 00 METAL WINDOWS
1. ALUMINUM WINDOWS: Windows shall be provided in each instructional space so as to allow natural light to enter the space. Windows may be provided in Computer Rooms, Band Rooms, and Gymnasiums but are not required.
  2. Instructional spaces shall have a minimum of 36 square feet of window space with a minimum area of operable sash equal to 2 percent of the net floor area. Art Classrooms shall have a minimum of 72 square feet of window space.
  3. In instructional spaces, the height of a windowsill shall be a minimum of 30" above the finished floor in order to allow for usable space below the window.
  4. Exterior windows shall be thermally broken and utilize low-e, clear insulated glass units that are vacuum sealed to prevent condensation.
  5. Aluminum window system finish shall be anodized (architectural class I) or a 2-coat fluoropolymer finish. Finish warranty period shall be for twenty years.
- 08 62 00 UNIT SKYLIGHTS
1. TUBULAR SKYLIGHTS: While roof penetrations and in particular, skylights are to be avoided, tubular daylighting systems can be utilized to provide natural daylighting into spaces as needed. These systems shall be composed of a transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, meeting with the acceptance criteria set forth in the latest edition of ICC AC16. These systems shall need to be dimmable from a switch mounted in the space.
- 08 70 00 HARDWARE
1. All hardware shall be specified and inspected (post installation after the building's HVAC system has been balanced) by an independent Architectural Hardware Consultant (AHC) as certified by the Door and Hardware Institute (DHI). The above consultant shall be a part of the Architect's design team.
  2. The hardware specifications shall be written by an AHC certified consultant who has no affiliations with any entities involved with bidding and supplying hardware materials. The hardware specification writer shall mark up a set of plans indicating the hardware to go on the doors at a meeting which is to include the architect, the access control system supplier, the electrical engineer, and a representative from FCPS Maintenance.
  3. The hardware supplier shall be an established contract hardware firm which maintains and operates an office, display, and stock in project area, and which is a factory authorized distributor and installer of the lock being furnished. The hardware supplier shall employ a certified Architectural Hardware Consultant.

4. The hardware suppliers Architectural Hardware Consultant shall coordinate the building keying schedule with the school principal/building manager or their designee, the key cylinder manufacturer, and a representative from FCPS Maintenance. A documented and signed agreement by all parties containing a floor plan indicating the key schedule for the building shall be utilized for ordering and installing the locking system. Copies shall be provided to all parties involved.
5. All Locks and Latches shall be provided by Best Access Systems, Schlage Commercial Lock Division, or Hager Commercial Locks and Hardware. Locks shall be capable of using the Best Keyway small-format IC, 7-pin cylinder factory keyed to FCPS existing master key system. Provide keyed brass construction cores for exterior door locks plus ten (10) extra for use by the General Contractor and ten extras for use by FCPS.
6. Hardware supplier shall provide three-cylinder change keys per cylinder, six (6) master keys per master, 25 uncombined cores and 100 blanks. A metal wall mounted key control cabinet shall be provided with a key capacity of 150% the number of locks.
7. All door closers shall be LCN 4041 series, Hager 5100 series, or Falcon Door Controls SC71 series. Sex bolts shall be utilized for fastening closers to doors.
8. All panic exit devices shall be Von Duprin XP99 series, Detex, Inc., or Hager model 4501. Do not utilize surface mounted or concealed vertical rods.
9. All Automatic Door Operators shall be electric powered, low-energy LCN Closer 4640 series, Hager, or Dor-O-Matic Senior Swing. Provide unit with a keyed switch utilizing the Best keyway small format IC 7 pin core.
10. All exterior doors are to have continuous hinges mounted 2" from the bottom edge of the door.
11. All permanent cores are to be handed over to FCPS Maintenance for installation.
12. All exterior doors (except for aluminum entry doors) shall have 12"h stainless steel kick plates installed on the push side only. All interior doors shall have 12"h stainless steel kick plates installed on both sides. Custodial closets shall have half height stainless steel armor plate installed on the push-side face of in-swinging doors and pull-side face of out-swinging doors.
13. Finish hardware, including electrified hardware, for wood, hollow metal, and aluminum doors are to be installed by personnel trained and certified by the manufacturer of the product furnished. Contractor is to provide certificates within 48 hours after receipt of bid.
14. Obtain each type and variety of door hardware from a single manufacturer.
15. See Division 10 41 00 (EMERGENCY ACCESS AND INFORMATION CABINETS) for Knox Box specifications.
16. A key box shall be provided in the project and hung in the building. Coordinate location with building principal, FD&C and Maintenance during construction.

08 80 00

#### GLAZING

1. Wired glass is not allowed.
2. Glass for exterior aluminum doors shall be ¼" thick laminated safety glass.

## DIVISION 9 FINISHES

### 09 05 00 COMMON WORK RESULTS FOR FINISHES

1. All materials, colors, finishes, product specifications, and details are to be reviewed and approved by the Director, Facility Design & Construction prior to the Documents being released for Bidding. It is the responsibility of the Architect to ensure that the review of materials, etc. is done in a timely manner so as not to adversely affect the project design schedule.
2. Ease of maintenance is an important consideration when specifying finishes. Architects should specify materials that require minimal maintenance from custodial staff. The use of special paint finishes or graphics that are considered difficult to maintain or repair shall not be specified.
3. Specifications should give preference to products that are GREENGUARD Children and Schools Certified.
4. FCPS intends for all new and renovated classroom instructional spaces to be designed to conform to ANSI S12.60 "Acoustical Performance Criterion, Design Requirements and Guidelines for Schools" without necessarily requiring the services of an acoustician to verify conformance. Instructional space design should take into account methods and materials that decrease the background noise levels, decrease reverberation times, and provide higher Sound Transmission Class (STC) ratings for surrounding partitions. One of the most important factors in lowering background noise is to locate noisy spaces away from instructional areas. Providing a higher Noise Reduction Coefficient (NRC) ceiling system will have a major impact on the overall reverberation time in a classroom. When gypsum board partitions are utilized around private offices, classrooms, conference rooms, bathrooms, and other acoustically sensitive spaces, the Architect is to detail the sound rated partition such that it is continuous to the roof or floor structure above. The Sound Transmission Class (STC) of a wall separating two adjacent classrooms shall be a minimum of 50.

### 09 22 16 NON-STRUCTURAL METAL FRAMING

1. Steel studs and runners shall conform to ASTM C645 and be a minimum 20 gauge for interior studs and a minimum 18 gauge for exterior studs.
2. All steel framing shall be composed of galvanized sheet steel.

### 09 29 00 GYPSUM BOARD

1. All gypsum wallboard shall be 5/8" thick type X. (Gypsum ceiling board may be 1/2" in thickness as long as it meets the sag resistance requirements set forth in ASTM C1396 as well as any code requirements.) Gypsum board partitions are preferred in administrative office areas. If gypsum board partitions are used in restrooms, moisture resistant gypsum board shall be specified. Gypsum board ceilings are preferred in ganged student restroom spaces in Middle and High Schools.
2. When gypsum board partitions are located in high traffic areas and / or areas that are prone to abuse, the Architect shall specify high impact resistant gypsum board partitions that conform to ASTM C 1629, Level 2 criteria. High impact gypsum board shall be utilized from the floor level up to a minimum of 8'-0" above the floor in the locations noted above.

09 30 00

#### TILING

1. CERAMIC TILING: All restrooms shall have epoxy painted CMU or ceramic tile on the “wet” wall at a minimum. All shower enclosures are to have ceramic tile floors and walls.
2. All floor tiles shall be non-slip and rated for heavy use. All floor tile grout shall be sealed. In shower areas and other areas that are frequently wet, floor and wall tile grout shall be sealed.
3. Specify an epoxy grout at all ceramic tile floors.
4. QUARRY TILING: Extruded, unglazed quarry tile and base meeting the requirements of ANSI A137.1 are preferred in the Kitchen area. While it is not necessary to use a recessed slab and thick set mortar application, ensure that the threshold transition between the tile flooring and adjacent flooring meets accessibility requirements. Ensure that the specified quarry tile has a minimum coefficient of friction (based on ASTM C1028 testing) of 0.8 dry and 0.7 wet. Color shall be Summitville Rd. Specify a three-part 100% solids epoxy grout system in Kitchens that meets the requirements of ANSI A118.3 and is approved by the USDA for use in Kitchens.

09 51 00

#### ACOUSTICAL CEILINGS

1. ACOUSTICAL PANEL CEILINGS: Install acoustical panel ceilings in accordance with ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems.
2. In addition to the requirements above, ceiling suspension assemblies shall be supported directly from the building structure and shall be supported at all four corners of light fixtures. The underside of roof deck is not to be used for supporting acoustic ceiling systems or light fixtures.
3. Acoustic ceiling panels in instructional spaces are to be classified according to ASTM E1264 as Type III, Forms 2 or 4 and have a minimum Noise Reduction Coefficient (NRC) of 0.70, a minimum Ceiling Attenuation Class (CAC) of 35, zero VOC, a Flame Spread Classification of Class A, and a minimum Light Reflectance value of 0.80. Panel size shall be 24” x 24”. The basis of design shall be Armstrong Fine Fissured Item #1713.
4. Acoustic ceiling panels in Kitchen spaces are to be classified according to ASTM E1264 as Type XX and have a minimum Ceiling Attenuation Class (CAC) of 35, a Flame Spread Classification of Class A, and a minimum Light Reflectance value of 0.70. Panel sizes are to be 24” x 24”. Panels must meet USDA/FSIS requirements for food processing areas. The basis of design shall be USG’s Sheetrock Lay-In Clima Plus Ceiling Panels Item #3260.
5. Ceiling grids shall be no closer than 6” below the closest structural, mechanical, plumbing or electrical element located in the plenum space.
6. Ceiling suspensions systems shall comply with the requirements of ASTM C635. Use of concealed grid systems, such as tee-and-spline systems is not acceptable.
7. Ceiling suspension systems shall use USG’s Donn DX/DXL as a basis of design. The color shall be white.
8. Support of ceiling mounted objects such as exit lights, light fixtures, speakers; signage, etc. shall have independent supports and shall not be secured to the ceiling tile.
9. Acoustic panels shall be square lay-in profile only. The color shall be white.

09 60 00

## FLOORING

1. The Architect shall specify critical flooring substrate conditions appropriate to the material being specified. Standard testing methods for determining relative humidity and alkalinity in ALL concrete floors shall be included in the specifications. Ensure that relative humidity testing using in situ probes per ASTM F2170 are required in the specifications. The Architect shall outline the Contractor's responsibilities for conducting the tests prior to installation as well as remediation procedures if substrates do not conform to the standards specified. FCPS requires that relative humidity testing be completed and the results issued to the Architect prior to any resilient flooring, carpet and epoxy terrazzo product being installed.
  - a. Relative humidity testing can be done prior to bidding, if needed. Coordinate with Director of FD&C.
2. FCPS requires that the manufacturer's representative provide onsite training to the installer for a minimum of 800 sf per material used. This area will then become the standard for the remaining installation. This requirement applies to all resilient flooring products as well as modular carpet.
3. Ensure that the guidelines in ASTM F710 are specified and followed during construction. Specifically, that existing concrete substrates must be "free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive remover, curing, sealing, hardening, or parting compounds, alkaline salts, excessive carbonation or laitance, mold, mildew, and other foreign materials that might prevent adhesive bond."
4. All resilient floors shall be installed only after the building's HVAC system is in operation and the flooring material has acclimated for a minimum of 48 hours or for the specified time period listed per the flooring manufacturer's recommendations.
5. In order to address the issue of "wet" concrete floor slabs, special attention is required by the Architect to ensure that the proper adhesive is specified / used for the particular flooring product.

09 64 00

## WOOD FLOORING

1. WOOD ATHLETIC FLOORING: Provide  $\frac{3}{4}$ " thick by 2  $\frac{1}{4}$ " width northern hard maple strip flooring, MFMA Grade Second and Better over a sleeper / subfloor system in a recessed concrete slab. Provide a 3" x 4" vented rubber base at the floor / wall intersections. Wood flooring system shall be specified to meet DIN requirements. Contract Documents are to indicate painted court line marking locations.
2. Provide  $\frac{3}{4}$ " thick white pine edge grain strip flooring at Middle and High School Stage Platform floors over a sleeper system with rubber or neoprene pads. Stages shall have a maple stage nosing.

09 65 00

## RESILIENT FLOORING

1. RESILIENT BASE AND ACCESSORIES: Resilient base shall comply with ASTM F 1861, Type TP (rubber, thermoplastic), Group 1 (solid), 1/8" gauge and 4" high with preformed inside and outside corners. Specify strips in lieu of rolled base. Typically, a cove base is used at resilient flooring and concrete floors and a straight base is used at carpeted locations. Acceptable manufacturers include Johnsonite, Mannington, Roppe, and Flexco.
2. RUBBER TILE FLOORING: Rubber tile flooring shall have an overall thickness of 0.125" minimum. The hardness shall not be less than 75 Shore A with a Static Load Limit – Residual indentation not greater than 0.005" per ASTM F 970 at 250 psi. Flooring shall be slip resistant (> 0.8), PVC free, resistant to bacteria, fungi, and micro-

organism activity according to ASTM E2180 and G21. Rubber tile flooring shall have a five-year limited wear warranty. Architects are to specify that adhesives used for rubber tile flooring meet a minimum Relative Humidity (RH) as required by manufacturer. Acceptable manufacturers include Johnsonite, Mannington, Nora, Roppe and Flexco.

3. RESILIENT TILE FLOORING: Luxury Vinyl Tile (LVT) shall meet the requirements of ASTM F1700, Class 3. Architects are to specify that adhesives used for LVT flooring meet a minimum Relative Humidity (RH) as required by manufacturer. Acceptable manufacturers include Armstrong, Shaw, and Mannington.
4. RESILIENT ATHLETIC FLOORING: Athletic flooring material shall be a sheet vinyl sports flooring with an overall thickness not less than 7mm and a wear-layer thickness not less than 1.3mm. The backing layer shall be high density closed-cell foam. The wear layer shall be factory treated with a UV cured polyurethane finish. In addition, the flooring shall be factory treated with a fungicidal / anti-microbial. The sports flooring shall have minimum shock absorption (per EN14808) of 29% as well as a ball rebound (per EN 12235) of greater than 90%. Warranty for materials shall be for a minimum of two years and wear shall be for a minimum of fifteen years. Ensure that a "BleacherBlok" permanent indentation system is used where bleacher loads require. Acceptable manufacturers include Taraflex Sport M plus, Tajima Sport Performance 70, and Mats, Inc. Woodflex Extreme.

09 66 00

#### TERRAZZO FLOORING

1. RESINOUS MATRIX TERRAZZO FLOORING: When specifying a thin-set epoxy terrazzo flooring system, ensure that the concrete substrate is tested to verify that the moisture vapor transmission doesn't exceed the thin-set epoxy terrazzo flooring system manufacturers' recommendations.
2. The basis for design is General Polymers Thin-set epoxy terrazzo flooring system #1100 with a 3/8" nominal thickness. The use of a crack bridging membrane is recommended.
3. Terrazzo flooring shall be sealed using two coats of a low VOC acrylic sealer recommended by the manufacturer.

09 68 00

#### CARPETING

1. TILE CARPETING: Modular carpet shall be a tufted, level or multi-level loop pile. Fiber type shall be a type 6, 6 nylon or a type 6 nylon. Carpet shall have a minimum pile weight of 18 oz / sq yd. The carpet shall be rated for a minimum of Heavy Traffic end use ( $\geq 3.0$  ARR) according to the Texture Appearance Retention Rating System (CRI TM101). The Carpet shall as a minimum pass the British Spill Test. Moisture Penetration by Impact Test: No penetration of backing after 5,000 impacts at 10 psi. The modular carpet shall be warranted for wear, edge raveling, de-lamination, shrinkage for a minimum of fifteen years. The modular carpet shall be warranted for staining for a minimum of fifteen years. All modular carpet tiles shall be installed with direct glue-down application using a pressure sensitive release adhesive per the manufacturer's recommendation. Acceptable modular tile manufacturers are: Interface, Lees, Mannington, Shaw, Tandus, and Patcraft.
2. SHEET CARPETING: Broadloom carpet shall be a tufted, level or multi-level loop pile. Fiber type shall be a type 6, 6 nylon or a type 6 nylon. Carpet shall have a minimum pile weight of 20 oz / sq yd. The carpet shall be rated for a minimum of Heavy Traffic end use ( $\geq 3.0$  ARR) according to the Texture Appearance Retention Rating System

(CRI TM101). The carpet primary backing shall be a tufted 100% woven or non-woven synthetic. The secondary backing shall be a high-performance latex or equivalent. The broadloom carpet shall be warranted for wear, edge raveling, de-lamination, shrinkage for a minimum of fifteen years. The broadloom carpet shall be warranted for staining for a minimum of fifteen years. All broadloom carpet shall be installed with direct glue-down application using adhesive per the manufacturer's recommendation. Acceptable broadloom carpet manufacturers are: Interface, Lees, Mannington, Shaw, Tandus, and Patcraft.

3. Carpeting shall be installed by an experienced installer who is Certified Floor covering Installer (CFI) Certified C-2, Master or higher. This installer must be on site and actively engaged with the installation process.
4. All carpeting must be eligible for recycling by the supplying mill to an existing operational third-party certified recycling center. Landfills are not an option.
5. Used carpet shall be removed and recycled regardless of manufacturer, fiber type or construction. Reclamation agency and carpet remover shall verify in writing that used carpet was removed and recycled. Landfills are not an option.
6. The preference is for modular carpet over broadloom carpet for replacement ease and longevity. If there is a need for both modular and broadloom carpet on a particular project, both types of carpet shall be from the same manufacturer.

09 80 00

#### ACOUSTIC TREATMENT:

1. In new construction projects it is FCPS's preference for an acoustical type metal deck to be used as a major component in controlling reverberation times in large volume spaces such as Cafeterias, Gymnasiums and in some cases Media Centers. These spaces may require additional sound control products in addition to the acoustical deck in order to achieve a desirable reverberation time. In renovation projects where no existing acoustical deck has been used previously, it shall most likely be necessary to provide a suitable combination of sound absorption materials such as sprayed acoustic insulation on the underside of the existing metal roof deck, fixed panels or baffles hung tight to the structure. Acceptable sprayed acoustic insulation products include K-13 by International Cellulose and Acoustement Plaster 20 by Pyrock. Acceptable fabric-wrapped sound absorptive panel products include Colorsonix by MBI and HardSide by Kinetics Noise Control. Acceptable acoustic baffles include Cloud-Lite by MBI or KB-803 by Kinetics Noise Control, Acoustical Solutions, Inc., Armstrong World Industries, or Golterman & Sabo.

09 90 00

#### PAINTING AND COATING:

1. The painting contractor shall have a minimum of five years proven satisfactory experience and shall be required to show proof before commencement of work that he / she will maintain a qualified crew of painters throughout the duration of the work.
2. When requested by the Architect, the painting contractor shall provide 24" (min.) square samples of the requested paint with the specified gloss / sheen and textures for review and approval.
3. Perform no painting work when the ambient air and substrate temperatures are below 50° F for both interior and exterior work. Perform no painting work when the maximum moisture content in the substrate exceeds 12% for concrete and masonry, 15% for wood, and 12% for plaster and gypsum board. Concrete and masonry surfaces must be installed at least 28 days prior to painting work and visually dry on both sides.
4. Ensure that a five-year manufacturer's warranty for paints and coatings is specified.

5. Acceptable manufacturers include Sherwin-Williams, PPG / Porter, and Ferrell Calhoun.
6. The Architect shall be responsible for ensuring that all substrates scheduled for painting are properly identified and specified. For example, in many renovation projects that utilized a glazed structural tile wainscot / base on the interior of corridors, the condition of this surface must be examined thoroughly as well as proper surface preparation specified to ensure that a new paint finish will adhere to the existing finish.
7. Preference should be given to paints that are low odor / low VOC.
8. Special attention should be paid to high traffic and high exposure areas in schools such as corridors, kitchens, ganged restrooms, and gymnasiums. Consideration should be given to high performance paints that are extremely durable and scrub resistant. Examples include epoxy and some acrylic paints. Generally speaking, walls should be either an eggshell or semi-gloss finish. Painted ceilings should be a flat finish. All metal doorframes should be alkyd enamel with a semi-gloss finish.



## DIVISION 10 SPECIALTIES

### 10 11 00 VISUAL DISPLAY UNITS

1. Marker boards and Tack boards shall be sized per the FCPS Facility Programming Specifications. All boards shall be mounted using continuous 'Z' brackets at the top and 'L' brackets at the bottom. No glue shall be allowed for any installation. The height of the board above the finish floor shall be dependent on the layout of the room and its use. In Elementary Schools, the height from the finished floor to the bottom of the board shall be 24" at teaching wall locations and 32" at all other locations. In grades 6 through 12 the bottom of the board shall be mounted at 32" above the finished floor.
2. Marker boards shall be white porcelain enamel steel with mitered square corners and aluminum trim. Marker boards shall have a continuous, solid box type chalk tray with ribbed tray and end closures, as well as a top mounted integral 1" map rail with cork insert and a flag holder (Ghent Model FH1 or approved equal) mounted to the map rail. There shall need to be one flag holder per room. Provide Map Holders (Ghent Model MH1 or approved equal) for every 48" of map rail provided.
3. Tack boards shall have a natural cork tack assembly with mitered square corners and edges concealed by aluminum trim.
4. One 6' wide x 4' high Tack board shall be mounted on the exterior of instructional spaces a minimum of 36" from the edge of the door. A 4' wide Tack board may be used in lieu of a 6' wide where space is limited. The use of display rails in corridors is prohibited.

### 10 12 00 DISPLAY CASES

1. Display cases are to be located near the primary entrance to the building in a public corridor / entrance lobby and are to be integrated into the overall design of the building. Display cases should be recessed into the wall where possible. When it is not feasible to recess the display case, ensure that the materials used at the base of the case protrusion are water / moisture resistant.
2. For Elementary Schools, provide a maximum of 12 linear feet of display space. For Middle Schools, provide a maximum of 16 linear feet of display space. For High Schools, provide a maximum of 20 linear feet of display space.
3. Display cases shall have a tack board assembly on the back inside surface as well as tempered glass doors that are lockable. Shelves shall be tempered glass on adjustable shelf standards.
4. Display cases shall be internally illuminated with a concealed top lighting system.

### 10 14 00 SIGNAGE

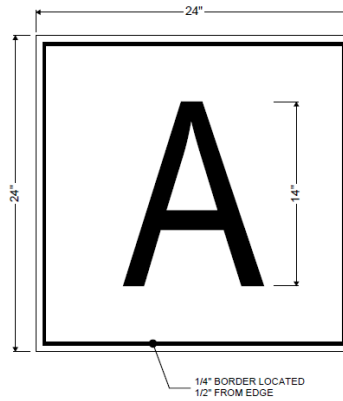
1. PLAQUES: Building plaques are to be located in the interior primary entrance lobby to the facility. Plaques are to be 18" w x 24" l and be cast bronze alloy. Coordinate with FCPS Facility Design & Construction for sign verbiage and design. See attached Appendix A.
2. DIMENSIONAL LETTER INTERIOR SIGNAGE: All interior signage shall be included by the design team in the project.
  - a. Material: shall be of an acrylic material (ASTM D4802 or the most up to date standard for this material) with ¼" rounded edges.
  - b. Application:
    - i. "Liquid Nails" adhesive on CMU walls
    - ii. Double-sided "3M" tape on gypsum walls

- iii. Room plaque signs mounted on glass shall have a blank on the back of matching material that is in alignment.
- c. A signage schedule (example below) should be included in the bidding documents either on the drawings or in the specifications.

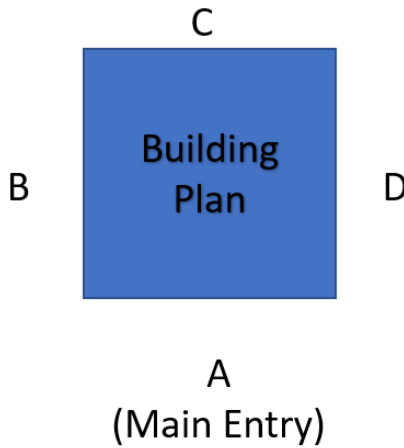
TATES CREEK HIGH SCHOOL - BUILDING SAFETY SIGNAGE SCHEDULE												
SIGN NO.	QUANTITY	EXTERIOR				INTERIOR				DOOR NO.	REMARKS	
		SIZE	COLOR	MATERIAL	MOUNTING	SIZE	COLOR	MATERIAL	MOUNTING			
1A	1	18 X 18	GREEN	VINYL FILM	GLASS	1	18 X 18	GREEN	VINYL FILM	GLASS	D.1 / D.2	
2A	1	12 X 12	BLACK	ALUMINUM	BRICK	1	12 X 12	BLACK	ALUMINUM	CMU	E106.1	
3A	2	18 X 18	GREEN	VINYL FILM	GLASS	2	18 X 18	GREEN	VINYL FILM	GLASS	F1.4 / F1.5 / F1.6	
4A	1	12 X 12	BLACK	ALUMINUM	BRICK	1	12 X 12	BLACK	ALUMINUM	CMU	F003.3 / F003.4	
5A	1	12 X 12	BLACK	ALUMINUM	BRICK	1	12 X 12	BLACK	ALUMINUM	CMU	F003.1 / F003.2	
6B	1	12 X 12	BLACK	ALUMINUM	BRICK	1	12 X 12	BLACK	ALUMINUM	CMU	B1.3	
7B	1	12 X 12	BLACK	ALUMINUM	BRICK	1	12 X 12	BLACK	ALUMINUM	CMU	B1.2	
8B	1	12 X 12	GREEN	ALUMINUM	BRICK	1	12 X 12	GREEN	ALUMINUM	CMU	B3.2	
9B	1	18 X 18	BLACK	ALUMINUM	BRICK	1	12 X 12	BLACK	ALUMINUM	CMU	ST-F2.B	
10B	1	12 X 12	GREEN	ALUMINUM	BRICK	1	12 X 12	GREEN	ALUMINUM	CMU	B6.2	
11B	1	12 X 12	BLACK	ALUMINUM	BRICK	1	12 X 12	BLACK	ALUMINUM	CMU	B7.2	
12B	1	12 X 12	BLACK	ALUMINUM	BRICK	1	12 X 12	BLACK	ALUMINUM	CONCRETE	B8c	Include Text "Mechanical" on exterior sign
13B	1	12 X 12	RED	ALUMINUM	BRICK	1	12 X 12	RED	ALUMINUM	CMU	B9.1	Include Text "Storage" on exterior sign

- d. Standard naming of rooms includes the following (unless there is a conflict in the most current building code being used on the project):
  - i. CLASSROOM (*Typical and resource rooms*)
  - ii. ART
  - iii. MUSIC/BAND/ORCHESTRA
  - iv. PRINCIPAL (This is the only office that is named).
  - v. OFFICE
  - vi. TOILET
  - vii. STAFF TOILET
  - viii. GIRLS TOILET
  - ix. BOYS TOILET
  - x. GENDER NEUTRAL/ALL GENDER RESTROOM
  - xi. No *Abbreviations* when it come to the actual signs
    - a) For example, if EMR on floor plans, then the sign should read "ELEVATOR MACHINE ROOM"
  - xii. Provide all code required signs such as:
    - a) EXIT (non-lighted)
    - b) SPRINKLER ROOM (red sign with white lettering)
    - c) STAIR
    - d) ROOF ACCESS
- 3. BUILDING ADDRESS SIGNAGE: The building address numerals shall be a minimum of 10" h aluminum and permanently mounted to the building's exterior within view from the main street for fire department visual identification. Numerals may be larger if aesthetically pleasing.
  - a. Verify location and size requirement of building address numerals with local safety officers, fire and emergency management.
- 4. POST AND PYLON SIGNAGE: All exterior street, road and parking signage shall conform to the specifications set forth in the latest edition of the Federal Highway Administration's Manual on Uniform Traffic Control Devices.
- 5. EXTERIOR SCHOOL MARQUEE: See attached Appendix B.
- 6. SAFETY SIGNAGE: There are two types. They include building side identification and door signage. Provide plans, elevations, and a signage schedule to review with FCPS FD&C and FCPS School Police office before the project goes out to bid for the following:

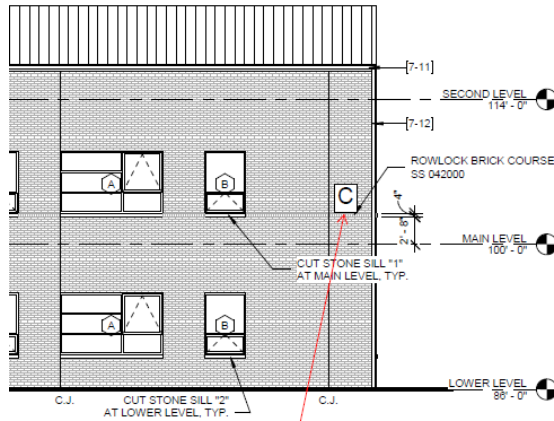
- a. All signage font shall be Helvetica Condensed Bold.
- b. Building Side Identification (24" x 24") on exterior face of building.
  - i. Shall be aluminum with black text and border.



- ii. No matter the shape of the building, each side of the building should be labeled as if it is a rectangle. Start with Main entry of building as side "A." Then move clockwise around the building to side "B," "C," and "D."

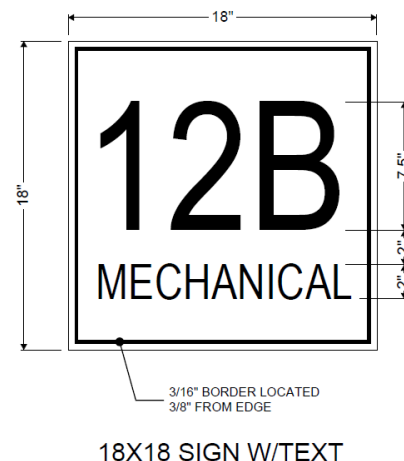
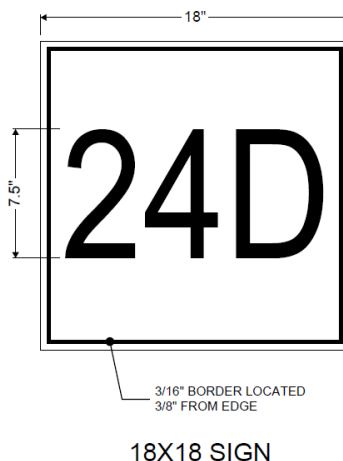
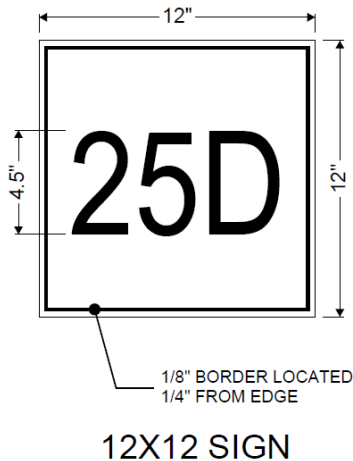


- iii. Mounting heights should be reasonable and readable.

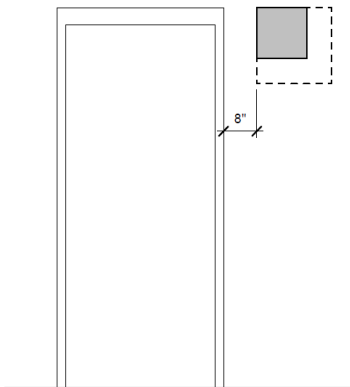


ALIGN BOTTOM OF SIGN WITH  
BOTTOM OF WINDOW AND 2'-0"  
AWAY FROM CORNER.

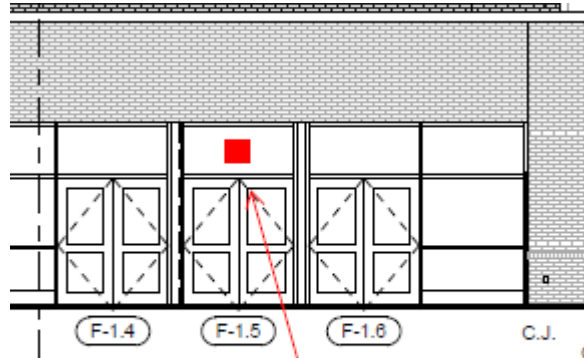
- c. Door safety signage colors shall be black, red (standard highway series red ink), or green (standard highway series green ink) and should be indicated on the Signage Schedule.
  - i. The green indicates that door is a main entrance and provides a quicker access to main corridors/hallways.
  - ii. The black indicates that the door can provide access to the rest of the building, but that one would need to travel through other doors to get to the rest of the building.
  - iii. The red indicates that door does not provide access to the rest of the building. An example of this could be a mechanical room that only has that exterior door as its access.
- d. Install door signage (12" x 12" or 18" x 18") at every exterior door on both the exterior and the interior of the doors leading to the exterior.
  - i. Exterior Door Signage shall be aluminum or vinyl with black, red, or green text and border as indicated in signage schedule.
  - ii. Text to be included will only be needed for "MECHANICAL" or "STORAGE" spaces.
  - iii. 18" x 18" is used when there is a storefront system or canopy that will require the vinyl sign to be mounted above the door or canopy so that it can be seen.



ALIGN TOP OF 12X12 OR 18X18 ALUMINUM SIGNS WITH TOP OF DOOR FRAME AND LOCATE 8" FROM FRAME UNLESS NOTED OTHERWISE.



TYPICAL EXTERIOR DOOR SIGNAGE MOUNTING



3A  
CENTER IN GLASS  
ABOVE CENTER DOOR

- e. ALUMINUM SIGNS - Building-mounted aluminum signs shall be 0.080 sheet thickness with rounded corners. Numbers and borders shall be direct print engineer grade reflective sheeting 3200 series with UV protection. Attach aluminum signs to masonry with stainless steel bolts and/or screws to be tamper resistant with lock nuts. Attach aluminum interior signs to CMU or gyp. board with cement tape with professional silicone.
- f. VINYL SIGNS - Glass-mounted vinyl signs shall be printed vinyl film signage on 3M opaque engineer grade reflective sheeting 3200 series with added UV protection. Mount vinyl signs to windows where indicated. Where window mounted signs are installed on both sides of a window, align signs as closely as possible.

10 21 13 TOILET COMPARTMENTS

- 1. Toilet compartments and urinal privacy screens shall be constructed of 1" thick solid high-density polyethylene (HDPE) and shall be floor mounted and overhead braced. Mounting to walls shall be provided by a continuous bracket. Hardware specified shall be heavy duty and utilize theft resistant thru-bolt construction. Pilaster shoes and sleeves shall be stainless steel. Acceptable manufacturers include products by Scranton, Hadrian, Ampco or approved equal.

10 22 13 WIRE MESH PARTITIONS

- 1. Wire Mesh Partitions are utilized mainly to separate the kiln from the adjacent storage area for security and safety concerns. The height of the panels shall be a minimum of 8'-0" above the floor and shall have a 3'-0" wide out swinging door with a lever handle and cylinder lock core keyed to match building master key system.

10 22 39 FOLDING PANEL PARTITIONS

- 1. Folding panel partitions are recommended for use only at the cafeteria side of a combination gymnasium / cafeteria stage. Folding panel partitions are to be manually operated, individual panels with a STC rating of not less than 50. The suspension system used shall be by overhead supported suspension tracks. Acceptable manufacturers include Hufcor, Modernfold, and Panelfold.

10 26 13

#### CORNER GUARDS

1. Corner guards shall be utilized at all gypsum board partition corners that are located in high traffic areas. Position corner guards 4" above the finish floor and be 48" in height typically. Corner guards are to be rigid vinyl composition and utilize a continuous retainer screwed into the steel studs. Corner guards shall have end caps top and bottom. Acceptable manufacturers include Arden Architectural Specialties, Construction Specialties, or InPro Corporation.

10 28 13

#### TOILET ACCESSORIES

1. Toilet Tissue Dispensers are to be provided by the Owner and installed by the General Contractor. See Appendix C for current model #s and specs.
2. Paper Towel Dispensers are to be provided by the Owner and installed by the General Contractor. See Appendix C for current model #s and specs.
3. Soap Dispensers are to be provided by the Owner and installed by the General Contractor. See Appendix C for current model #s and specs.
4. A folding type shower seat is required in both standards roll-in showers and alternate roll-in shower configurations where the seat extends into the minimum clear inside dimensions. In private showers accessed through a private office such as the Coach's Office, a shower seat shall not be provided. However, reinforcement shall be installed so that a compliant shower seat may be installed at a later date if needed. Verify weight capacity of shower seat. This may need to increase in a middle or high school.
5. Sanitary Napkin Disposal units shall be provided and installed by the Contractor. Units shall be partition mounted when possible (Basis of Design: Bobrick B-354) and recessed where partition mounting is not an option (Basis of Design: Bobrick B-353). Sanitary Napkin Disposal units shall be provided in Elementary School, Middle School and High School girl's public restrooms as well as women's and unisex facilities.
6. Grab bars shall be made of 18-gauge, type 304 stainless steel tubing welded to 1/8" thick type 304 stainless steel flanges. Grab bars shall be capable of supporting loads in excess of 900 pounds as well as meeting the structural strength requirements of the Americans with Disabilities Act (ADA). Grab bars shall have 22-gauge type 304 stainless steel snap flange covers to conceal mounting screws.
7. Mirrors shall have a stainless steel channel frame with mitered corners. Mirrors shall be mounted on a concealed galvanized wall hanger. Glass in mirrors shall meet the requirements of ASTM C1036. See Appendix D for mirror configuration with soap dispensers.
8. Warm-air electric dryers shall be installed in each public restroom facility. The basis of design is Excel Dryer Inc. "Xlerator" with electrostatically applied, chip resistant paint on rust resistant steel housing. Standard features include a noise reduction fixed nozzle and a recess kit for ADA compliancy as required. Additional approved manufacturer include: VERDEdri, Hi-Speed Surface-Mounted ADA Compliant Hand Dryer
9. Provide one stainless steel mop and broom holder at each custodial closet directly over the janitor's sink. (Basis of design: Bobrick B-223 x 36.)
10. Contractor to send Toilet Accessory Request Form during construction to FD&C. See Appendix E.

10 41 00

#### EMERGENCY ACCESS AND INFORMATION CABINETS

1. Each building shall have an emergency access key vault located within 10' of the main entry. The key box is contractor provided and installed and shall be mounted 6' above

grade in a recessed mount. Basis of design is Knox Co. Knox-Vault **Dual** Lock Model #4446, dark bronze (along with the recessed mounting kit #4470.) See Appendix F. The Division of Maintenance shall obtain waiver documents for LFUCG Fire Department approval.

10 44 00

#### FIRE PROTECTION SPECIALTIES

1. FIRE PROTECTION CABINETS: Fire extinguisher cabinets shall be recessed where possible and have an anodized aluminum finish and narrow vertical safety glass door glazing. All cabinets shall be labeled "FIRE EXTINGUISHER" in vertical aligned red lettering.
2. FIRE EXTINGUISHERS: Multi-purpose dry chemical fire extinguishers rated for use on Class A, B and C fires shall be used throughout the building (except for the Kitchen area) as required. Units shall have a 10-pound capacity and be located in fire protection cabinets when in public view. Kitchen areas shall be equipped with wet chemical units designed specifically for kitchen grease fire hazards and meet the K-Class listing now required. Units shall have a 6-liter capacity and be wall mounted as required.
3. A UL approved Class C fire extinguisher shall be wall mounted just inside the door of each Communications room.
4. In renovation projects, all fire extinguishers shall be replaced with new units and the building shall be brought up to current National Fire Protection Association (NFPA) requirements for portable fire extinguishers.

10 51 00

#### LOCKERS (During design, review if lockers are still used by the school.)

1. METAL LOCKERS: All lockers shall be detailed so that they sit 8" above the finished floor on a concrete masonry unit base. The base shall be recessed back from the face of the metal lockers 1/2" typical. All metal lockers shall have a sloped top profile. Lockers shall be anchored per manufacturer's recommendations and have a baked enamel finish.
2. Wardrobe lockers for student use shall be 12"w x 12"d x 72"h, two-tiered construction with continuous side mounted hinge and recessed handle with integral combination lock.
3. Wardrobe lockers for staff use shall be same as that for student use with the exception that they shall be single tiered construction and 60" in height. Typically, these are for kitchen and custodial staff.
4. Acceptable manufacturers include Republic, Penco, ASI, or Lyon.
5. Athletic lockers are to be reviewed by FD&C.

10 75 00

#### FLAGPOLES

1. Flagpoles shall be composed of tapered 6063-T6 alloy aluminum tubing. All parts shall be corrosion resistant.
2. Standard heights of flagpoles shall be as follows: Elementary Schools: 30' in height, Middle Schools: 35' in height, High Schools: 45' in height.
3. Flagpoles shall not be illuminated.
4. Flags for all flagpoles are owner provided.
5. Flagpoles shall be clear anodized finish and shall have a ball top. Provide one (1) external halyard on a cast aluminum revolving truck. Provide two (2) chrome plated bronze snap hooks per halyard. Provide a spun aluminum collar at the base of the pole.

6. All flagpoles shall have a cast aluminum cleat with a key based cleat box.
7. Poles 35' in height or less are to be one-piece construction. Poles greater than 35' in height shall be two-piece construction with flush seams and self-locking joints.
8. Acceptable manufacturers include American Flagpole, Baartol, or Morgan-Francis.



# APPENDIX A

## BUILDING PLAQUE SPECIFICATIONS AND MOCKUP

Plaques shall be fabricated 18" wide x 24" long of cast bronze alloy (Architectural Bronze 85-5-5-5), with the following features:

1. 3/8" wide raises, polished border;
2. Pebble textured background;
3. Raised and polished, sans-serif (Helvetica) lettering, font size varies similar to diagram; and
4. Fasten through rosettes at each corner with theft-resistant anchors (furnished by the manufacturer) into masonry.

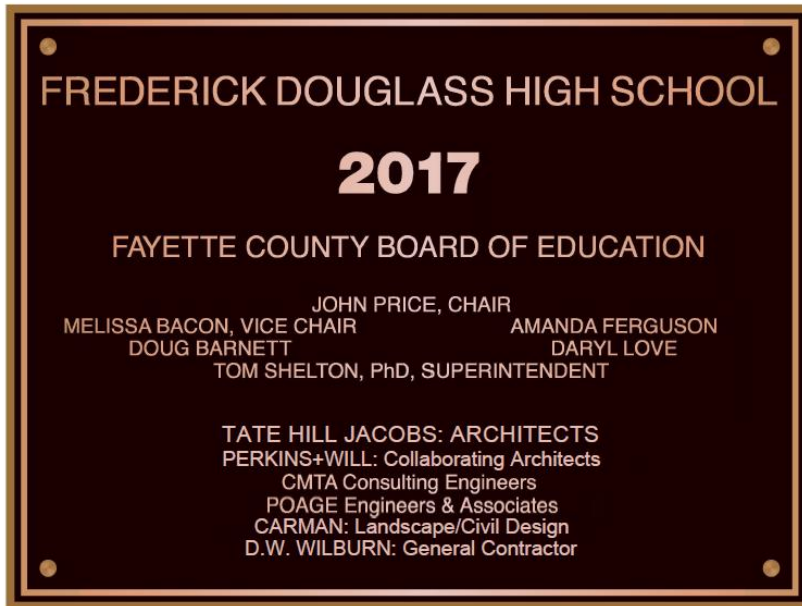
Provide plaques free of pits, scale and sand holes or other defects. Hand tool and buff to provide clean, sharp figures with a bright finish. Protect exposed surfaces with two coats of clean, non-yellowing lacquer.

Information Listed on Plaque:

Date: Year of Substantial Completion

Board Members and Superintendent Names: As of date of approval of initial BG1.

Typical Plaque:



### PRECISION TOOLED PLAQUE

MATERIAL - BRONZE

SIZE - 24"W X 18"H

QTY - 1

DEPTH - 1/2"

BORDER - Inset Single Line Border

COPY - Raised Copy-Horizontal Stroke

FINISH - Pebble w/Brushed Surface

CLEAR COAT - Semi-Gloss

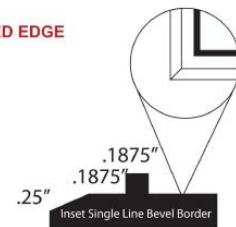
MOUNT - Blind Mount-Standard Studs

ROSETTES - R-1 Rosette:1/2" Diameter  
- DECORATIVE ONLY

 -RAISED  
BRONZE

 -RECESSED  
1315-Dark Oxide Painted

 BEVELED EDGE



### PLEASE NOTE THE FOLLOWING:

**Kerned to allow for production method**

**Border at standard minimum**

**Reduced size of school name to prevent it hitting the border**

## APPENDIX B

### Exterior School Marquee SPECIFICATIONS

1. Sign to be all aluminum frames, with steel supports. Four feet high by six feet wide (4'x6').
2. Aluminum frame with minimum 3/16-inch Lexan doors.
3. White 3/16-inch Plexiglas faces with zip track and either four inch or six-inch choice of letters.
4. 300 each, four- or six-inch letters and numbers on clear Plexiglas. Black letters and numbers.
5. Must have three cancelled locks on each side, all keyed alike or equal locking mechanism to prevent doors from being pried open.
6. Should have four adjustable "L" brackets to install into brick pillars.
7. Polyurethane enamel paint sprayed on frames. Color of Owner's choice.
8. Eight- to ten-inch black high-grade vinyl with six-inch white lettering of school name of Owner's choice.
9. One-year warranty against manufacturer's defects.
10. One-year warranty against paint fading or chipping.
11. .125 inch - .150 inch thickness of aluminum extrusion.
12. Aluminum hinges.
13. Gas-charged lift supports; 2 per side.
14. Doorframe to be 1-1/2-inch aluminum angle. .125 inches thick.
15. No internal lighting.
16. Provide grade or surface around marquee that is accessible in order to maintain and change signage on a regular basis.

See attached drawings for brick foundation.



# APPENDIX C

## TOILET ACCESSORIES SPECIFICATIONS

FCPS Toilet Room Accessories (5/24/22)



### Side-by-Side Bath Tissue Dispenser

#### **SSS STERLING SELECT 2.0 SIDE-BY-SIDE BATH TISSUE DISPENSER**

**PRODUCT DESCRIPTION:**

Use at home quality bathroom tissue in this high capacity, compact twin dispenser that reduces waste. Reduced-Core™ technology maximizes the footage per roll which reduces maintenance costs and run-outs. Elegance is redefined with its timeless, smooth styling and micro-textured finish, and fits nicely in bathroom stalls. The dual function lock works as a push-button open or as a secure keyed lock to eliminate pilferage.



**FEATURES & BENEFITS:**

- High Capacity** - Reduced-Core™ technology maximizes roll footage
- Small Footprint** - Compact design fits nicely into bathroom stalls
- Stub Roll Feature** - Eliminates stub roll waste and the possibility of run-outs
- Sanitary & Hygienic** - Fully enclosed to help protect tissue supply

**SPECIFICATIONS:**

Item No.:	76112
Height:	7.5 inches
Width:	13.0 inches
Depth:	5.25 inches
Hub Diameter:	Reduced-Core™
Packaged:	4 per case
Cases per Pallet:	50 cases
Case Weight:	10.6 lbs.
Case Cube:	1.37
ADA Compliant:	yes

**TISSUE REFILL #:**

76304





# TouchFree Mechanical Roll Towel Dispenser

## SSS STERLING SELECT 2.0 8" TOUCHFREE MECHANICAL ROLL TOWEL DISPENSER

**PRODUCT DESCRIPTION:**

Improve the look and performance of your hand towel dispenser with this mechanical hands free system. Elegance is redefined with its timeless, smooth styling and micro-textured finish. An extra-long paper tail reduces tabbing, and the dual function lock works as a push-button open or as a secure keyed lock. No batteries required - ever.



**FEATURES & BENEFITS:**

- Reduced Tabbing** - Long paper tail and low pull force reduces paper tabbing
- Stub Roll Feature** - Eliminates stub roll waste and the possibility of run-outs
- Sanitary/Hands-Free** - Touch only the towel you use eliminating cross contamination
- No Batteries Required** - Mechanical system eliminates costly batteries

**SPECIFICATIONS:**

Item No.:	76122
Height:	15.21 inches
Width:	12.04 inches
Depth:	9.48 inches
Hub Diameter:	Reduced-Core™
Packaged:	1 per case
Cases per Pallet:	110 cases
Case Weight:	6.1 lbs.
Case Cube:	1.01
ADA Compliant:	yes

**TOWEL REFILL #:**





A New Level in Skin Care Dispensing

# ELEVATE™: Easy to Service, Built to Perform.

You'll love the easy servicing, advanced formulations, and reliable performance built into the all-new ELEVATE skin care system. Combining smart design and robust construction, ELEVATE dispensers combine efficient, problem-free product delivery with refined spa-inspired skin cleaners to create a higher standard in skin care dispensing.

### A Two-Way Advantage

The high-capacity 1250 mL dispenser extends time between change-outs while the smaller-footprint 700 mL system fits easily into compact spaces. Both feature oversized sight windows and colorful formulations in see-through refill bottles for quick checking of fill status.



**1250 mL DISPENSER**  
4.5" w x 11.75" h x 4" d  
**Black**

**700 mL DISPENSER**  
3.7" w x 9.75" h x 3.5" d

### Safety-Sealed Refills

Refills simply snap in place, saving labor time while eliminating contamination risks associated with open, messy bulk soap containers.

### Precision Pumps

High-performance pump mechanism delivers exactly the right amount time after time. Pumps are easily removable for fast, convenient bottle recycling.

### Controlled-Flex Bottles

Refills are engineered to hold their shape as they empty, retaining a clean, neat appearance. Bottles are made from crystal clear, recyclable PET material providing 30% material savings compared to rigid HDPE.



**1250 mL DISPENSER**  
Available in Black or Gray

### Quick Installation

Fasten unit to wall in minutes using peel-back double sided tape include, or screws.

### Simple Maintenance

The large sight windows and clear refill bottles work together to allow at-a-glance checking of fill status.

### Built to Last

Rugged ELEVATE dispensers are made from impact-tested engineering-grade plastics.

### Easy-Open or Keyed Cabinet

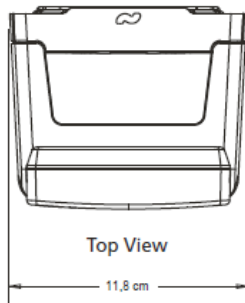
Open cabinet using one of the dual side latches, or convert to a locking cabinet by removing the key inside. Change your mind anytime simply by replacing key.

### Easy to Use

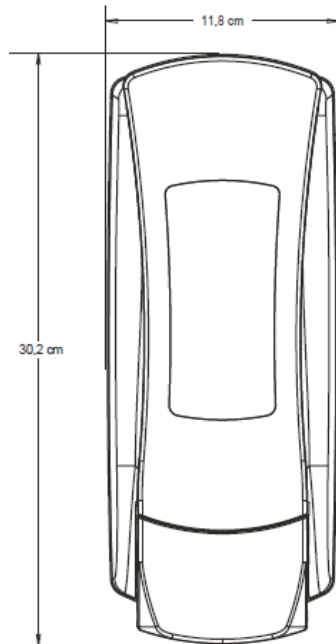
With large-area, one-touch operation, ELEVATE dispensers are easy to use and ADA compliant.

# GOJO ADX-12™ Dispenser Dimensions

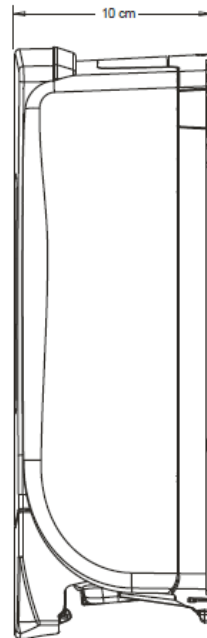
These dimensions apply to GOJO® and PURELL® brand ADX-12 dispensers.



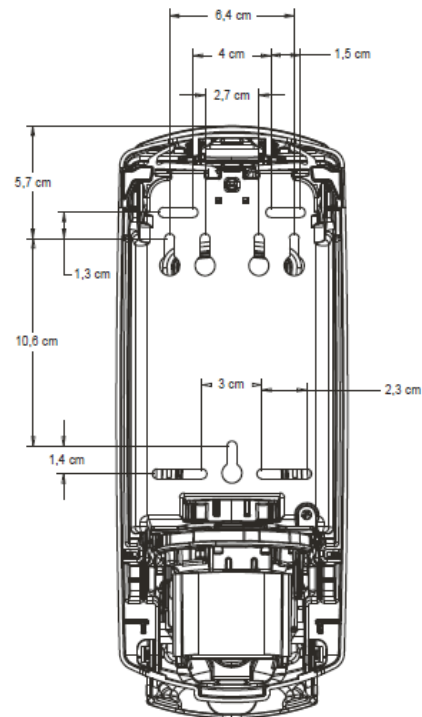
Use the dimensions provided to ensure adequate wall spacing and clearance for the unit.



Front View



Side View



Back View



GOJO Industries - Europe, Ltd.  
Units 5 & 6  
Stratus Park  
Brinklow  
Milton Keynes  
MK10 0DE, UK  
Tel: +44 (0)1908 588444  
Fax: +44 (0)1908 588445  
sales@gojo.com

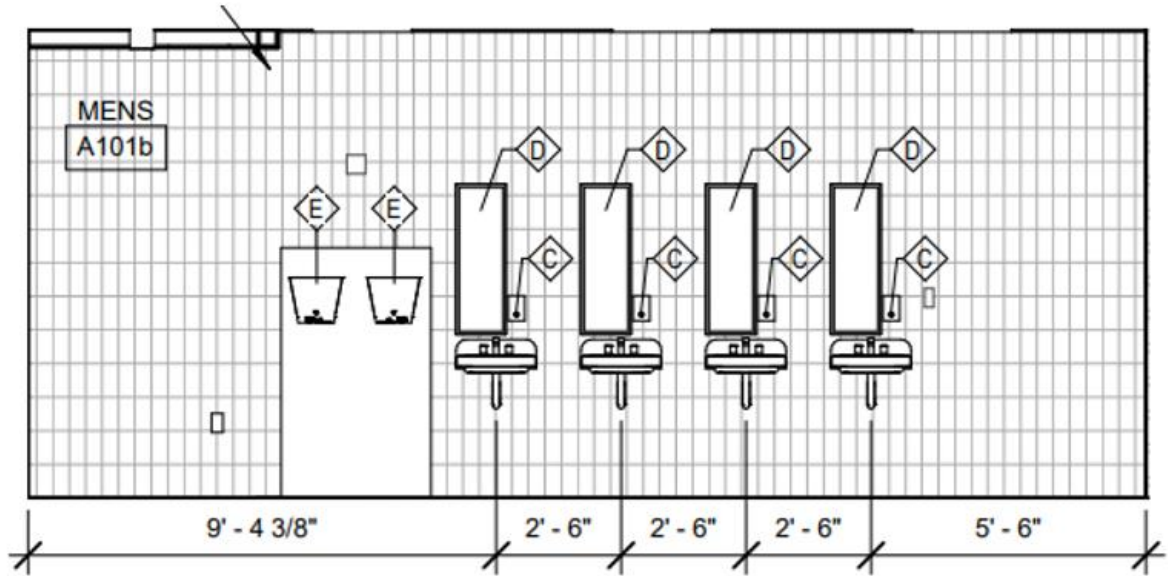
Prodene GmbH - a GOJO  
Family Company  
Im Trutz Frankfurt 55  
60322 Frankfurt  
Germany  
Tel: +49 6074 91960 57  
info@prodene.de

Laboratoires Prodene Klint  
- a GOJO Family Company  
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77183 Croissy-Beaubourg  
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GOJO Iberia  
Sucursal em Portugal  
Alameda dos Oceanos,  
Lote 3.14.04-H  
Escritório A  
1990-196 Lisboa  
Telf: 00351 21 898 82 30  
Tim: 00351 91 586 31 97

## APPENDIX D

### MIRROR AND SOAP DISPENSER CONFIGURATION



- ◇ C HAND SOAP DISPENSER, SURFACE MTD. OWNER PROVIDED / CONTRACTOR INSTALLED.
- ◇ D S.S. FRAMED MIRROR, 12" X 36", SURFACE MTD.
- ◇ E SEMI-RECESSED ELECTRIC HAND DRYER



APPENDIX E

REQUEST FOR OWNER-PROVIDED TOILET ACCESSORIES

**REQUEST FOR  
OWNER-PROVIDED TOILET ROOM ACCESSORIES  
(To be completed by GC and sent to FD&C)**

PROJECT: \_\_\_\_\_ DATE REQUESTED: \_\_\_\_\_

Phase #	Date to be Delivered by FCPS to Job Site	Toilet Paper Dispensers	Soap Dispensers	Paper Towel Dispensers

NOTE: NO soap dispensers in kitchen areas or kitchen bathroom.

**Requested by:** \_\_\_\_\_

# APPENDIX F



## ELECTRONIC KNOXVAULT™ 4466 DUAL LOCK MODEL

Now available with the electronic Knox eLock Core™, the KnoxVault 4400 is a secure, high capacity key lock box trusted by emergency responders, property owners, and universities. The dual lock capability allows for unique shared system access. Store up to 50 keys, access cards and/or emergency plans to gain rapid emergency access to large business and industrial facilities and campuses. Box openings are tracked and recorded in the cloud-based KnoxConnect™ Management System.



### FEATURES

- ✓ Configurable dual lock key system (i.e. 2 eLock cores or 1 eLock core and 1 mechanical core)
- ✓ Large capacity, storing up to 60 keys. Access cards, entry items, emergency planning documents, and Knox FDO Wrench may also fit in interior compartment but will reduce max key quantity.
- ✓ Knox eLock Core, powered by the Knox eKey™
- ✓ Dust cover reflective label for Knox eLock System Identification
- ✓ Enables tracking of box openings via cloud-based KnoxConnect™
- ✓ Built Knox-Rugged and secure: UL 1037, UL 1610, UL 1332
- ✓ Finished with Knox-Coat® to protect four times better than standard powder coat
- ✓ Weather-resistant door gasket
- ✓ Knox RainGuard™ for weather protection

### BENEFITS

- ✓ Dual locks allow for unique shared system access
- ✓ No wiring or battery needed for power
- ✓ Captures box openings by date and time
- ✓ Allows rapid property access
- ✓ Reduces forced entry property damage
- ✓ Prevents forced entry into buildings
- ✓ Minimizes first responder injury
- ✓ Compliant to National Fire Code (NFPA, IFO, IBO)

### OPTIONS

- ✓ Knox Tamper Alert connects to building's alarm system for extra security
- ✓ Mount types: Recessed and Surface
- ✓ 3 color options: Black, Aluminum, **Dark Bronze**

### ACCESSORIES

- ✓ Multi-Purpose Switch for use on electrical doors, gates and other electrical equipment
- ✓ Recess Mounting Kit for new concrete or masonry construction
- ✓ Public Safety Labels
- ✓ Tag-Out Tamper Seals, Key Tags, Key Rings

### ORDERING SPECIFICATIONS

To insure procurement and delivery of the Electronic KnoxVault 4400, it is suggested that following specification paragraph is used:

KnoxVault surface/recessed mount with/without UL Listed Knox Tamper Alert. 1/4" plate steel housing, 5/8" thick steel door with interior gasket seal and stainless steel door hinge. Vault is UL Listed. Lock has 1/8" thick stainless steel dust cover with tamper seal mounting capability and a rainguard to protect against weather conditions. Vault has anti-theft re-locking mechanism with drill resistant hard-plate lock protector.

**Exterior Dimensions:** Surface Mount Body: 7" H x 7" W x 5" D  
Recessed Mount Flange: 9 1/2" H x 9 1/2" W

**Electronic Lock:** Powered by Knox eKey. Communicates using industry standard encryption.

**Finish:** Knox-Coat proprietary finishing process

**Color:** Black, **Dark Bronze** or Aluminum

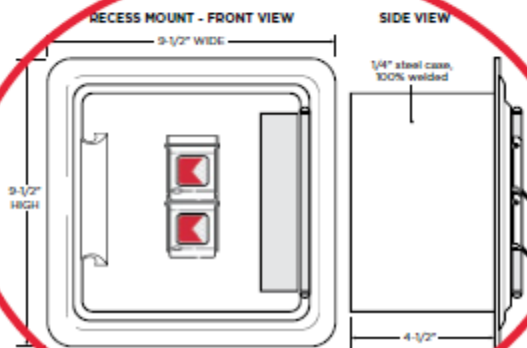
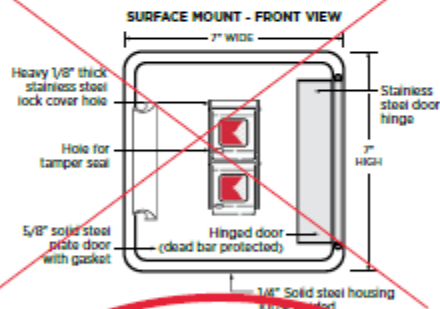
**P/N:** KnoxVault KLS-4400 (mfr's cat. ID)

**Mfr's Name:** KNOX COMPANY



**WEIGHT:**  
Surface Mount: 28 lbs  
Recessed Mount: 29 lbs

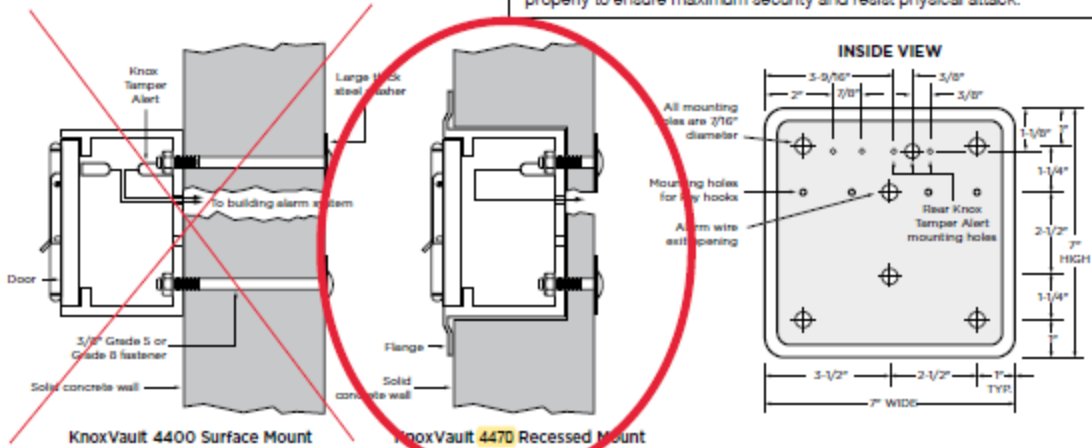
**DIMENSIONS:**  
Surface Mount Body: 7" H x 7" W x 5" D  
Recessed Mount Flange: 9 1/2" H x 9 1/2" W



**GENERAL MOUNTING INSTRUCTIONS**

Suggested minimum mounting height, 6 feet above ground.

**ATTENTION:** KnoxVault is a very strong device that **MUST** be mounted properly to ensure maximum security and resist physical attack.

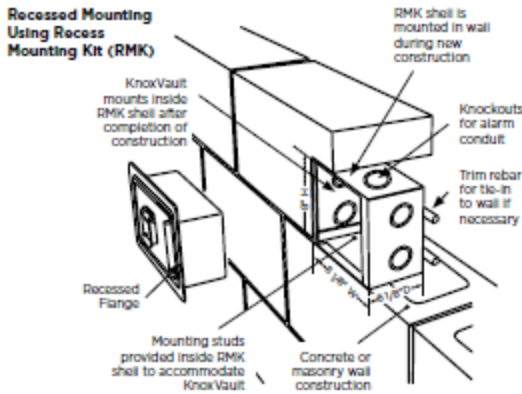


**RECESS MOUNTING KIT AND INSTALLATION INSTRUCTIONS**

The Recess Mounting Kit (RMK) includes shell housing and mounting hardware, which may only be used for recessed models to cast-in-place within new concrete or masonry construction. The KnoxVault is mounted into the shell housing after construction is completed.

**RECESS MOUNTING KIT DIMENSIONS**

Rough-In Dimensions:  
8-1/2" H x 8-1/2" W x 7" D



**IMPORTANT:**  
Care should be taken to ensure the front of the Recess Mounting Kit (RMK) shell housing, including the cover plate and screw heads, is flush with the wall. The RMK must be plumbed to ensure vertical alignment of the vault.

## DIVISION 11 EQUIPMENT

### 11 13 00 LOADING DOCK EQUIPMENT

1. Loading docks shall be at the same level as the adjacent floor surface, shall be 44" to 52" above the adjacent pavement, and shall be provided with a dock leveler.
2. All loading docks shall have laminated tread dock bumpers securely attached to the vertical surface of the loading dock.
3. Verify with OSHA requirements if removable railings or gates are required.

### 11 40 00 FOOD SERVICE EQUIPMENT

1. All specifications and drawings for a food service project shall be approved by FCPS Child Nutrition prior to the documents being sent out for bid. Manufacturers cut sheets for each piece of equipment specified shall be provided for the review process. The design team shall allow a minimum of two weeks for FCPS staff to inspect bid documents prior to bid being approved for advertisement. FCPS is to be added to all manufacturers' approved list of installers in order to receive all Manufacturers Updates, Recall Notices, and Service Bulletins. These Bulletins are to be provided by the manufacturer to FCPS for the life of the equipment. Technical and operator training sessions shall be required by factory trained service technicians for all equipment furnished in all FCPS facilities and shall be video recorded by the appropriate vendor/contractor and turned over to FCPS for future use. The Kitchen Equipment Contractor shall examine mechanical and electrical drawings. Charges incurred due to use of alternate items or substitutions that require changes to mechanical and electrical systems as shown in original bid documents shall be the responsibility of the Kitchen Equipment Contractor.
2. Preference is that all kitchen equipment, to include boilers, shall be electrically operated.
3. Where possible, all three-phase kitchen equipment shall have phase protection with automatic restart after correct phasing has returned.
4. The Food Service documents shall contain a space for the equipment serial number to be filled in by the Contractor. This information is to become part of the close-out documentation for the project.
5. All kitchen equipment, not equipped with internal air gaps, tied into the domestic water supply shall be equipped with a backflow preventer (anti-siphon device) supplied by the kitchen equipment contractor or subcontractor. Kitchen equipment contractor/subcontractor shall coordinate installation of the anti-siphon device with the Project's plumbing contractor.
6. Preference is for designated kitchen equipment, to include racks, shelving and support legs exposed to water & scratching to be built of stainless steel (with the exception that racks and shelving designated for cooler/freezer use shall be coated with an epoxy or a polymer mix.) An alternate preference is for designated kitchen equipment, to include racks, shelving and support legs exposed to water & scratching to be built of reinforced solid phenolic or reinforced high-density polyethylene (HDPE). CAMBRO is an acceptable manufacturer.
7. FOOD SERVICE STORAGE EQUIPMENT: All walk-in freezers and coolers shall be of Norlake, Thermocool, WA Brown or equivalent manufacture with Copeland manufactured compressors and Russell, Bohn or Heatcraft manufactured evaporators. Walk-ins shall be fire sprinkled per code requirements.

8. All freezers and food refrigeration equipment shall be filled with HFC-only refrigerants. HCFC refrigeration/cooling equipment shall be accepted on a case-by-case basis. Refrigerant for Coolers shall be R401 and refrigerant for freezers shall be R404. CFC refrigerants are not permitted in any new or retrofit case/situation.
9. FOOD PREPARATION EQUIPMENT: All steamers shall be pressureless and of Market Forge or Cleveland manufacture of equivalent Preference is for an electric steamer, 36 kW/3 phase/480vAC/44 amps (nominal), with standard controls. Electronic/computer controls are not desired. High pressure steamers are not allowed.
10. If the entire building's water supply cannot be filtered, discuss water testing with FCPS Child Nutrition prior to construction documents.
11. All ovens shall be Alto Sham or Rational Combi Ovens. Preference is for an electric oven (480 VAC) with standard controls. Electronic/computer controls are not desired.
12. All fryers are to be Frymaster, Pitco or Dean. The preference is for an electric fryer with self-contained millivolt controls or, as an alternate, a gas fryer with self-contained millivolt controls. Multiple units are not desired nor are digital/electronic/computer controls.
13. The kitchen exhaust hoods shall be: a) welded, stainless steel; b) tied into total building's fire suppression/alarm systems; c) low heat/cooling loss fresh air exchange IAW ASHRAE 62-1989 and ASHRAE 62-R; d) with easily accessible filters and e) low maintenance fire suppression equipment. Exhaust hoods shall be bid with the Kitchen Equipment Package. Installation package shall include fire suppression, ductwork, lighting, controls, roof curbs and roof vents.
14. Kitchen exhaust hood Fans shall be of the belt-driven vertical discharge type. Belts shall be non-static and oil resistant. Drives shall be sized for a minimum of 165% of driven horsepower. The exhaust fan shall be constructed to include a built-in grease drain. The fan wheel and cone shall be aluminum and of the high performance, centrifugal blower type, statically and dynamically balanced. Motors and drives shall be isolated from the exhaust air stream and shall be located in a chamber cooled by air brought in through a tube from a location free from discharge contaminants. The fan shall be AMCA licensed for sound and air performance and shall be UL listed for grease removal in accordance with UL standards.
15. Kitchen exhaust hood Make-up Air Unit - The complete system shall be fabricated and assembled by a single manufacturer regularly engaged in the production of such equipment to provide a single point performance responsibility. Make-up Air Unit shall provide conditioned (heated) air to the space. Unit should not blow air directly onto equipment. Exhausted air should be vented to the exterior of the building. All exterior duct work shall be made of stainless steel and shall be reinforced as not to pool water.
16. Kitchen exhaust hood Supply Fan Module - the supply fan shall be belt driven, double width, double inlet, forward curved centrifugal blower type. Drives shall be sized for a minimum of 165% of driven horsepower. The blower shall be mounted on vibrations isolators. Belts shall be non-static and oil resistant. Motor and blower bearings shall be of the permanently lubricated, sealed ball bearing type. Motor pulleys shall be of machined cast iron and adjustable. Unit should not blow air directly onto equipment.
17. FOOD DISPENSING EQUIPMENT: Preference is for Color Point serving lines. Serving lines shall not be equipped with water.
18. ICE MACHINES: The preference for ice machines is Manitowoc or Scotsman, either being air-cooled. Minimum ice delivery capability for ice machines is 300 lbs/day for elementary schools, 800 lbs/day for middle schools and 1,200 lbs/day for high schools.

19. All ice machines tied into the domestic water supply shall be equipped with a water filter system supplied by the kitchen equipment contractor or subcontractor. Kitchen equipment contractor/subcontractor shall coordinate installation of the water filter system with project's plumbing contractor.
20. All ice machines not equipped with internal air gaps are to have a back flow preventer installed at time of installation by the contractor/ subcontractor and shall coordinate installation of the backflow preventer with the plumbing contractor/ subcontractor.
21. CLEANING AND DISPOSAL EQUIPMENT: All disposals shall be of the RED GOAT manufacture (No Substitutes).
22. Preference is for dishwashers to be built by the HOBART Co. See the Kentucky Food Establishment Act and the Kentucky State Retail Food Code for water temperature requirements.
23. Owner training is required on all kitchen equipment before the kitchen is turned over to FCPS Child Nutrition.

11 52 00 AUDIO-VISUAL EQUIPMENT

1. All Administration offices, SBDM Conference Rooms, Reception areas and two locations in the Cafeteria shall have cable TV outlets located such that they provide 80" clear vertical space below the TV. Flat screen television monitors and associated brackets shall be located in the Administration Reception area, Principal's Office, PSA Office, and SBDM Conference Room. Coordinate additional locations with FD&C.
2. The cable television bracket (Omnimount ULPC-S) and the 27" flat panel television are provided by FCPS. The cable television outlet box / associated wiring are provided and installed by the Contractor. The cable television bracket is installed by the Contractor.
3. PROJECTION SCREENS: Projection screens shall be motorized units with automatic ceiling closure that are recessed into the ceiling where possible. The screen material shall be high contrast matte-gray vinyl coated glass-fiber fabric. Refer to the Facilities Programming Specifications for size and location requirements.
4. Coordinate classroom technology with FCPS Technology and FD&C.

11 53 00 LABORATORY EQUIPMENT

1. All high school science classrooms shall have a standard Class B fume hood and shall be equipped with easily accessible filters. Fume hood fire suppression systems are required in science classrooms as required by code.
2. The recommended liner air flow is 80 – 120 linear feet per minute (based on annualized testing)
3. Fume hoods shall be located so that persons exiting the lab do not have to pass in front of the hood.
4. There must be two exits from rooms where fume hoods are installed.
5. Windows in labs containing fume hoods shall not be operable.
6. Fume hoods shall not be situated directly opposite occupied work stations.

11 61 00 THEATER AND STAGE EQUIPMENT

1. STAGE CURTAINS: All fabrics shall meet current flame retardant requirements, including NFPA 701, either by the immersion method or be inherently-flame-proofed fabric. Flame certificates shall be provided for all projects. Each individual curtain shall have flame-proof labels permanently attached. Heavy weight fabric shall be woven cotton velour

weighing not less than 25 oz / linear yard. Light weight fabric shall be woven cotton velour weighing not less than 15 oz / linear yard.

2. All draperies shall have 50% added fullness sewn in, using box pleating on 12" centers.
3. The tops shall be sewn to 3" heavy jute webbing.
4. Grommets for all curtains shall be #2 brass at 12" on center centered at the pleats.
5. No. 3 brass grommets shall be installed in each pleat. Appropriate tie-line or S-hook shall be provided.
6. Valance and borders shall have 2" side and bottom hems.
7. Front curtain and travelers shall have 4" bottom hems with No.8 plated chain sewn in a separate canvas pocket.
8. Front curtains shall have a 12" center hem, and a 2" side hem
9. Traveler curtains shall have a 4" center hem, and a 2" side hem
10. The stage curtain configuration shall vary from school to school. The Designer is responsible for coordinating the curtain configuration with the involved parties.

11 66 00 ATHLETIC EQUIPMENT

1. GYMNASIUM EQUIPMENT: Basketball backstops and goals are to be provided in Gymnasiums. Units will be either stationary or forward folding with electronic operation. Units are to have 24" of vertical adjustment.
2. Safety padding shall be provided at each end of the main basketball court. Padding shall be wall mounted in a continuous row from sideline to sideline at each end. Padding shall meet the requirements set forth in ASTM F2440-04. Padding shall be a minimum of 3" thick and Class "A" fire rated. Padding panels are to be installed using continuous z-clips top and bottom. Ensure that panels are not mounted higher than 4" above the finished floor.
3. INTERIOR SCOREBOARDS: Interior scoreboards, when provided as a part of the construction contract, are to be LED display and wireless connectivity. Acceptable manufacturers include: Fair-Play, Nevco and Daktronics.

11 68 00 PLAY FIELD EQUIPMENT AND STRUCTURES

1. PLAYGROUND EQUIPMENT: Playground (preschool and intermediate) equipment is to be supplied and installed by the Owner or Owner's contractor.
2. Owner is responsible for removal of existing playground equipment.
3. Coordinate playground details with FD&C and FCPS Grounds & Custodial Services.

11 95 13 KILNS

1. The kiln standard is the Skutt model KM1027 (elementary/middle) and Skutt model KM 1227 (high) electric kiln which is to be provided and installed by the Owner. Power for the unit shall be via a dedicated 208 volt, 3-phase supply with the disconnect located outside the kiln enclosure. All electrical work is to be part of the general contract. The unit shall be wired for 60 amps and fused down. The unit shall be located such that it has a minimum of 18" clear in all directions. See attached Appendix A.
2. Kiln ventilation shall be provided by a downdraft vent (Skutt's EnviroVent 2) system directly vented to the exterior through the wall if possible or through the roof if access to through the wall is not possible. The kiln ventilation unit is to be provided and installed by the Owner. The connections for the ventilation to the exterior are to be part of the general contract. See attached Appendix B.

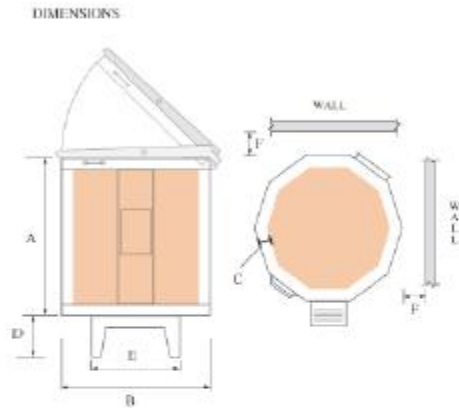
3. Sprinkler heads should not be placed directly above the kiln. Any sprinkler head in the room must be adequately rated so that they shall not be activated through normal use of the kiln.
4. Kiln rooms shall have a sealed concrete floor and either a painted gypsum board ceiling or exposed structure. The perimeter partitions as well as doors shall be treated as a smoke partition assembly.



APPENDIX A  
(ELEMENTARY / MIDDLE SCHOOL)



## PRODUCT SPECIFICATION: KM-1027



**SPECIFICATIONS & DIMENSIONS**

MODEL	Phase	Volts	Maximum		Chamber			O.D.Dimension						Power		Copper Wire Size	NEMA Recp. Conf.	BTU's
			Cone	Temp	Depth	Opening Width	Cu.Ft.	A	B	C	D	E	F	Amps	Watts			
KM-1027	3	208	10	2350	27	23.00	7	32	28.5	2.5	8	17	18	31.7	11000	8	15-50	22000

**OPTIONAL ACCESSORIES**

1027 ROLLING KILN STAND	Optional
ENVIROLINK	Optional
ENVIROVENT 2	Optional
LINKBOARD SERVICE 1 YEAR	Optional
LINKBOARD SERVICE 5 YEAR	Optional

**CONTROLLER**

Thermocouple: K  
 Clock: 60 Mhz  
 Voltage: 24 DC Relays  
 Output: 12 Volts DC  
 Fuse: 0.5 AMP



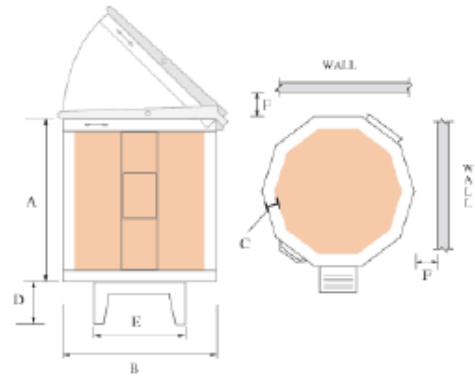
(HIGH SCHOOL)



# PRODUCT SPECIFICATION: KM-1227



DIMENSIONS



SPECIFICATIONS & DIMENSIONS

MODEL	Phase	Volts	Maximum		Chamber			O.D.Dimension						Power		Copper Wire Size	NEMA Recp. Conf.	BTU's
			Cone	Temp	Depth	Opening Width	Cu.Ft.	A	B	C	D	E	F	Amps	Watts			
KM-1227	3	208	8	2300	27	28.00	9.9	33	34	3	8	24	18	31.7	11000	8	15-50	23000

OPTIONAL ACCESSORIES

1227 ROLLING KILN STAND	Optional
ENVIROLINK	Optional
ENVIROVENT 2	Optional
LINKBOARD SERVICE 1 YEAR	Optional
LINKBOARD SERVICE 5 YEAR	Optional

CONTROLLER

Thermocouple: K  
 Clock: 60 Mhz  
 Voltage: 24 DC Relays  
 Output: 12 Volts DC  
 Fuse: 0.5 AMP



## APPENDIX B

# STANDARD ENVIROVENT 2 INSTALLATION

This section of the manual covers standard installations of The EnviroVent 2 on a single top loading, multi-sided, electric kiln with a chamber size under 12 cubic feet. A Dual Intake Kit is available for venting a single kiln over 12 cubic feet or two kilns with chamber volumes each at or under 12 cubic feet. The maximum chamber volume that can be vented with one motor is 24 cubic feet. For instructions on venting two kilns, kilns greater than 12 cubic feet and other custom installations consult the [Custom Installations](#) section of this manual.

As with any change in firing routine, we recommend that you closely follow all instructions and monitor your firings with witness cone groups on each shelf of your kiln both before and after you install the EnviroVent 2. If you have any questions, please contact your supplier.

### EnviroVent 2 Contents

Blower Motor w/6 ft. Power Cord w/In-line Switch

8" x 12" Mounting Plate

8 ft. x 3" Flexible Aluminum Duct

Spring Loaded Plenum Cup Assembly

Cast Plenum Cup

Fiber Gasket

Plenum Stand w/Base

Plenum Spring

Blower Inlet Tube

Blower Discharge Tube

3" to 4" Connector

Floor Mount Plate

Operating Manual

Mounting Hardware

4 - #10 x 1 1/2" Sheet Metal Screws

4 - 8-32 x 1/4" Screws

4 - 8-32 Lock Washers

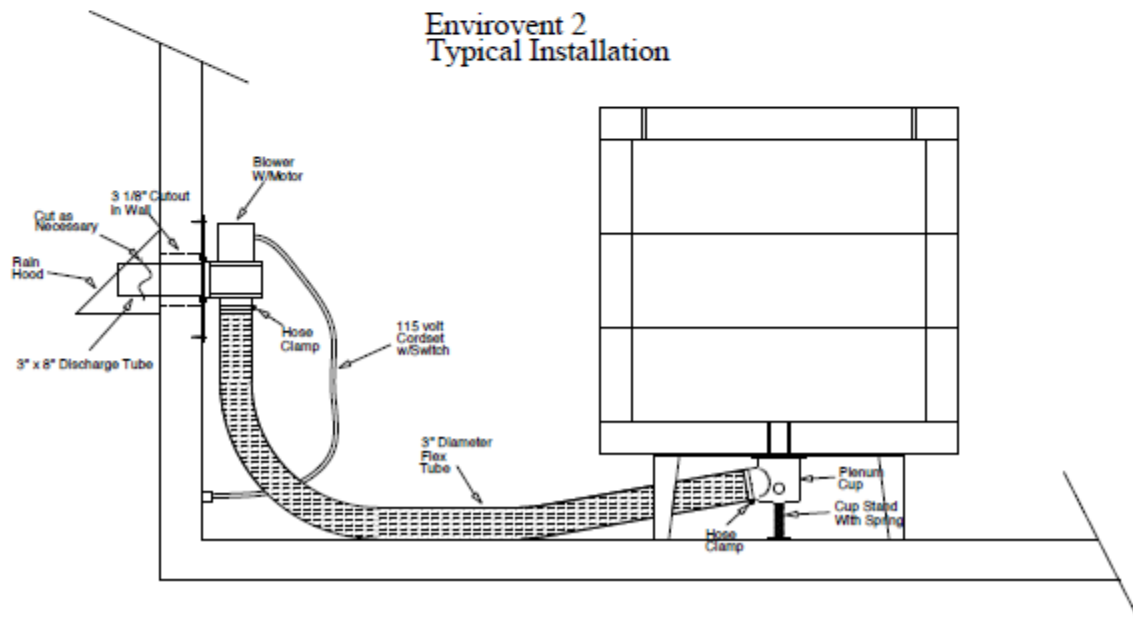
4 - 8-32 Hex Nuts

4 - 1/8" x 2" Toggle Bolts

1 - 1/4" twist drill

1 - 3/16" twist drill

2 - Hose Clamps



## DIVISION 12 FURNISHINGS

- 12 05 00 COMMON WORK RESULTS FOR FURNISHINGS
1. Freestanding Office, Classroom, Media Center and Computer Lab furnishings are to be shown on the contract documents. Freestanding Office and Classroom furnishings are provided by the Owner. The Contractor is required to coordinate connections for electrical and communications wiring for these furnishings. Refer to FCPS Facility Programming Specifications for furnishing requirements.
- 12 24 00 WINDOW SHADES
1. Roller window shades are preferred to horizontal louver blinds. Color to be selected by Design Team, but reviewed with Director of FD&C.
  2. Verify locations with Owner before bidding. In general, **ALL** windows should have shades.
  3. Acceptable manufacturers are Levelor, Mechoshade, and Hunter Douglas. Please review any additional manufacturers with Director of FD&C.
- 12 32 16 MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK
1. The manufacturer shall have a minimum of ten years' experience in providing manufactured casework systems for similar types of projects. The manufacturer shall be certified by the Architectural Woodwork Institute (AWI) Quality Certification Program as well as providing products that are certified to meet the requirements of ANSI-A 161.1-2000.
  2. All material and workmanship shall be warranted for a period of ten years from date of final project substantial completion.
  3. All hinges shall be five-knuckle, epoxy powder coated, a natural finished metal, or anodized finish, institutional grade, 2 ¾" overlay type with hospital tip and shall meet ANSI-BHMA standard A156.9 Grade 1.
  4. Door and drawer pulls shall be epoxy powder coated metal wire style, a natural finished metal, or anodized finish,
  5. Locks shall be removable core, disc tumbler, cam style lock with strike. Locks are typically provided on all doors and drawers.
  6. All base and wall cabinet exterior surfaces are to be high pressure laminate. Interior surfaces are to be white thermo fused melamine. Countertops are to be high pressure laminate with PVC banding.
  7. Accommodate access to under-sink grease traps and plaster traps.
  8. Acceptable manufacturers include: TMI Systems, Case Systems, and LSI Corporation.
- 12 35 53 LABORATORY CASEWORK
1. All middle and high schools shall have laboratory case work with chemical resistant tops, installed in all science laboratory rooms.
  2. Refer to FCPS Facility Programming Specifications for furnishing requirements.
- 12 56 51 LIBRARY FURNITURE
1. Media Center freestanding furnishings are to be shown on the construction documents for coordination purposes.
  2. Media Center seating capacity shall equal 10 percent of the student population (including the table seating, flexible seating with casters, and the lounge seating), but

in no case shall there be less than 60 student seating capacity provided. All Media Centers shall have seating to accommodate a *minimum* of two classrooms of students for instructional purposes.

3. The total shelving capacity shall accommodate 10 to 15 volumes per student. The volume counts shall be obtained before laying out the shelving for existing collections since they may already exceed 15 volumes per student.
4. For planning purposes, each standard 42" H x 36" W bookshelf has 3 shelves for a 120-book capacity. Each standard 63" H x 36" W bookshelf has 5 shelves for a 200-book capacity. Each standard 82" W x 36" H bookshelf has 7 shelves for a 280-book capacity. Each picture bookshelf 42" H x 36" W has 2 shelves for a 100-book capacity. Each picture bookshelf 63" H x 36" W has 3 shelves for a 150-book capacity. Most elementary schools prefer 42" high picture book shelves.
5. ELEMENTARY SCHOOL MEDIA CENTER
  - a. Tables shall be 27" H and have a lumber core top with apron rails and beveled external wood edge banded tops. Chairs shall be 16" H and have solid wood saddle seats.
  - b. Computer Workstations shall be 27" H with 18" H seating and shall accommodate 10 to 12 computers total. Workstations shall have full end panels (not legs) and be 31 1/2" D. (*Verify if computer workstations are still needed*).
  - c. Wall shelving shall be 63" H x 12" D. Island shelving shall be double faced, 42" H x 24" D. Picture book shelving shall be 42" H x 12" D. All shelving shall have 1" end and intermediate panels with hardboard backs.
  - d. The circulation desk shall be 33" H and shall be modular with a full panel front, wire management, and power column. The extended desk shall be 70" W x 30" D with a book return that is 36" W x 30" D. There shall be a descending platform book truck, cupboard storage (two doors) 36" W by 30" D.
  - e. One display book truck shall be provided. The book truck shall be 38 1/2" H x 30" W x 16" D. The book truck shall have full paneled sides with 4-inch casters.
6. MIDDLE AND HIGH SCHOOL MEDIA CENTERS
  - a. Tables shall be 29" H and have a lumber core top with apron rails and beveled external wood edge banded tops. Chairs shall be 18" H and have solid wood saddle seats.
  - b. Wall shelving shall be 82" H x 12" D. Island shelving shall be double faced, 42" H x 24" D. All shelving shall have 1" end and intermediate panels with hardboard backs.
  - c. The circulation desk shall be 39" H and shall be modular with a full panel front, wire management, and power column. The extended desk shall be 70" W x 30" D with a book return that is 36" W x 30" D. There shall be a descending platform book truck, cupboard storage (two doors) 36" W by 30" D.
  - d. Two to three display book trucks shall be provided at middle schools and three to four display book trucks shall be provided at high schools. The book truck shall be 38 1/2" H x 30" W x 16" D. The book truck shall have full paneled sides with 4-inch casters. If it is an existing school then verify this number with the current media center specialist.

12 63 00

#### STADIUM AND ARENA SEATING

1. All interior and exterior stands and bleachers shall conform to the NFPA 102 Standard for Assembly Seating, Tents, and Membrane Structures and all code requirements.

## TELESCOPING BLEACHERS

1. All bleacher seating shall conform to NFPA 102 Standard for Assembly Seating, Tents and Membrane Structures, and specifically with Chapter 5 Folding and Telescopic Seating and all code requirements.
2. Telescopic bleachers in gyms shall be electrically operated and shall be equipped with seat numbers and row letters as well as vinyl end curtains. Aisles at the footrest level shall have non-slip treads on the top front edge. "P" rail handrails shall be provided at aisles. End rails shall be of the self-storing type. Seats shall be constructed of molded plastic or wood with a high gloss urethane finish.
3. Ensure that the safety disconnect is located at the center of the bleacher back wall 48" above the finish floor.
4. Provide lights for maintenance underneath bleachers.
5. Provide power and data centered on the wall behind the bleachers in order to provide table to a scorers' table which should be centered off of the bleachers.
6. Design bleachers to either include a centered scorers' table or provide enough space so that one can be added during ball games that will still provide the proper clearances required for safety.
7. Acceptable Manufacturer include Hussey, Irwin, and Interkal.

**DIVISION 13 SPECIAL CONSTRUCTION**

13 05 00 COMMON WORK RESULTS FOR SPECIAL CONSTRUCTION  
1. RESERVED.

13 34 19 METAL BUILDING SYSTEMS  
1. RESERVED.

13 34 23 FABRICATED STRUCTURES  
1. PORTABLE AND MOBILE BUILDINGS - RESERVED

## **DIVISION 14 CONVEYING EQUIPMENT**

### 14 24 00 HYDRAULIC ELEVATORS

1. Hydraulic elevators shall be a minimum 2500-pound capacity, have 3'-6" wide doors and travel at a minimum of 100 fps.
2. Elevator pits shall have sump pumps. Provide a removable, flush grate cover over the sump pit.
3. The warranty and maintenance service period shall begin on the date of substantial completion of the entire project. Warranty shall include all labor and materials and shall be for a period of one year.
4. Keying options to be discussed with FCPS FD&C and Maintenance.
5. Acceptable manufacturers include ThyssenKrupp, Abell, and Canton.



## DIVISION 21 FIRE SUPPRESSION

### 21 10 00 WATER-BASED FIRE-SUPPRESSION SYSTEMS

1. Sprinkler systems shall be designed such that there are several zones with control valves located at each wing of a building to facilitate flexibility.
2. Buildings are to be fully protected with a “wet” type sprinkler system. In locations where it is advisable to provide a “dry” type sprinkler system, permission must be granted by the Director of Facility Design and Construction.
3. Install guards over sprinkler heads where the head is 7'-0" or less above the floor or where the heads are subject to injury such as gymnasiums.
4. Back flow preventers shall be provided on new sprinkler systems as well as renovation projects if not already installed.
5. Sprinkler piping shall be Schedule 10 black steel or Chlorinated polyvinyl chloride (CPVC) where approved by NFPA 13. Schedule 10 shall not be used on dry pipe systems.
6. Fire protection piping shall be identified per ANSI/ASME 13.1. Where fire protection piping extends through walls, identify pipe on both side of the wall.
7. Flexible sprinkler drops may be used to properly locate sprinkler heads. The drops shall be UL listed or FM approved with one piece open gate bracket for sprinkler installation before or after the bracket is secured to the ceiling grid.
8. Sprinkler heads shall be semi recessed type heads. Side wall sprinkler heads shall be semi-recessed type with escutcheon plates. Color is to be selected by the Architect.
9. Ensure that FCPS Maintenance personnel are notified in a timely manner of the date for the final sprinkler testing.
10. Ensure that the specifications call for a steel, wall-mounted cabinet to store replacement heads of each type used in the building. Refer to NFPA 13 for requirements.
11. A fire department connection per standard UL 405 shall be installed at each building. Coordinate exact location and size with the local water company and fire marshal.
12. Ensure that fire hydrant locations are coordinated with landscaping. Refer to LFUCG Ordinance 17B-2 for additional information.

## DIVISION 22 PLUMBING

### 22 05 00 COMMON WORK RESULTS FOR PLUMBING

1. Freeze proof hose bibs shall be provided at each new or renovated structure. Acceptable manufacturers include Zurn, Woodford, Smith, and Josam. One separate hot and cold water hose bib shall be installed at the kitchen can wash service area. At a minimum, provide two hose bibs at the front of the building and two hose bibs at the rear of the building. Coordinate with FCPS Maintenance for hose bib locations. Each installed hose bib shall have an isolation valve inside the structure to allow for servicing and repair.
2. It is preferred that ganged public restroom chases have a minimum of 30" clear for access and maintenance. It is preferred that access to these chases be provided by a 2'-0" x 7'-0" hollow metal door. Each ganged restroom shall have one-quarter (¼) turn ball valves to isolate and shut down the domestic water
3. Where possible, locate custodial closets in close proximity to ganged restrooms. Ensure that all custodial closets include a floor sink.
4. Water softeners shall be used for Kitchen areas at a minimum. Discuss this issue with FCPS Maintenance early in the design phase.
5. Refer to FCPS Facilities Programming Specifications for programmed spaces that require clothes washing machines and dryers. It is preferred that dryer venting shall be routed horizontally directly to the exterior of the building. Washing machines shall have metal clad supply lines.
6. No gas or plumbing lines shall be located on the roof. All plumbing under the roof structure shall be a minimum of 4" below the roof decking.
7. No water supply lines shall be located under slab, except main water supply line to the backflow.
8. All gas fired equipment shall be hard piped. No flexible piping is allowed.
9. Middle & High School Science Labs shall have chemical resistant plumbing, emergency gas shut-off valves with 2-way solenoid valves with line voltage coils, normally closed.
10. Connections of dissimilar metal piping shall not be permitted.
11. All piping shall be identified by signage per the requirements of ANSI/ASME 13.1.
12. All external plumbing lines (domestic water, sanitary, storm, and gas) shall have marking tape installed directly above to facilitate location efforts. All non-metallic external plumbing lines shall also include a tracer wire.
13. Grease traps shall be minimum 25 gallons.
14. Isolation valves and shut-off valves shall be on side or bottom of pipe with blue handle.

### 22 11 00 FACILITY WATER DISTRIBUTION

1. Backflow preventers shall be mounted in Mechanical Rooms and be readily accessible for maintenance. Adequate drainage shall be provided. FDA approved strainers shall be installed in front of the backflow preventer and supplied by the backflow preventer manufacturer. Provide a drainage outlet from the backflow preventer directly to the exterior where possible. All wye strainers to have blow-down valves. Acceptable manufacturers include Wilkens Zurn, Watts, Ames Silver Bullet series, and Apollo.
2. Where possible, provide dual backflow preventers to facilitate maintenance.

3. Provide butterfly valves on both the inlet and outlet side of both backflow preventers for the purpose of isolating the backflows without shutting down domestic water to the facility.

22 30 00 PLUMBING EQUIPMENT

1. All rotating equipment shall be balanced both statically and dynamically. Mounted equipment shall not exceed a self-excited vibration velocity of 0.05 inches per second in the vertical, horizontal or axial directions.
2. All electrical motors shall comply with NEMA balancing standards. All motors shall be certified to meet "premium" efficiency standards.
3. Accommodate access to under-sink grease traps and plaster traps (see Appendix A).

22 33 00 ELECTRIC DOMESTIC WATER HEATERS

1. Primary domestic water heaters shall be electrically operated. Acceptable manufacturers include Bradford White, Lochinvar, A.O. Smith, Rheem and State.
2. All locations with tempering valves are to be furnished with replacement cartridges.
3. All water heaters to have magnesium anode rods.

22 40 00 PLUMBING FIXTURES

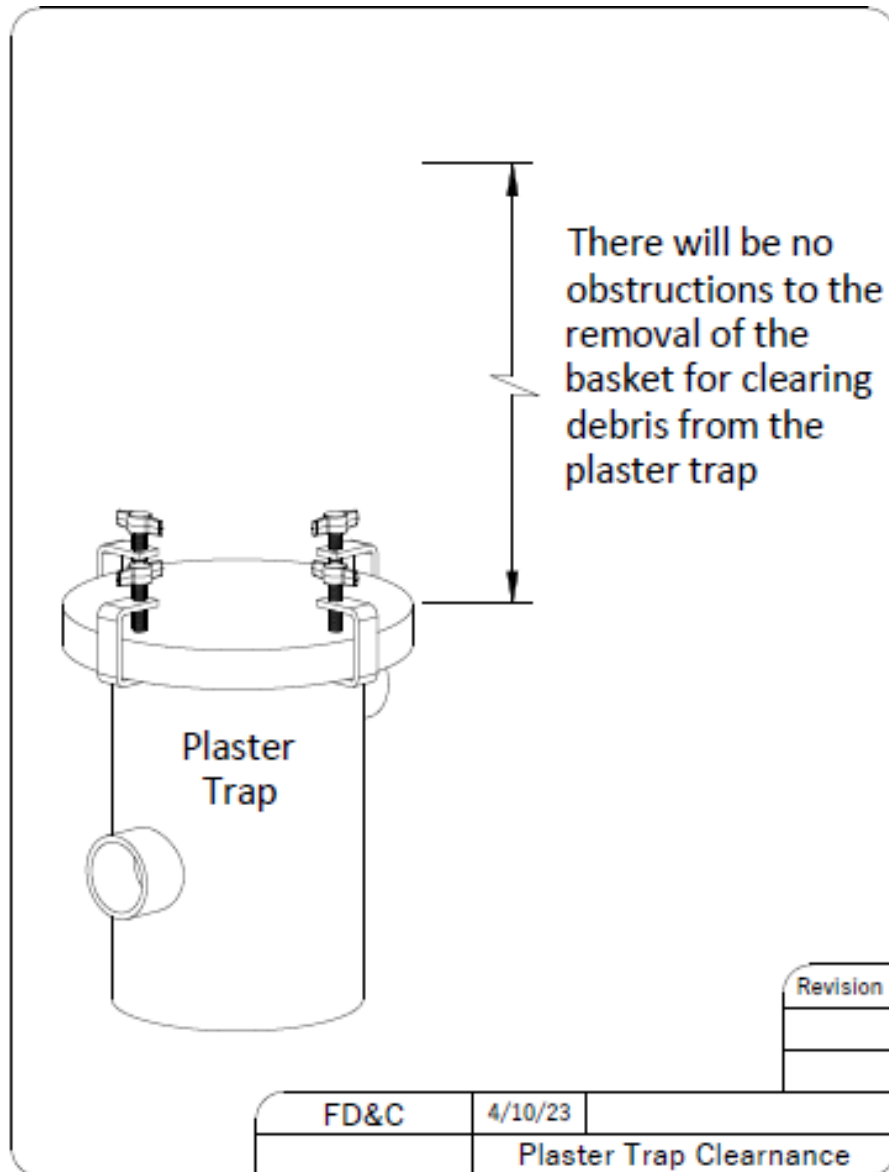
1. All wall hung carrier mounted water closets shall have neoprene gaskets. "Wax rings" shall not be accepted.
2. All water closets, lavatories, and urinals are to have manual flush valves.
3. All water closets and urinals shall be porcelain that meet current water conservation standards. Acceptable flush valve and faucet manufacturers are Zurn, Sloan, and Moen. Acceptable manufacturers of water closets are Crane, Kohler, and American Standard.
4. All student restrooms shall have carrier mounted porcelain lavatories, wall mounted water closets and wall mounted urinals. Floor mounted water closets are allowed in Preschool Classrooms or in other single user toilet rooms in renovation projects where space for a carrier is not available.
5. All restroom faucets shall be 4" single lever ADA approved commercial grade and be of chrome plated solid brass construction. All faucets shall have ceramic cartridges with temperature limit stops warranted for 5 years against material or manufacturing defects. Acceptable manufacturers are Zurn, Delta, Cambridge, American Standard, Moen, and T&S.
6. All mop sink faucets to be of solid brass construction and have check valves installed on supply lines.
7. Custodial floor sink is standard 12" lip around with a 6" drop at front.

22 47 00 DRINKING FOUNTAINS AND WATER COOLERS

1. In general, drinking fountains shall be used instead of water coolers at FCPS facilities. Drinking fountains are to be bi-level wall mounted and constructed of stainless steel. Units are to be a two face fountain design with a one-piece stainless steel back plate and include bottle filler as required by code. Acceptable manufacturers include Halsey-Taylor, Elkay, Haws or Acorn.
2. All drinking fountains shall have a cane touch panel (if not recessed in an accessible alcove) and a vandal resistant kit supplied.

APPENDIX A

Plaster Trap Clearance



## DIVISION 23 HEATING, VENTILATING, AND AIR CONDITIONING

### 23 05 00 COMMON WORK RESULTS FOR HVAC

1. The preferred HVAC system is a geothermal system. Other systems that may be considered based on project specific life cycle cost review are as follows:
  - a) Geothermal vertical closed-loop, ground-coupled heat pump system.
  - b) Boiler / Tower configuration with each room having its own heat pump.
  - c) 4-pipe air-cooled chiller and multiple packaged boiler system, with each room having its own heat pump/fan coil unit.
  - d) Provide exterior location for future cooling tower.
2. Mechanical equipment and associated piping, conduit and ductwork shall be mounted on vibration isolators in order to minimize transmission of vibration and structure-borne noise to building structure or spaces.
3. All rotating equipment shall be balanced both statically and dynamically. When mounted, equipment shall not exceed a self-excited vibration velocity of 0.05 inches per second in the vertical, horizontal or axial directions.
4. All electrical motors shall comply with balancing requirements of NEMA Standard HG-1-4.23. All motors shall carry and be certified to meet "premium" efficiency standards.
5. All piping (installed and existing to remain) shall be identified per the standards listed in ANSI/ASME A13.1.
6. All three phase HVAC equipment shall have phase protection with automatic restart after correct phasing has been restored.
7. All major HVAC equipment (with the exception of compressors – see #8 below) shall have a one year manufacturer's parts and labor warranty, effective from the date of the project substantial completion. Specifications should be written so as to require an extended warranty on all HVAC equipment that has not worked properly during the first 12 months of the warranty period. The intent is to ensure that all HVAC equipment works properly for a minimum of 12 months after project substantial completion. An additional 12 month warranty (total 24 month warranty) can be added as an alternate. Discuss with Director of FD&C.
8. All equipment containing compressors shall have a minimum 5 year parts warranty on the compressor.
9. Pumps and other mechanical equipment should be mounted on the Mechanical Room floor to facilitate inspection and/or repair.
10. Contractors shall flush, back flush and chemical de-scale all HVAC units and piping scheduled to remain during renovation.
11. All major mechanical equipment shall be listed on the contract documents in a schedule that includes a space for the serial numbers to be filled in by the Contractor when the units are installed. Contractor shall include this information in the close out documents.

### 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

1. FCPS shall contract directly with an independent testing, adjusting, and balancing agency to test, adjust, and balance the HVAC system. The final balancing of the HVAC system, (including the energy management system) shall be performed by an Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) certified contractor. Instruments used for testing and balancing shall have

been calibrated within the previous six months. All final test reports shall include a letter of certification listing instrumentation used.

- a. Design Team shall solicit to at least 3 companies for this service.
2. Three copies of the complete test reports shall be submitted to the Architect/Engineer prior to final acceptance of the project.
3. Prior to starting the HVAC System the Contractor shall ensure the following:
  - a) All equipment has been cleaned of foreign materials.
  - b) All air filtering materials are clean and in good condition.
  - c) All water piping have been cleaned with chemicals and thoroughly flushed with clean water until all impurities have been removed.
  - d) All fluid filtering materials are clean and in good condition.
  - e) All HVAC equipment including pumps are properly lubricated and in working order.
  - f) All drives on rotating equipment have been checked for proper alignment.
  - g) All belts have been checked and adjusted for proper tension.
  - h) All drives are set at the recommended speeds.
  - i) All sheaves and bearing blocks have been checked for loose screws or nuts.
  - j) All variable speed pumping equipment has been tested and placed in proper operation according to manufacturers' instructions.
  - k) All controls and safety devices have been properly installed.
  - l) Where equipment is intended to contain fluids, it shall be filled with the proper fluid and tested for leaks as recommended by the equipment manufacturer.
4. Prior to testing the HVAC System the Contractor shall ensure the following:
  - a) A clean plenum, ductwork, fans and all other equipment.
  - b) All dampers have been checked and set in the full open position.
  - c) All fans have been started and run continuously for a minimum of eight hours at full volume. At the completion of the eight-hour run, all diffusers, coils, etc. shall be cleaned of any collected dirt or debris.
  - d) Start the HVAC system and adjust all equipment, controls, valves, pumps, drives, etc. to ensure proper operation during the first heating and cooling seasons.
  - e) The controls have been properly calibrated, set and checked to make certain that all parts of the control system are functioning properly.
  - f) Each component of the HVAC system, including EMS components, are individually and, as an entire system, operating properly.
  - g) Inform the HVAC Design Engineer when starting and testing of the individual components and the entire system is complete and all are operating properly and as intended to include phase protection and phase monitoring.
5. Only a manufacturer's certified equipment representative / contractor shall be permitted to start up equipment. The design engineer shall be given a minimum of one week notice before starting major HVAC equipment.

23 07 00

#### HVAC INSULATION

1. All outside air ductwork and plenums, all supply air ductwork, condensate drains, hot and chilled water piping, and refrigerant piping are to be externally insulated.

23 09 00

#### INSTRUMENTATION AND CONTROL FOR HVAC

1. A fully integrated Building Automation System (BAS) shall be specified that incorporates direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities. The system shall utilize BACnet protocol for communication to the operator workstation or web server and for communication between control modules. There shall be "Global Control" of set points on DDC systems. The specified software, firmware and hardware shall be upgraded to meet FCPS Energy Management communications requirements with facility controls.

2. The location of all room temperature sensors shall be located four feet off the floor on the latch side of the door. Room temperature sensors shall not be located within ten feet of a data network drop. Discuss with FD&C and Maintenance option of locating sensors in return area ducts.
3. All control field panels shall have their own individual power source circuit. Field panels shall not be powered from equipment power sources or receptacle / lighting circuits.
4. Set Points for HVAC / EMS Controls:

Temperature Set Point (Occupied)	71° to 74° F
Maximum Thermostat Adjustment	+/- 3° F
Summer Setback	78° F
Winter Setback	65° F
HVAC “normal” operating hours for elementary schools:	7:30 am to 2:50 pm
Start-up/stop time:	6:30 am to 4:00 pm
HVAC “normal” operating hours for middle schools:	8:30 am to 3:50 pm
Start-up/stop time:	6:45 am to 5:00 pm
HVAC “normal” operating hours for high schools:	7:30 am to 3:20 pm
Start-up/stop time:	6:45 am to 5:00 pm

5. Outside Air Units are to be scheduled to turn on when students arrive and turned off within 30 minutes of their scheduled departure time.
6. Fresh air exchange operations shall start and stop with normal schedules and event schedules.
7. The following minimum equipment status points shall be monitored: (a) Return air on energy recovery units, (b) Supply air, (c) Compressor status, (d) Supply fan status, (e) Return fan status, (f) Space temperature, (g) alarm status.
8. Digital energy monitoring shall also cover electrical services.
9. Demand Control Ventilation (DCV) is to be considered based on discussions with Facility Design & Construction prior to system design. The consulting engineers shall base their discussion on project specific life cycle cost analysis.
10. The following are the approved Control System Contractors and Manufacturers:

Supplier	Manufacturer	Product Line
EMCOR Services	Automated Logic Corporation	WebCTRL
Siemens	Siemens	DESIGO CC

- a. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless Owner approves use of multiple manufacturers.
- b. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

- 11. All rooms must be trended.
- 12. Keep the quantity of panels to a minimum.
- 13. Leave 20% of the space on a panel for spare points for future use.

23 20 00 HVAC PIPING AND PUMPS

- 1. There shall be a primary pump and a backup pump for all HVAC and domestic hot water piping loops. In all cases non lubricated shaft bearing races shall be used.
- 2. All pumps shall be field aligned.
- 3. In geothermal well fields, all vertical piping, including u-bends shall be grouted with thermally enhanced grout.
- 4. It is preferred that all heat pump supply and return piping shall branch off the top or the side of the main. Special attention by the project engineer shall be paid to branch piping location and shall be reviewed on a case-by-case basis with the goal being to avoid any clogs caused by sediment, etc.
- 5. Any closed loop HVAC unit shall have a normally closed full size by-pass with a valve installed upstream.

23 25 00 HVAC WATER TREATMENT

- 1. All HVAC systems shall have water treatment to prevent scale, corrosion, and fouling of the circulating systems. Chemicals, service, and equipment shall be provided by a single source water treatment company. Water treatment chemical and service supplier shall be a recognized specialist, active in the field for a minimum of 5 years and whose major business is in the field or water treatment. The Water Treatment Company shall have access to regional water analysis laboratories, development facilities and service department, plus full-time personnel located within 50 miles of Fayette County Public Schools.

23 30 00 HVAC AIR DISTRIBUTION

- 1. HVAC ductwork shall be sealed, galvanized metal, externally-lined duct or flexible duct. Internally lined ductwork is not acceptable except on return air lines.
- 2. All exterior ductwork shall be wrapped or fabricated of stainless steel and shall be reinforced so as not to pool water.
- 3. Painted ductwork must follow manufacturer's specifications and best industry practices.

23 35 00 DUST COLLECTION SYSTEM

- 1. If dust collection system needed in wood shop area, discuss system with FD&C.

23 38 00 VENTILATION HOODS

- 1. Refer to Division 11 for Kitchen Hood System.
- 2. Kiln room ventilation shall be by a 6" diameter vent pipe through the roof to connect to a relief ventilator located on the roof. This is a separate system from the downdraft vent that is located at the kiln itself. Refer to Division 11 for Kilns.



3. All high school science classrooms shall have a standard Class B fume hood and shall be equipped with easily accessible filters. Fume hood fire suppression systems as required by code.
4. Supply and exhaust volumes should be such that labs are slightly negative (+/-10%) in pressure relative to adjacent corridors.
5. Fume hood exhaust fans should be oriented in a straight up, blast orientation – not horizontally, nor with any turns in the ductwork before exhausting upward.

23 40 00

#### HVAC AIR CLEANING DEVICES

1. All HVAC filters are to be changed every two weeks by the contractor after each unit is started until such time as the entire building has been turned over to the Owner.
2. At final completion, Contractor shall clean all units and leave one (1) new filter for Owner use.
3. Filters for VRF systems shall be 20"x20"x1" and located in return air grilles for easy access. Filters on air handling units and energy recovery units should be located at the unit, not in the returns.
4. Filtering shall be a minimum of 30% - 35% efficient "pleated" anti-microbial type. Filters shall meet ASHRAE Standard #52.2 for removal efficiency by particle size. Installed filters shall be of commonly used sizes that can be purchased without special ordering. If HVAC units require non-standard size filters, require the contractor to construct and install a metal box/frame to house a common sized filter with no degradation to the HVAC units' efficiency. Ensure that different filter sizes are kept to a minimum. Architect to verify with current building code as this may change.
5. The Contractor shall provide FCPS with the sizes and locations of filters located on a floor plan at substantial completion of each phase of construction. A complete listing shall be provided with the Operations and Maintenance manual.

23 52 00

#### HEATING BOILERS

1. Units providing domestic hot water shall have the following characteristics:
  - a) 316L stainless steel tank
  - b) 90/10 cupronickel heat exchanger
  - c) 6-year warranty on commercial application
  - d) 95% efficiency
  - e) 2" water blown polyurethane foam insulation around tank
  - f) Self-diagnostic electronic control
  - g) Zero clearance to combustible surface
2. Acceptable gas heating boiler manufacturers are Lochinvar (Intelli-Fin, Power-Fin, and Knight), Thermal Solutions EVH, Peerless, Weil-McClain, and HB Smith.
3. Acceptable electric heating boilers are Lochinvar, Cleaver-Brooks, and Precision Compac Series.

23 64 00

#### PACKAGED WATER CHILLERS

1. Acceptable chiller models are Trane Series R, Daikin, and Carrier.

23 65 00

#### COOLING TOWERS

1. Acceptable water tower models are Baltimore Air Coil, Marley, and Evapco.
2. Water filtration between the cooling tower and other HVAC equipment (i.e., heat exchangers, spray nozzles, pumps, etc.) shall be of the self-cleaning filter type.

3. Sub metering shall be installed on all HVAC make-up/fill water systems to facilitate water treatment and/or sewer evaporation credits.

23 72 00

#### AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

1. Energy recovery equipment shall be electric powered. Hot water for dehumidification is not allowed. Preference is for heat recovery dehumidification.
2. Make up air units shall have an air source heat pump with backup modulating silicon-controlled rectifier (SCR) electric heat. (For geothermal based systems, a water source heat pump system may be utilized. Two-way valves shall be installed on each compressor circuit that also act as head pressure control valves.)
3. LCD display on unit shall provide numerous data monitoring points including head pressure for each compressor.
4. Unit shall use DDC controls and have color coded wiring diagram laminated to the inside of the control cabinet door
5. Unit shall have hinged access doors with lockable handles
6. Unit shall have direct drive supply fan.
7. Unit and Energy wheel shall be AHRI certified
8. The unit EER and COP shall be specified on the schedule as a minimum and shall exceed requirements listed in ASHRAE 189.1
9. Unit shall be double wall construction with 2" thick R-13 closed cell foam insulation with stainless steel drain pan and coil casing
10. Unit shall use modulating capacity compressors for all compressors (i.e., digital scroll) for unit capacity control
11. Unit shall use modulating hot gas reheat for humidity control
12. Unit shall have factory mounted fused disconnect and one-point electrical connection
13. Exterior units shall have pipe chases made of the same material as unit's cabinet.
14. All motors shall be premium efficient and inverter rated duty. Fans shall be variable speed where integrated with zone occupancy sensors.
15. All motors shall be protected by phase protection relays.
16. Outside air supplied to the building is to comply with the latest state adopted requirements of ASHRAE 62.1. AHRI 1060 Outside Air Correction Factors and Exhaust Air Transfer as related to purge are to be considered where applicable.
17. Acceptable manufacturers for Single Heat Exchanger Air Cooled Units are Venmar, Aeon, Daikin and Semco (Pinnacle). Double Heat Exchanger Water Source Units - Venmar, Daikin, and Semco (Pinnacle).

23 74 00

#### PACKAGED OUTDOOR HVAC EQUIPMENT

1. All HVAC units shall have stainless steel drain pans lined with a 22-gauge chemical resistant plastic liner.
2. For buildings with Roof Top Units (RTUs) that may not be upgradeable, the acceptable replacement is an RTU with Variable Air Volume distribution. Acceptable manufacturers are Aeon, Trane, Carrier, and Daikin.
3. Rooftop HVAC units shall be oriented and/or baffled to preclude weather related debris, rain, hail, sleet and snow from entering the units through intake and/or exhaust louvers.
4. Roof top HVAC units shall be screened and or baffled to preclude birds and other pests from entering the units through intake and/or exhaust louvers.

## DECENTRALIZED HVAC EQUIPMENT

1. Acceptable Water Source Heat Pump manufacturers that currently meet the ISO 13256 Standard are Trane, Florida Heat Pump and Daikin.
2. All heat pumps and other ceiling or suspended HVAC equipment shall be supported from the bottom of the equipment.
3. Acceptable fan coil units are Trane, York, Daikin, and Envirotec.
4. The first year parts and labor warranty shall be performed by service personnel authorized by the unit manufacturer. Service shall include all internal and external temperature controls provided by the unit manufacturer. Service shall not include routine oiling, cleaning, thermostat adjustment, or filter changing.
5. If heat pumps are used during construction, all warranties and service agreements shall cover the equipment during this period and shall not be subtracted from the warranty service period. Service agreements on heat pumps shall start on substantial completion date of the entire project and shall continue for the specified time period after final acceptance by the Owner.
6. Units shall be able to be reset remotely via DDC system. Units requiring field reset of main power are not acceptable.
7. Units shall be equipped with a solid-state operational controller responsible for the following functions:
  - a) Fan speed control for field balancing between 80% and 100% of design rpm.
  - b) Built in occupied mode for night setback and reset.
  - c) Random start to 35 seconds.
  - d) Condensate overflow horizontal above ceiling
  - e) Low and High voltage protection.
  - f) Low pressure bypass timer (required for stable rotary operation)
  - g) Phase protection (Brown out protection on all individual equipment.)
8. All units shall be equipped with a set of dry contacts to indicate an alarm condition to the building management system.

## APPENDIX A - HVAC Controls

### PART 1 – GENERAL

#### 1.01 Work Included:

- A. GENERAL - Energy Management System (EMS) Contractor shall provide and install a complete DDC Control system as follows:
1. A fully integrated Building Automation System (BAS), incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as herein specified.
  2. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends, and alarms specified in the sequence of operation and points list shall be BACnet objects
  3. The control system shall consist of a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
  4. All controls shall utilize electronic actuation.
  5. All wiring, conduit, panels, and accessories for a complete operational system.
  6. BAS Contractor shall be responsible for all electrical work associated with the BAS.
    - a. Perform all wiring in accordance with all local and national codes.
    - b. Install all line voltage wiring, concealed or exposed, in conduit in accordance with the division 26/27 specifications, NEC and local building code.
    - c. All BAS equipment power shall be from 120VAC, 20 amp circuits and circuit breakers from emergency power panels. The Temperature Controls Contractor (TCC) contractor shall be responsible to provide emergency power to all BAS equipment panels. TCC shall provide and install local UPS Power supply for all major BAS system panels and equipment. Unitary and application specific controllers are not required to be powered from emergency power panels.
    - d. Surge transient protection shall be incorporated in design of the systems to protect electrical components in all DDC Controllers and operator's workstations.
    - e. All exposed low voltage electrical control wiring throughout the building shall be run in conduit in accordance with the division 26/27 specifications, local building code and the NEC. Low voltage wiring in concealed accessible locations may be plenum-rated cable and shall be installed parallel to building lines and supported.
    - f. All systems requiring interlock wiring shall be hardwired interlocked and shall not rely on the BAS to operate (e.g. emergency generator to fuel oil pump interlock, emergency generator damper interlock, freeze protection low limit thermostats, etc.).
  7. Provide Siemens DESIGO CC or Automated Logic WebCTRL system architecture. System shall be capable of high speed Ethernet communication using TCP/IP protocol.

- a. System shall be capable of BACnet communication according to ANSI/ASHRAE 135-2004.
  - b. System shall be capable of OPC server communications according to OPC Data Access 2.0 and Alarms and Events 1.0.
  - c. The system shall be capable of supporting wireless field level networks and sensor communications using a mesh topology and IEEE 802.15.4 network.
8. Provide hardware, software, and wiring to provide communication interfaces with third party systems as indicated in the sequence of operation and points list.
9. Provide system graphics for each controlled device and/or integrated system(s) as indicated in sequence of operation and points list. Origin of information shall be transparent to the operator and shall be controlled, displayed, trended, etc. as if the points were hardwired to the BAS.
10. The controls shall seamlessly integrate to the existing Siemens DESIGO CC server or WebCTRL server currently in use by Fayette County Public Schools as applicable
11. Provide one (1) Portable Operator Terminal complete with all necessary software and hardware to allow simultaneous communication to the entire BAS from any DDC Controller. The portable terminal shall be able to monitor, adjust, trend, edit, modify, add, and delete, all system information or points.
12. Primary DDC panels as follows:
  - a. Minimum one (1) Building Controller (as defined by ANSI/ASHRAE 135, BACnet Annex L) per building. The advanced application controllers (AAC), application specific controllers (ASC), smart actuators (SA), and smart sensors (SS), as defined by ANSI/ASHRAE 135, BACnet Annex L, will be connected to the primary Building Controller.
  - b. Minimum one (1) Advanced application controller or application specific controller (as defined by ANSI/ASHRAE 135, BACnet Annex L) per each major mechanical system including:
    - 1) Air Handling Units
    - 2) Hot Water heat Exchangers and associated pumps
    - 3) Chillers and associated pumps
    - 4) Cooling Towers associated pumps
    - 5) Emergency Generators
  - c. It shall be acceptable to combine up to three (3) of the following mechanical equipment into one advanced application controller (AAC) or application specific controller (ASC):
    - 1) Exhaust Fans
    - 2) Standalone Supply Fans
    - 3) Package AC Units
  - d. It is acceptable to wire the following systems into any of the Building Controllers:
    - 1) Miscellaneous alarm monitoring (i.e. ATS, leak, temperature, light, etc.)

2) Miscellaneous equipment (i.e. Unit Heater, Domestic Water Heater, Standalone Dampers ...etc.)

e. Motors in motor control centers (MCC) shall be controlled from the advanced application controller (AAC) or application specific controller (ASC) associated with HVAC system being powered from the MCC. It shall not be acceptable to control all motors in a MCC from a single AAC or ASC controller dedicated to the MCC. The intent of this specification is that the loss of any one ASC or AAC controller shall not affect the operation of other HVAC systems, only for the points connected to the AAC or ASC controller.

13. Stand-alone Application Specific Controllers (ASCs) for terminal equipment (CAV, FP VAV, and VAV units, WSHP's, Daikin terminal units, and fan coil units).

#### B. GENERAL PRODUCT DESCRIPTION

1. The installation of the control system shall be performed under the direct supervision of the controls manufacturer or the controls manufacturer's representative with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer or representative.
2. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed especially for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.
3. The system shall be scalable in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, and operator devices.
4. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each BC, AAC, and ASC Controller shall operate independently by performing its own specified control, alarm management, operator I/O, and data collection. The failure of any single component or network connection shall not interrupt the execution of any control strategy, reporting, alarming and trending function, or any function at any operator interface device.
5. DDC Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC Controllers shall also be able to send alarm to multiple operator workstations without dependence upon a central or intermediate processing device.
6. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust or control only the points that the operator is authorized for. All other points shall not be displayed at the PC workstation or portable terminal. (e.g. all base building and all tenant points shall be accessible to any base building operators, but only certain base building and tenant points shall be accessible to tenant building operators). Passwords and priority levels for every point shall be fully programmable and adjustable.
7. All DDC controllers shall be installed with 20% spare points (of each type) and 20% spare memory capacity for connection of floor work.
8. Digital Energy Monitors shall be provided for each school to measure kWh usage.

9. The latest revision, at time of installation, of the vendor's remote alarm notification software shall be provided.

1.02 Products Furnished but Not Installed Under This Section

A. Hydronic Piping:

1. Control Valves
2. Temperature Sensor Wells and Sockets
3. Flow Switches
4. Flow Meters

B. Duct-work Accessories:

1. Dampers
2. Air-flow Stations

1.03 Products Installed but Not Furnished Under This Section

- A. All wells for water monitoring devices, flow switches and alarms, as required.

1.04 Related Sections

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents.

1.05 Approved Control System Contractors and Managers

- A. The following are the approved Control System Contractors and Manufacturers:

Supplier	Manufacturer	Product Line
EMCOR Services	Automated Logic Corporation	WebCTRL
Siemens	Siemens	DESIGO CC

1. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless Owner approves use of multiple manufacturers.
2. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.06 Quality Assurance

- A. The BAS system shall be designed and installed, commissioned and serviced by factory trained personnel. BAS contractor shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. The BAS contractor shall provide an experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the B.M.S. The Bidder shall be regularly engaged in the installation and maintenance of BAS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the installation and maintenance of BAS systems similar in size and complexity to this project.

- B. The BAS contractor shall maintain a service organization consisting of factory trained service personnel and provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.
- C. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- D. All BAS peer-to-peer network controllers, central system controllers, and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 916 category PAZX; Standard UL 864, categories UDTZ, and QVAX and be so listed at the time of Bid.
- E. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
- F. All wireless devices shall conform to:
  - 1. The requirements of Title 47 of the Code of Federal Regulations, FCC Part 15, governing radio frequency intentional radiating devices and be issued a FCC user identification and be so labeled.
  - 2. CE Directive 1999/5/EC (Radio Equipment and Telecommunications Terminal Equipment and the Mutual Recognition of their Conformity)
- G. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network. Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

#### 1.07 Codes and Standards

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
  - 1. National Electric Code (NEC)
  - 2. International Energy Conservation Code (IECC)
  - 3. Kentucky Building Code (KBC)
    - a. Section 710.5, Wiring in Plenums
    - b. Section 1106, Refrigeration Machinery Rooms
    - c. Section 1107, Refrigeration Machinery Room Ventilation
    - d. Section 1108, Refrigeration Machinery Room Equipment and Controls
    - e. Section 1120, Detection and Alarm Systems
  - 4. International Mechanical Code (IMC)
  - 5. ANSI/ASHRAE Standard 135- 2004, BACnet--A Data Communication Protocol for Building Automation and Control Networks.

#### 1.08 System Performance



- A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
1. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, control loops, and similar control logic shall automatically refresh within 6 sec.
  2. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
  3. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
  4. Performance. Programmable controllers shall be able to completely execute DDC control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control
  5. Multiple Alarm Annunciations. Each workstation on the network shall receive alarms within 5 sec of other workstations.
  6. Reporting Accuracy. System shall report values with minimum end-to-end accuracy as listed in Product section.
  7. Control Stability and Accuracy. Control loops shall maintain measured variable at set point within tolerances listed in Product section.

#### 1.09 Submittals

- A. Product Submittal Requirements. Meet requirements of Section 220100 on Shop Drawings, Product Data, and Samples. Provide six copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished. Begin no work until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD 2004 (or newer) compatible files on optical disk (file format: .dwg, .dxf, or comparable) or hard copies on 11" x 17" prints of each drawing. When manufacturer's cut sheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work.
- B. Provide submittals within 12 weeks of contract award
- C. Submittal data shall consist of the following:
1. Direct Digital Control System Hardware:
    - a. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
    - b. Manufacturer's description and technical data, such as product specification sheets, installation and maintenance instructions for items listed below and for relevant items not listed below:
      - 1) Direct Digital Controllers (controller panels)
      - 2) Transducers and transmitters
      - 3) Sensors (including accuracy data)

- 4) Valves
  - 5) Dampers
  - 6) Relays and Switches
  - 7) Control Panels
  - 8) Power Supplies
  - 9) Operator Interface Equipment
- c. Wiring diagrams and layouts for each control panel. Show all termination numbers.
  - d. Floor plan schematic diagrams indicating control panel and space temperature sensor locations.
2. Central System Hardware and Software:
    - a. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.
    - b. Manufacturer's description and technical data such as product specifications for items listed below and for relevant items furnished under this contract not listed below:
      - 1) Central Processing Unit (CPU)
      - 2) Monitors
      - 3) Keyboards
      - 4) Power Supply
      - 5) Battery Backup
      - 6) Interface Equipment Between CPU and Control Panels
      - 7) Operating System Software
      - 8) Operator Interface Software
      - 9) Color Graphic Software
    - c. Schematic diagrams of all control, communication, and power wiring for central system installation. Show interface wiring to control system.
  3. Controlled Systems:
    - a. Riser diagrams showing control network layout, communication protocol, and wire types.
    - b. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.
    - c. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic use the same name.
    - d. Instrumentation list for each controlled system. List control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
    - e. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system.
    - f. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
  4. Description of process, report formats and checklists to be used in and completed.

5. Contractor shall submit documentation in the following phased delivery schedule:

- a. Valve and damper schedules
- b. Point Naming Convention
- c. Sample Graphics
- d. System schematics, including:
  - 1) System Riser Diagrams
  - 2) Sequence of Operations
  - 3) Mechanical Control Schematics
  - 4) Electrical Wiring Diagrams
  - 5) Control Panel Layouts
  - 6) Product Specification Sheets
- e. As-Built drawings

D. Schedules:

1. Schedule of work provided within one month of contract award indicating:

- a. Intended sequence of work item.
- b. Start dates of each work item.
- c. Duration of each work item.
- d. Planned delivery dates for ordered material and equipment and expected lead times.
- e. Milestones indicating possible restraints on work by other trades or situations.

2. Monthly written status reports indicating work completed and revisions to expected delivery. Include updated schedule of work.

E. Project Record Documents: Submit three copies of record (as-built) documents upon completion of installation. Submittal shall consist of:

- 1. Project Record Drawings. As-built versions of the submittal shop drawings provided as AutoCAD 2004 (or newer) compatible files on optical media and as 11" x 17" prints.
- 2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs shall be submitted.
- 3. Operation and Maintenance (O & M) Manual.
  - a. As-built versions of the submittal product data.
  - b. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.
  - c. Operator's Manual with procedures for operating control systems, logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
  - d. Programming manual or set of manuals with description of programming language and of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
  - e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform

preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.

- f. Documentation of all programs created using custom programming language, including set points, tuning parameters, and object database.
- g. Graphic files, programs, and database on magnetic or optical media.
- h. List of recommended spare parts with part numbers and suppliers.
- i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.
- j. Complete original original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
- k. Licenses, guarantees, and warranty documents for equipment and systems.

F. Training Materials. Provide course outline and manuals at least six weeks before training.

#### 1.10 Warranty

- A. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Failures on control systems that include all computer equipment, transmission equipment and all sensors and control devices during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
- B. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts, each contract shall have a separate warranty and start date period. If specified work is split into a multi-phase contract, the warranty for all phases shall begin from the date of acceptance of the final phase.
- C. If Engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, Engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
- D. Provide updates to operator workstation software, project-specific software, graphic software, database software, and firmware that resolve Contractor identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with the above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
- E. Exception:
  - 1. Contractor shall not be required to warrant reused devices, except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

2. Contractor shall not be required to warrant systems, equipment and devices or software if the damages and/or failures were caused by lack of training, unauthorized use, negligence or deliberate action of other parties, or job site conditions.

#### 1.11 Ownership of Proprietary Material

- A. Project specific software and documentation shall become Owner's property. This includes, but not limited to:
  1. Graphics
  2. Record drawings
  3. Database
  4. Application programming code
- B. Documentation
  1. General
    - a. Submit two (2) draft copies of owner's manuals for review. After review by authorized representative, the contractor shall incorporate review comments and submit four (4) interim final copies.
    - b. Submit four (4) copies of owner's manuals upon completion of project.
    - c. Submit two (2) electronic copies of complete as-built documentation on CD ROM. All drawings shall be in standard AutoCAD 2004 format, other documentation shall be in standard MS Office format.
    - d. Update manuals with modifications made to system during guarantee period. Provide replacement pages or supplements in quantity stated above for "as built" manuals.
    - e. Assemble owner's manuals into multi-volume sets as necessary and required by the owner.
    - f. Protect each volume with a heavy duty binder. Volumes to have plastic printed dividers between major sections and have oversized binders to accommodate up to ½ inch thick set of additional information.
    - g. Each binder to be printed with project name and volume title on front cover and binder.
    - h. On the first page of each manual identify with project name, manual title, owner's name, engineer's name, contractor's name, address and service phone number, and person who prepared manual.
- C. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:
  1. Sequence of operation for automatic and manual operating modes for all building systems. The sequences shall cross reference the system point names.
  2. Description of manual override operation of all control points in system.
  3. BAS system manufacturers complete operating manuals.

- D. Provide maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:
1. Complete as-built installation drawings for each building system.
  2. Overall system electrical power supply schematic indicating source of electrical power for each system component. Indicate all battery backup provisions.
  3. Photographs and/or drawings showing installation details and locations of equipment.
  4. Routine preventive maintenance procedures, corrective diagnostics troubleshooting procedures, and calibration procedures.
  5. Parts list with manufacturer's catalog numbers and ordering information.
  6. Lists of ordinary and special tools, operating materials supplies and test equipment recommended for operation and servicing.
  7. Manufacturer's operation, set-up, maintenance and catalog literature for each piece of equipment.
  8. Maintenance and repair instructions.
  9. Recommended spare parts.

## PART 2 – PRODUCTS

### 2.01 Materials:

- A. All products used in this project installation shall be new and currently manufactured and shall have been applied in similar installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner or Owner's representative. Spare parts shall be available for at least five years after completion of this contract.

### 2.02 Communication:

- A. The design of the BAS shall support networking of operator workstations, building controllers, advanced application controllers, and application specific controllers. The network architecture shall consist of two levels, an Ethernet based primary network for all operator workstations, servers, and building controllers (BC) along with secondary Floor Level Networks (FLN) for application specific controllers (ASC), and Advanced application controllers (AAC).
- B. Control products, communication media, connectors, repeaters, hubs and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
- C. Access to system data shall not be restricted by the hardware configuration of the building management system. The hardware configuration of the BAS network shall be totally transparent to the user when accessing data or developing control programs.
- D. Operator Workstation Communication:
1. The servers will act as the central database for system graphics and databases to provide consistency throughout all system workstations.

2. The Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

E. Primary Network - BC to BC Communication:

1. All Building Controllers shall directly reside on the primary network such that communications may be executed directly between Building Controllers, directly between server and Building Controllers on a peer-to-peer basis.
2. Systems that operate via polled response or other types of protocols that rely on a central processor, file server, or similar device to manage panel-to-panel or device-to-device communications shall not be acceptable.
3. All operator interfaces shall have the ability to access all point status and application report data or execute control functions for any and all other devices. Access to data shall be based upon logical identification of building equipment. No hardware or software limits shall be imposed on the number of devices with global access to the network data.
4. The primary network shall use TCP/IP over Ethernet. All devices must:
  - a. Auto-sense 10/100 Mbps networks.
  - b. Receive an IP Address from a Dynamic Host Configuration Protocol (DHCP) Server or be configured with a Fixed IP Address.
  - c. Resolve Name to IP Addresses for devices using a Domain Name Service (DNS) Server on the Ethernet network.
  - d. Allow MMI access to an individual Primary Network Controller using industry standard Telnet software to view and edit entire Primary Network.
5. The primary network shall provide the following minimum performance:
  - a. Provide high-speed data transfer rates for alarm reporting, report generation from multiple controllers and upload/download efficiency between network devices. System performance shall insure that an alarm occurring at any Building Controller is displayed at any PC workstations, all Building controllers, and other alarm printers within 15 seconds.
  - b. Message and alarm buffering to prevent information from being lost.
  - c. Error detection, correction, and re-transmission to guarantee data integrity.
  - d. Synchronization of real-time clocks between Building Controllers, including automatic daylight savings time corrections.
  - e. The primary network shall allow the Building Controllers to access any data from, or send control commands and alarm reports directly to, any other Building Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. Building Controllers shall send alarm reports to multiple operator workstations without dependence upon a central or intermediate processing device. The network shall also allow any Building controller to access, edit, modify, add, delete, back up, restore all system point database and all programs.

F. Secondary Network – Advanced Application Controller and Application Specific Controller Communication:

1. Communication over the secondary network shall be one or the following, or a combination of, BACnet MS/TP or BACnet Arcnet protocol.
2. Communication over the secondary network can utilize a wireless MESH topology based on an IEEE 802.15.4 network. Point to point communication shall be acceptable.
3. This level communication shall support a family of application specific controllers for terminal equipment.
4. The Application Specific Controllers shall communicate bi-directionally with the primary network through Building Controllers for transmission of global data.
5. The maximum number of application specific controllers shall be limited so as not to impede the global data and alarm response times as specified.

G. Wireless Communications

1. Wireless communications shall take place using modular wireless transceivers at each device that eliminate the need for a physical network communication cable.
  - a. The wireless transceiver shall utilize 2.4 GHz in the license free global Industrial Scientific & Medical (ISM) band for greater bandwidth.
  - b. The wireless transceiver shall be encased in a plenum-rated enclosure. If the application dictates, the wireless transceiver shall be able to be installed in a metal enclosure utilizing a remote mounted antenna.
  - c. The wireless transceiver channel shall be factory set and capable of being field set to a different channel if interference with IEEE 802.11 devices or other 2.4 GHz products is encountered.
  - d. The wireless transceiver shall be 24 VAC powered.
  - e. The wireless transceiver shall give a visual indication that it is powered and communicating.
  - f. The wireless transceiver shall have a field settable network identifier that allows multiple networks to occupy the same channel for maximum scalability.

2.03 Building Controller Software

A. General:

1. The software programs specified in this Section shall be provided as an integral part of Building Controllers and shall not be dependent upon any higher level computer or another controller for execution.
2. All points, panels and programs shall be identified by a 30 character name. All points shall also be identified by a 16 character point descriptor. The same names shall be displayed at both Building Controller and the Operator Interface.



3. All digital points shall have a user defined two-state status indication with 8 characters minimum (e.g. Summer, Enabled, Disabled, Abnormal).
4. Building Controllers shall have the ability to perform energy management routines including but not limited to time of day scheduling, calendar-based scheduling, holiday scheduling, temporary schedule overrides, start stop time optimization, automatic daylight savings time switch over, night setback control, enthalpy switch over, peak demand limiting, temperature-compensated duty cycling, heating / cooling interlock, supply temperature reset, priority load shedding, and power failure restart.
5. The Building Controllers shall have the ability to perform the following pre tested control algorithms:
  - a. Two position control
  - b. Proportional control
  - c. Proportional plus integral control
  - d. Proportional, integral, plus derivative control
  - e. Automatic tuning of control loops
  - f. Model-Free Adaptive Control
6. Each controller shall be provided with an interactive HELP function to assist operators using POTs and remote connected operators.

#### B. System Security

1. User access shall be secured using individual security passwords and user names.
2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
3. User Log On / Log Off attempts shall be recorded.
4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.
5. Use of workstation resident security as the only means of access control is not an acceptable alternative to resident system security in the field panel.

#### C. User Defined Control Applications:

1. Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
2. It shall be possible to use any system measured point data or status, any system calculated data, a result from any process, or any user-defined constant in any controller in the system.
3. Any process shall be able to issue commands to points in any and all other controllers in the system.

4. Processes shall be able to generate operator messages and advisories to other operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
5. Each controller shall support plain language text comment lines in the operating program to allow for quick troubleshooting, documentation, and historical summaries of program development.
6. Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task oriented information from the user manual.

D. Alarm Management:

1. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each Building Controller shall perform distributed, independent alarm analysis, minimize network traffic and prevent alarms from being lost. At no time shall the Building Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.
2. Conditional alarming shall allow generation of alarms based upon user defined multiple criteria.
3. An Alarm "shelving" feature shall be provided to disable alarms during testing. (Pull the Plug, etc.).
4. Binary Alarms. Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
5. Analog Alarms. Each analog object shall have both high and low alarm limits. Alarming must be able to be automatically and manually disabled.
6. All alarm or point change reports shall include the point's user defined language description and the time and date of occurrence.
7. Alarm reports and messages shall be routed to user-defined list of operator workstations, or other devices based on time and other conditions. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display graphics.
8. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
9. Each Building Controller shall be capable of storing a library of at least 50 alarm messages. Each message may be assignable to any number of points in the Controller.
10. Operator-selected alarms shall be capable of initiating a call to a remote operator device.

E. Scheduling:

1. Provide a comprehensive menu driven program to automatically start and stop designated multiple objects or events in the system according to a stored time.
2. Heating/Cooling Seasons:

Heating Season:

Dates: October 15<sup>th</sup> (each year) through April 15<sup>th</sup> (following year)  
ACCEPTABLE HUMIDITY = 20% - 60% Relative Indoor Humidity  
CARBON DIOXIDE CONTENT = Less than 1,000 Parts per Million (ppm)

Cooling Season:

Dates: April 15<sup>th</sup> (each year) through October 15<sup>th</sup> (following year)  
ACCEPTABLE HUMIDITY = 20% - 60% Relative Indoor Humidity  
CARBON DIOXIDE CONTENT = Less than 1,000 Parts per Million (ppm)

3. Schedules shall reside in the building controllers, advanced application controllers and application specific controllers and shall not rely on external processing or network.
4. It shall be possible to define a group of objects as a custom event (i.e. meeting, athletic activity, etc.). Events can then be scheduled to operate all necessary equipment automatically.
5. For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start and/or stop within that group.
6. The operator shall be able to define the following information:
  - a. Time, day
  - b. Commands such as on, off, auto, etc.
  - c. Time delays between successive commands.
  - d. There shall be provisions for manual overriding of each schedule by an authorized operator.
7. It shall be possible to schedule calendar-based events up to one year in advance based on the following:
  - a. Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start, optimal stop, and night economizer. When a group of objects are scheduled together as an Event, provide the capability to adjust the start and stop times for each member.
  - b. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.
- F. Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.
- G. Night setback control. The system shall provide the ability to automatically adjust set points for night control. This shall be accomplished globally for the entire building.
- H. Loop Control. A Model-Free Adaptive Control algorithm or alternatively a PID (proportional-integral-derivative) closed-loop control algorithm with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, set point, and weighting parameters shall be user-selectable.

- I. Sequencing. Provide application software based upon the sequences of operation specified to properly sequence equipment.
- J. Staggered Start:
  - 1. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user definable.
  - 2. Upon the resumption of power, each Building Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.
- K. Totalization:
  - 1. Run-Time Totalization.

Building Controllers shall automatically accumulate and store run-time hours for all digital input and output points. A high runtime alarm shall be assigned, if required, by the operator.
  - 2. Consumption Totalization.

Building Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for all analog and digital pulse input type points.
  - 3. Event Totalization.

Building Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for all points. The event totalization feature shall be able to store the records associated with events before reset.
- L. Data Collection:
  - 1. A variety of historical data collection utilities shall be provided to manually or automatically sample, store, and display system data for all points.
  - 2. Building Controllers shall store point history data for selected analog and digital inputs and outputs:
    - a. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each Building Controllers point group.
  - 3. Trend data shall be stored at the Building Controllers and uploaded to the server when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command or when the trend buffers are full. All trend data shall be available for use in 3rd party personal computer applications.
  - 4. Loop Tuning. Building Controllers shall also provide high resolution sampling capability for verification of DDC control loop performance. Documented evidence of tuned control loop performance shall be provided on a <monthly, seasonal, quarterly, annual> period.
    - a. For Model-Free Adaptive Control loops, evidence of tuned control loop performance shall be provided via graphical plots or trended data logs. Graphical plots shall

minimally include depictions of set point, process variable (output), and control variable (e.g., temperature). Other parameters that may influence loop control shall also be included in the plot (e.g., fan on/off, mixed-air temp).

- b. For PID control loops, operator-initiated automatic and manual loop tuning algorithms shall be provided for all operator-selected PID control loops. Evidence of tuned control loop performance shall be provided via graphical plots or trended data logs for all loops.
  - 1) In automatic mode, the controller shall perform a step response test with a minimum one-second resolution, evaluate the trend data, calculate the new PID gains and input these values into the selected LOOP statement.
  - 2) Loop tuning shall be capable of being initiated either locally at the Building Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

#### 2.04 Building Controllers

- A. Building Controllers shall be 32 bit, multi-tasking, multi-user, real-time 48 MHz digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point list.
- B. Each Building Controller shall support a minimum of 3 directly connected Secondary Networks.
- C. Each Building Controller shall have sufficient memory, a minimum of 72 megabyte, to support its own operating system and databases, including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, and dial-up communications.
- D. Building Controller shall have an integral real-time clock.
- E. Each Building Controller shall support firmware upgrades without the need to change hardware.
- F. Each Building Controller shall support:
  - 1. Monitoring of industry standard analog and digital inputs, without the addition of equipment outside the Building Controller cabinet.
  - 2. Monitoring of industry standard analog and digital outputs, without the addition of equipment outside the Building Controller cabinet.
- G. Spare Point Capacity. Each Building Controller shall have a minimum of 10 percent spare point capacity.
  - 1. The type of spares shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall there be less than one spare of each implemented I/O type.
  - 2. Provide all processors, power supplies, and communication controllers so that the implementation of adding a point to the spare point location only requires the addition of the appropriate items:

- H. Serial Communication. Building Controllers shall provide at least two EIA-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, and portable laptop operator's terminals. Building Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected printers or terminals.
- I. Manual Override. The operator shall have the ability to manually override automatic or centrally executed commands at the Building Controller via local, point discrete, integral hand/off/auto operator override switches for all digital control type points and gradual switches for all analog control type points. These override switches shall be operable whether the panel processor is operational or not. Each Building Controller shall monitor and alarm the hand, off and auto positions of integral HOA switches.
- J. I/O Status and Indication. Building Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. All wiring connections shall be made to field-removable terminals.
- K. Self Diagnostics. Each Building Controller shall continuously perform self diagnostics, communication diagnosis, and diagnosis of all panel components. The Building Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication for any system.
- L. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 100 hours.
- M. Environment.
  - 1. Controller hardware shall be suitable for the anticipated ambient conditions.
  - 2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°F to 120°F.
  - 3. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 32°F to 120°F.
- N. Immunity to power and noise.
  - 1. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
  - 2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.
  - 3. Isolation shall be provided at all primary network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
    - a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V
    - b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact

- c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
  - d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)
4. Isolation shall be provided at all Building Controller's AC input terminals to suppress induced voltage transients consistent with:
- a. IEEE Standard 587 1980
  - b. UL 864 Supply Line Transients
  - c. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)
- O. Minimum Approved Building Controllers. BAS Contractors shall furnish Building Controllers as listed below. Providing an approved controller does not release the contractor from meeting all performance, software and hardware specifications for Building Controllers and system operations.
- 1. Siemens Building Technologies Inc. - Modular Building/Equipment Controllers (MBC/MEC/PXC).
  - 2. OR Automated Logic Controls – LGR/Multi Equipment controller (MEx, MELGR)

Application Specific Controllers (ASC)

A. General:

Provide for control of each piece of equipment as required for each individual project.

- 1. Each Building Controller shall be able to communicate with application specific controllers (ASCs) over the Secondary Network to control terminal equipment only.
- 2. Each application specific controller shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.
- 3. Each application specific controller shall include all point inputs and outputs necessary to perform the specified control sequences. The ASC shall accept input and provide output signals that comply with industry standards. Controllers utilizing proprietary control signals shall not be acceptable. Outputs utilized either for two-state, modulating floating, or proportional control, allowing for additional system flexibility.
- 4. Space Temperature Sensors. Each controller performing space temperature control shall be provided with a matching room temperature sensor.
  - a. Wired Sensor specifications. The sensor may be either RTD or thermistor type providing the following.
    - 1) Accuracy: + .5 F
    - 2) Operating Range: 35 to 115 F
    - 3) Set Point Adjustment Range : 55 to 95 F





LCD or the portable operator's terminal as specified herein. Controllers that incorporate proportional and integral (PI) control algorithms only shall not be acceptable.

7. Control Applications. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.
8. Calibration. Each controller shall include provisions for manual and automatic calibration of the differential pressure transducer in order to maintain stable control and insuring against drift over time.
9. Memory.
  - a. Provide each ASC with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 72-hour battery backup shall be provided. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration.
  - b. Upon replacement, new ASCs shall recover control function and site specific defaults automatically and resume normal operation.
10. Power Supply. The ASCs shall be powered from a 24 VAC source and shall function normally under an operating range of 18 to 28 VAC, allowing for power source fluctuations and voltage drops. Power supply for the ASC must be rated at a minimum of 125% of ASC power consumption and shall be of the fused or current limiting type. The BAS contractor shall provide 24 VAC power to the terminal units by utilizing:
  - a. The existing line voltage power trunk and installing separate isolation transformers for each controller.
  - b. Dedicated line voltage power source and isolation transformers at a central location and installing 24VAC power trunk to supply multiple ASCs in the area.
11. Environment. The controllers shall function normally under ambient conditions of 32 to 122 F and 10% to 95%RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the circuit board assembly.
12. Immunity to noise. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 3 ft.
13. Manufacturer Installed Controls.
  - a. BAS manufacturer shall furnish ASC and actuator for factory mounting to equipment manufacturer.
  - b. Cost of factory mounting shall be borne by equipment manufacturer.
  - c. For VAV terminals, equipment manufacturer shall provide and install flow-cross sensor, 24 Vac transformer, controls enclosure, fan relay, SCR and factory install, wire and tube ASC controller and actuator.
  - d. Fan powered VAV terminals shall be equipped with a fan speed controller and relay to change summer and winter speed set point.

## 2.05 Input/Output Interface:

- A. Hardwired inputs and outputs may tie into the system through building or application specific controllers.
- B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of On/Off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense “dry contact” closure without external power (other than that provided by the controller) being applied.
- D. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.
- E. Analog inputs shall allow the monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with—and field configurable to—commonly available sensing devices.
- F. Binary outputs shall provide for On/Off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have three-position (On/Off/Auto) override switches and status lights. Outputs shall be selectable for either normally open or normally closed operation.
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC, 4 to 20 mA or 0-20 PSI signal as required to provide proper control of the output device. Analog outputs on building or custom application controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
- H. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
- I. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

## 2.06 Power Supplies and Line Filtering

- A. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
- B. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall

be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.

1. Unit shall operate between 32°F and 120°F. EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
2. Line voltage units shall be UL recognized and CSA approved.

C. Power line filtering.

1. Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component. Surge protection shall have the following at a minimum:
  - a. Dielectric strength of 1000 volts minimum
  - b. Response time of 10 nanoseconds or less
  - c. Transverse mode noise attenuation of 65 dB or greater
  - d. Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

2.07 Auxiliary Control Devices

A. GENERAL

1. Specified in this section are the following hard wired input/output devices connected to the BC, AAC, or ASC.
  - a. Automatic Dampers
  - b. Electric Damper Actuators
  - c. Motorized Isolation Valves
  - d. Ball Valves
  - e. Automatic Control Valves
  - f. Airflow Measuring Stations
  - g. Binary Temperature Devices
  - h. Temperature Sensors
  - i. Dew Point/Humidity Sensors
  - j. Pressure Sensors
  - k. Water Differential Pressure Sensors
  - l. Differential Pressure Switches
  - m. Analog Water Level Sensors
  - n. Water Leak Detection Systems
  - o. Audio/Visual Alarm Units
  - p. Fuel Oil Meters
  - q. Water BTU Meters
  - r. Vortex Shedding Flow Meters
  - s. Indoor Air Quality (CO<sub>2</sub>/VOC) Space Sensors
  - t. Relays
  - u. Override Timers
  - v. Current Transformers
  - w. Voltage Transmitters
  - x. Voltage Transformers
  - y. Power Monitors
  - z. Current Switches

- aa. Pressure Electric Switches
- bb. Electro-pneumatic Transducers
- cc. Local Control panels
- dd. Local User Display

2. Specified in this section are the following devices connected to the BAS using serial communication.

- a. Water BTU Meters
- b. Variable Frequency Drives (VFD)
- c. Indoor Air Quality (CO<sub>2</sub>/VOC) Space Sensors
- d. Power Monitors
- e. [User Defined]

## B. AUTOMATIC DAMPERS

1. Dampers shall have 13-gauge galvanized frames of not less than 3" in width and blades of 14-gauge, equivalent thickness, galvanized steel roll formed airfoil type for low pressure drop and low noise generation and shall be adequately braced to from a rigid assembly where required in galvanized duct work. Dampers shall have blades not more 8" wide. Linkage and hardware shall be zinc plated steel and shall be concealed out of airstream within the damper frame. Damper blades and rods shall be installed in horizontal position.
2. In copper, aluminum and stainless steel duct work, damper material shall match the duct work material.

All dampers shall be of the proportioning or opposed blade type, and shall be motor operated. Dampers shall have continuous elastomer or stainless steel stops to avoid leakage. Bearings shall be corrosion resistant oil tight stainless steel sleeve type. All dampers shall be provided with continuous 3/16" x 1/2" closed cell neoprene gasket around perimeter of the frame and at interlocking blade edges to form an air tight seal. Blade seals shall be suitable for -76° F to 350°F mechanically locked into blade edge. Adhesive of clip on type are not acceptable. Axles shall be square or hexagonal positively locked into damper blade. Linkage shall be concealed out of airstream within the damper blade.

3. All dampers shall be constructed to provide a maximum leakage of 3-1/2%, with an approach velocity of 1500 fpm when closed against a pressure of 4 inches of water. Submit leakage and flow characteristic data for all dampers.
4. All outside air dampers, with the exception of the emergency generator dampers, shall automatically close in the event of a loss of power. Dampers on emergency generators shall automatically open on a loss of power.

## C. Electric Damper Actuators

### 1. General

- a. The actuator shall have mechanical or electronic stall protection to prevent damage to the actuator throughout the rotation of the actuator.
- b. Where shown, for power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing. Alternatively, an uninterruptible power supply (UPS) may be provided. On terminal unit valves actuators capacitor driven fail action is permitted.

- c. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range.
- d. All 24 VAC/VDC actuators shall operate on Class 2 wiring.
- e. All actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 Nm (60 in.-lb) torque capacity shall have a manual crank for this purpose.
- f. Electric actuators for emergency generator damper control shall be rated for 350 degree F. maximum operating temperature and capable to drive fully open and close within 15 seconds.

#### D. MOTORIZED ISOLATION VALVES

##### 1. Butterfly Valves.

- a. Furnish automatic butterfly valves for isolation requirements as shown on the drawings or required herein. All butterfly valves shall have body ratings in accordance with the piping specifications. Valves shall be high performance, fully lugged with carbon steel body ANSI 150/300. Valves shall be rated for bubble tight dead end closure, with 316 stainless steel disc, stainless steel shaft and reinforced Teflon seat and seals.
- b. Motorized valves located outdoors or in areas subject to outdoor air conditions provide fail in place, electric operators with water proof enclosure, crankcase heater, and open and closed position limit switches. Valve and all accessories shall be constructed for outdoor use. All electrical devices shall be weather proof and NEMA 4 rated.
- c. All valves shall be provided with external position indicators and a speed control device to prevent too rapid closure.
- d. All valves shall be provided with manual override hand wheels for operating the valve.
- e. The valves shall be line size as shown on plans.

#### E. BALL VALVES.

- 1. Furnish automatic full port ball valves for isolation requirements on line sizes up to 2" as shown on the drawings or required herein. All ball valves shall have ANSI 250 body rating. Valves shall be bronze body and stainless steel trim.
- 2. Valves shall close against a differential pressure equal to the design pump head pressure plus 10%.
- 3. The valves shall fail to their safe position upon power loss as specified in the sequence of operation.
- 4. All valves shall be provided with manual override.
- 5. Provide valve position indicator end switches with the actuator.
- 6. The valves shall be line size as shown on plans.

#### F. AUTOMATIC CONTROL VALVES.

1. General:
  - a. Control valves shall be two-way or three-way type single seated globe type for two-position or modulating service as shown. Valves shall meet ANSI Class IV leakage rating.
  - b. Body pressure rating and connection type construction shall conform to pipe, fitting and valve schedules. Where pressure and flow combinations exceed ratings for commercial valves and operators, industrial class valves and operators shall be provided.
  - c. Valve operators shall be of electric type.
  - d. The valves shall be quiet in operation and fail-safe in either normally open or normally closed position in the event of power failure.
  - e. Control valve operators shall be sized to close against a differential pressure equal to the design pump head plus 10 percent.
  - f. Furnish differential pressure control valves for all water systems as shown on plans and/or specified in the sequence of operations.
  - g. Provide valves 2" and smaller with screwed end bronze bodies and stainless steel trim. Provide valves 2-1/2" and larger with flanged ends, cast iron body and stainless steel trim.
  - h. For modulating service that require large valve size (above 6"), such as cooling tower temperature bypass, chiller head pressure ,etc. where proper control with globe type control valve cannot be achieved or the application is not economical butterfly or v-port ball valves are allowed.
2. Water Valves:
  - a. Control valves shall be of equal percentage flow characteristics for modulating service.
3. Steam Valves:
  - a. Control valves shall be of linear flow characteristics for modulating service.

#### G. AIR FLOW MEASURING STATIONS

1. Fan Inlet Type:
  - a. Airflow traverse probes shall be suitable for mounting in the inlet bell(s) of the indicated fan.
  - b. Probes shall be provided with the appropriate end support brackets for mounting in the inlet bell(s). Where fans are of dual inlet type, two sets of inlet probes must be provided.
  - c. Fan inlet probes shall be provided with the fittings to allow for the connection of control tubing to the probe assemblies.
  - d. Probes shall be capable of operating with an accuracy of 3% of actual volume over the fan operating range.

- e. The installation of the air flow measuring stations shall be coordinated with sheet metal contractor to ensure actual accuracy and accessibility for maintenance.

2. Duct Mounted Type:

- a. Air flow measuring stations are to be capable of continuously measuring air volume in the duct served.
- b. Probes shall utilize multiple total and suction pressure measurement points, located along the length of the probe surface in accordance with ASHRAE recommendations for duct traversing.
- c. The probes shall provide measurement accuracy within  $\pm 2\%$  of actual velocity when used with the appropriate conversion formula.
- d. Probes shall be of cylindrical cross section and shall indicate no more than a  $\pm 3\%$  percent deviation from the centerline velocity at a yaw angles up to 30 degrees.
- e. Probes shall be constructed of extruded aluminum, unless dictated otherwise by service requirements. Probes over sixteen inches long shall be supported on the insertion end.
- f. Probe quantities for each location shall be sufficient to meet ASHRAE recommendations.
- g. The pressure drop created by the traverse probes shall not be greater ten percent of the velocity pressure at the maximum design flow.
- h. The probes shall not amplify sound levels in the duct. The manufacturer shall provide submittal data indicating the developed differential pressure and pressure loss at the minimum and maximum design air flows for each duct location.

H. BINARY TEMPERATURE DEVICES

1. Line-voltage space thermostat:

- a. Line-voltage thermostats shall be bimetal-actuated, snap acting SPDT contact, enclosed, UL listed for electrical rating. The thermostat cover shall provide exposed set point adjustment knob. The thermostat shall operate within the 55°F to 85°F set point range, with 2°F maximum differential.

2. Low-temperature safety thermostat:

- a. Low-limit air stream thermostats shall be UL listed, vapor pressure type, with a sensing element of 20 ft. minimum length. Element shall respond to the lowest temperature sensed by any 1 ft. section. The low-limit thermostat shall be automatic reset, SPDT type.

I. TEMPERATURE SENSORS.

- 1. Provide the following instrumentation as required by the monitoring, control and optimization functions. All temperature sensors shall use platinum RTD elements only, nickel or silicon are not acceptable. All control signals shall be via a 4-20 mA loop.
- 2. Room Temperature:

- a. Temperature monitoring range +40/+90 F (+40/120 F for high temp alarms)
- b. Output signal 4-20 mA
- c. Installation adjustments none required
- d. Calibration adjustments zero & span
- e. Factory calibration point 70 deg F
- f. Accuracy at calibration point +0.5 F

3. Liquid Immersion Temperature

- a. Temperature monitoring range +20/+120 F or +70/+220 F
- b. Output signal 4-20 mA
- c. Installation adjustment none required
- d. Calibration adjustments zero & span
- e. Factory calibration point 70 deg F
- f. Accuracy at calibration point +0.5 F

4. Duct (Single Point) Temperature

- a. Temperature monitoring range +20/+120 F
- b. Output signal 4-20 mA
- c. Installation adjustments none required
- d. Calibration adjustments zero & span
- e. Factory calibration point 70 deg F
- f. Accuracy at calibration point +0.5 F

5. Duct (Averaging) Temperature

- a. Temperature monitoring range +20/+120 F
- b. Output signal 4 - 20 mA
- c. Installation adjustments none required
- d. Calibration adjustments zero & span
- e. Factory calibration point 70 deg F
- f. Accuracy at calibration point +0.5 F

6. Outside Air Temperature

- a. Temperature monitoring range -50/+122
- b. Output signal 4-20 mA
- c. Installation adjustments none required
- d. Calibration adjustments zero & span
- e. Factory calibration point 70 deg F
- f. Accuracy at calibration point +0.5 F

J. DEW POINT/HUMIDITY SENSORS

1. Outside Air Dew Point Temperature

- a. Dew point monitoring range -40/+115 F DP, 12% to 99% RH
- b. Output signal 4-20 mA
- c. Calibration adjustments zero & span
- d. Factory calibration point 70 F
- e. Accuracy at calibration point +2.0 Fdp

2. Room/duct Relative Humidity

- a. Sensor Humidity range 0 to 100%



- |                             |                   |
|-----------------------------|-------------------|
| b. Operating temperature    | 15 F to +170 F    |
| c. Accuracy                 | +2% RH            |
| d. Sensing element          | Capacitive sensor |
| e. Output signal            | 4-20 mA DC        |
| f. Installation adjustments | zero & span       |
| g. Operating temperature    | 15 F to +170 F    |
| h. Voltage requirement      | 12-36 VDC         |

K. PRESSURE SENSORS

1. Air Static Pressure Sensor

- |                      |                 |
|----------------------|-----------------|
| a. Duct Static range | -.5 to + 7.5"wg |
| b. Accuracy          | + .05" w.g.     |
| c. Output signal     | 4 - 20 mA       |

L. WATER DIFFERENTIAL PRESSURE SENSOR

1. Transducer shall have linear output signal. Zero and span shall be field adjustable.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.
3. Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Overrange limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 4 to 20 mA output, required mounting brackets, and three valve manifold.
4. Provide industrial grade differential pressure sensors for all differential pressure bypass valves. Sensor shall be factory calibrated for operating range and rated for system pressure. Provide manufacturers standard 316 stainless steel, 3 valve manifold and pressure gauges for supply and return pressures. Output shall be 4-20 mA.

M. DIFFERENTIAL PRESSURE SWITCHES.

1. Water Differential Pressure Switch

- a. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application or as shown.

- b. The differential switches shall meet the following requirements:

- |                                  |             |
|----------------------------------|-------------|
| 1) Range                         | 8 to 70 psi |
| 2) Differential                  | 3 psi       |
| 3) Maximum differential pressure | 200 psi     |
| 4) Maximum pressure              | 325 psi     |

2. Air Differential Pressure Switch

- a. Differential pressure switches shall be diaphragm type, with die-cast aluminum housing and adjustable set point. Switch rating shall be a minimum 5 amps at 120 VAC. Switches shall be SPDT and be used for fan status as specified in the point schedule. Switch pressure range shall be suited for application. (e.g. filter 0-2.0", fan status 0-5.0", etc.)

3. Performance

- a. A maximum wetted area of 2 inches of cable, at any point along the entire length of cable, shall activate an alarm.
- b. The system shall be continuously monitored for continuity. The loss of continuity shall cause an alarm within 5 seconds.
- c. The cable shall be capable of being cleaned with a clean dry cloth, in place.
- d. The cable shall dry and reset the module immediately upon removal from free water. No shaking, wiping or mechanical action shall be required.

N. INDOOR AIR QUALITY (CO<sub>2</sub>/VOC) SENSORS

- 1. The CO<sub>2</sub> sensors shall have no more than 1% drift during the first year of operation and minimal drift thereafter so that no calibration will be required.
- 2. Wall mounted sensors shall be provided with white plastic cover, without LED indicators.
- 3. Duct mounted sensors shall be provided with LED indicators in a dust proof plastic housing with transparent cover.
- 4. The VOC sensor shall have automatic self calibrating capability to ensure accuracy.
- 5. The sensor shall meet the following requirements:
  - a. Operating voltage: 24 VAC +/- 20%
  - b. Frequency: 50/60 Hz
  - c. Power consumption: max. 6 VA
  - d. CO<sub>2</sub> measuring range: 0 – 2000 ppm
  - e. Tolerance: +/- 100 ppm
  - f. Output: 0 – 10 VAC
  - g. Calibration: none required
  - h. VOC measurement range: 0 – 10 V VOC
  - i. Permissible air velocity in duct: <26.2 Ft/s.

O. RELAYS.

- 1. Control relays shall be UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
- 2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

P. OVERRIDE TIMERS.

- 1. Override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified. Timer shall be suitable for flush mounting on control panel face and located on local control panels or where shown.

Q. CURRENT TRANSMITTERS.

1. AC current transmitters shall be the self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, with internal zero and span adjustment and  $\pm 1\%$  full-scale accuracy at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA Recognized.
3. Unit shall be split-core type for clamp-on installation on existing wiring.

#### R. CURRENT TRANSFORMERS.

1. AC current transformers shall be UL/CSA Recognized and completely encased (except for terminals) in approved plastic material.
2. Transformers shall be available in various current ratios and shall be selected for  $\pm 1\%$  accuracy at 5 A full-scale output.
3. Transformers shall be fixed-core or split-core type for installation on new or existing wiring, respectively.

#### S. VOLTAGE TRANSMITTERS.

1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.
2. 2 Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with  $\pm 1\%$  full-scale accuracy with 500 ohm maximum burden.
3. Transmitters shall be UL/CSA Recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.

#### T. VOLTAGE TRANSFORMERS.

1. AC voltage transformers shall be UL/CSA Recognized, 600 VAC rated, complete with built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of 40°F to 130°F and shall provide  $\pm 0.5\%$  accuracy at 24 VAC and a 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic material.

#### U. POWER MONITORS.

1. Power monitors shall be the three-phase type furnished with three-phase disconnect/shorting switch assembly, UL Listed voltage transformers, and UL Listed split-core current transformers.
2. They shall provide a selectable rate pulse output for kWh reading and a 4 to 20 mA output for kW reading. They shall operate with 5 A current inputs with a maximum error of  $\pm 2\%$  at 1.0 power factor or  $\pm 2.5\%$  at 0.5 power factor.

#### V. CURRENT SWITCHES.

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

#### W. LOCAL CONTROL PANELS.

1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable sub panels. A single key shall be common to all field panels and sub panels.
2. Interconnections between internal and face mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Provide ON/OFF power switch with over current protection for control power sources to each local panel.

#### X. LOCAL USER DISPLAY

1. Where specified in the sequence of operation or points list, the controllers on the peer to peer building level network shall have a display and keypad for local interface. A keypad shall be provided for interrogating and commanding points in the controller.
2. The display shall use the same security password and access rights for points in the display as is used in the associated controller.
3. The LCD display shall be a minimum of a 2 line 40 character display.
4. The LCD display shall include the full point name, value (numeric, digital or state text), point priority and alarm status on one screen.
5. The LCD shall dynamically update the value, priority, and alarm status for the point being displayed.
6. The display shall be mounted either on the door of the enclosure or remote from the controller.

#### Y. Averaging Temperature Sensing Elements

1. Sensing elements shall be installed in a serpentine pattern.
2. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.

#### Z. Differential air static pressure.

1. Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.
2. Return Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.

3. Building Static Pressure: Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.
4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork.
6. Mount transducers in a location accessible for service without use of ladders or special equipment.
7. If the transmitter is wired in a homerun configuration to an AHU controller, the transmitter shall be located in the same enclosure as the air handling unit (AHU) controller(s) for the AHU serving the terminal units.

#### AA. Water Differential pressure sensors

1. Differential pressure sensors shall be installed with valved taps into the piping to ensure serviceability without draining the system
2. Sensors shall be mounted with bleed valves
3. After sensor installation any air shall be eliminated using the bleed valves to ensure reading accuracy
4. The sensors shall be located to ensure accessibility

#### BB. Relative Humidity Sensors

1. Relative humidity sensors in supply air ducts shall be installed at least 3m (10 feet) downstream of humidity injection elements.

#### CC. Flowmeters

1. The minimum straight unobstructed piping for the flowmeter installation shall be at least 10 pipe diameters upstream and at least 5 pipe diameters downstream and/or in accordance with the manufacturer's installation instructions.

#### DD. Flow Switch

1. Use correct paddle for pipe diameter.
2. Adjust flow switch in accordance with manufacturer's instructions.

#### 3.01 Flow Switch Installation:

- A. Use correct paddle for pipe diameter.
- B. Adjust flow switch in accordance with manufacturer's instructions.

#### 3.02 Actuators:

- A. Mount and link control damper actuators according to manufacturer's instructions.

1. Provide all mounting hardware and linkages for actuator installation.

B. Electric/Electronic

1. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.
2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.03 TRAINING

- A. The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed. Factory employed/certified instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays.
- B. Provide a minimum of four (4) on-site, on-line, or classroom training sessions throughout the contract period for personnel designated by the owner. Each session shall be a minimum of four (4) hours each
- C. Provide two additional training sessions at 6 and 12 months following building's turnover. Each session shall be three days in length and must be coordinated with the building owner.
- D. Provide 80 (Eighty) hours of site specific training for Owner's operating personnel. Training shall include:
  1. Day-to-day Operators:
    - a. Proficiently operate the system
    - b. Understand control system architecture and configuration
    - c. Understand DDC system components
    - d. Understand system operation, including DDC system control and optimizing routines (algorithms)
    - e. Operate the workstation and peripherals
    - f. Log on and off the system
    - g. Access graphics, point reports, and logs
    - h. Adjust and change system set points, time schedules, and holiday schedules
    - i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
    - j. Understand system drawings and Operation and Maintenance manual

- k. Understand the job layout and location of control components
  - l. Access data from DDC controllers and ASCs
  - m. Operate portable operator's terminals
2. Advanced Operators:
- a. Make and change graphics on the workstation
  - b. Create, delete, and modify alarms, including annunciation and routing of these
  - c. Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals
  - d. Create, delete, and modify reports
  - e. Add, remove, and modify system's physical points
  - f. Create, modify, and delete programming
  - g. Add panels when required
  - h. Add operator interface stations
  - i. Create, delete, and modify system displays, both graphical and others
  - j. Perform DDC system field checkout procedures
  - k. Perform DDC controller unit operation and maintenance procedures
  - l. Perform workstation and peripheral operation and maintenance procedures
  - m. Perform DDC system diagnostic procedures
  - n. Configure hardware including PC boards, switches, communication, and I/O points
  - o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
  - p. Adjust, calibrate, and replace system components
3. System Managers/Administrators:
- a. Maintain software and prepare backups
  - b. Interface with job-specific, third-party operator software
  - c. Add new users and understand password security procedures
- E. Provide 8 hours of additional training quarterly during warranty period.
- F. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If such training is required by the Owner, it will be contracted at a later date. Provide description in the Technical Proposal of available local and factory customer training.

G. Provide course outline and materials in accordance with the “Submittals” article in Part 1 of this specification. The instructor(s) shall provide one copy of training material per student.

H. The instructor(s) shall be factory-trained instructors experienced in presenting this material.

#### 3.04 SEQUENCE OF OPERATION

1. Insert sequence of operations for HVAC system specific to project.
2. FCPS items in addition to HVAC system for interface with third party systems.
  - a. Emergency Generator Interface
  - b. Outdoor Lighting Contactors
  - c. Freezer/Cooler Monitor
  - d. Kitchen Equipment Monitoring (MAU/Exhaust)
  - e. Power Monitoring – entire building or submetering
  - f. Lighting Control System
  - g. Fire Alarm System
  - h. Security and Access Control
  - i. Computer Room Air Conditioning
  - j. UPS System
  - k. PDUs and Static Transfer
  - l. ATS Switches

#### 3.05 POINTS LIST

1. See drawings for points lists.



**26 05 00 COMMON WORK RESULTS FOR ELECTRICAL**

1. Most new construction as well as renovation projects will be wired for 277/480 volt, three phase electrical service. If the Project Engineer feels that there are substantial benefits to designing a building to 120/208 volt, three phase service, approval from the FCPS Maintenance must be obtained first.
2. All disconnects mounted on walls shall be located no higher than 12" from the ceiling so as to be easily accessible. Typically, disconnects shall not be located on the equipment they serve, but within visible range. The exception to this is on roof top mechanical equipment which will have disconnects mounted on the unit itself.
3. All underground, external cabling shall be contained in minimum 1" conduit buried a minimum of 30" below grade. Install marking tape 12" above conduit and install marking wire directly above all non-metallic underground conduits. Ground level utility markers shall be provided on all future stub-out locations.
4. All required training sessions shall have training video-recorded and provided to the Owner in most up-to-date accessible format such as YouTube link, flash drive, etc.
5. Refer to Division 11 for power requirements of kilns.
6. Kitchen areas shall have GFI circuitry serviced from GFI breakers located in electrical panels.
7. Contractor shall maintain all utility services until closeout and all punch items have been completed for the HVAC DDC control system, Lighting control system, and any other energy consuming system that is installed/replaced within the project scope. Controls checkout will require sign off from both design engineer and FCPS representative.
8. Contractor shall label electrical outlet plugs that are turned off by sensors.
9. Coordinate power/equipment with all other consultants (i.e., door hardware, kitchen, etc.)
10. All exterior and interior lighting shall be LED, unless otherwise specified by Owner.
11. Use of cylinder/canned lights shall be limited. Easy access must be provided.
12. See information for Dental Van electrical connection.

**26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

1. Wire connectors of insulating materials or solderless pressure connectors, properly taped, shall be used for all splices in wiring, wherever possible.
2. All conductors terminating at terminal blocks shall be identified with numbers and/or letters identical to circuit or control identifications.
3. Metal-Clad (MC) cable shall only be used for lighting circuits accessible above suspended acoustical tile ceiling systems. The use of MC cable in walls, slabs, or to jump between rooms is prohibited. MC cable termination shall be prepared using a pre-engineered fitting designed specifically for the purpose.
4. As far as practical, all feeders shall be continuous from origin to panel termination without running splices in intermediate pull boxes.
5. The use of a common neutral shall not be allowed for receptacles or lighting branch circuits.

- 26 05 26           GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
1. All metallic conduit, cabinets, equipment, and service shall be grounded in accordance with the latest version of the National Electrical Code (NEC). All supporting framework and other metal or metal clad equipment or materials which are in contact with electrical conduit, cable, and enclosures shall be properly grounded to meet the code requirements.
  2. All grounding shall use a single point scheme from the building main transformer, with a minimum of #6 AWG solid copper wire that has been tested to a maximum of 0.5 ohms. All shields will be bonded to a common ground. All riser cable shall be shielded and properly grounded to the building ground through grounding facilities provided at the MDF. The shield of the riser cable is not a proper ground for the IDF. Does riser cable need to be shielded? Not typically done
  3. All exterior lighting poles shall be provided with a separate grounding electrode in addition to the equipment grounding conductor in the branch circuit.
- 26 05 29           HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
1. All mounting brackets and strut that are exterior to the building shall be aluminum. All mounting brackets and struts used interior to the building shall be aluminum or hot dip galvanized.
- 26 05 33           RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
1. No exposed conduit shall be allowed in corridors, classrooms, or offices. All power and communications wiring shall be run in metallic, single compartment style surface raceway. Metallic, double compartment style surface raceway shall be used when data and power cables are run adjacent to one another.
  2. Minimum conduit size shall be  $\frac{3}{4}$ ".
  3. All EMT fittings shall be compression type.
- 26 05 53           IDENTIFICATION FOR ELECTRICAL SYSTEMS
1. Panelboards shall be labeled with an engraved laminated acrylic label. Labels shall be black with white letters for panels fed by normal power and red with white letters for panels fed from the emergency system.
  2. Conductor labels shall be machine printed, heat-shrink type.
  3. Lighting relays should be located above doors and accessible by FCPS staff.
  4. Emergency lighting relays (ELR) shall be installed flush on hard ceilings. When installed above ceiling tiles, ELRs shall be labeled below the grid.
  5. Coordinate other labeling requirements with FCPS Maintenance.
- 26 05 73           OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY
1. Short Circuit Calculations shall be conducted in accordance with ANSI C37.5, IEEE standard 399 and IEEE standard 141.
- 26 09 23           LIGHTING CONTROL DEVICES
1. A distributed intelligent relay system shall be utilized throughout all spaces of the building. Vacancy sensors are to be used to minimize energy usage in all applicable areas, excluding corridor spaces. Vacancy sensor output shall be interconnected to the distributed relay system. The distributed relay system shall require a Windows™ based front end software that accesses the buildings control system remotely via the district's internal data network. A BAS integration module shall be provided to allow for

after-hours override of specific interior and exterior lighting zones to be sent from the BAS system. The exterior lighting control shall be controlled by the Building Automation System on a time-of-day schedule, independent of the interior lighting control system. The building mounted and site lighting fixtures shall be designed to operate individually through a minimum of two lighting contactors. Additional contactors may be added as the Engineer deems necessary. The lighting contactors shall be installed in NEMA 1 enclosures with Hand-Off-Auto switches and 120 volt coils. For additional protection from lightning strikes, provide a surge protection device on the control circuit just ahead of the coil. Acceptable lighting control manufacturers include Lutron, Wattstopper, and InLight .

<b>Space</b>	<b>Open Hours Manual On/Off</b>	<b>Vacancy Sensor Off</b>	<b>Min. # of Light Levels</b>	<b>Afterhours Override</b>
Classroom	•	•	2	•
Corridor	+			•
Admin/Office	•	•		•
Conference	•	•	2	•
Restrooms	•	+		•
Storage	•	•		•
Mech/Elec Space	•			•
Media Center	•	+	Project Specific	•
Gymnasium	•	+	Project Specific	•
Cafeteria	•	+	Project Specific	•
Kitchen	•	+	Project Specific	•
• - Required + - Owner Option				

- 26 22 00      **LOW-VOLTAGE TRANSFORMERS**
1. Acceptable manufacturers include Square D, Siemens, ABB and Cutler-Hammer.
  2. Provide NL rated transformers for harmonic loads greater than 50%.
- 26 24 13      **SWITCHBOARDS**
1. All primary and secondary switchboards shall be Square D, Siemens, ABB or Cutler-Hammer.
  2. Service Entrance equipment shall be protected by Main rated Transient Voltage Surge Suppressor (TVSS).
- 26 24 16      **PANELBOARDS**
1. All panelboards shall be Square D, Siemens, ABB, or Cutler-Hammer.
  2. Panels serving computer loads shall be provided by integral Transient Voltage Surge Suppressor (TVSS).
- 26 27 26      **WIRING DEVICES**
1. Receptacles shall be Leviton, Hubbell, or Pass & Seymour.
  2. One electrical outlet tied to the emergency generator shall be located approximately every 50' in corridors. Outlet color shall be red. Faceplate color is to be selected by the Architect.

3. All device covers shall be brushed stainless steel. All covers shall be marked (typed and laminated) to indicate controlling circuit breaker.
4. Computer electrical power requirement will be a minimum of one quadruplex outlet per computer station. Electrical power requirement for printer stations will be one duplex outlet per printer.
5. Locate one GFI duplex receptacle in accessible plumbing chases.

26 32 13

#### ENGINE GENERATORS

1. The backup generator shall be located exterior to the building and fueled by natural gas where possible (minimum run time of 72 hours). Diesel powered generators shall not be used. The generator assembly shall be manufactured by Kohler, Caterpillar, or Onan/Cummins. Generator must be enclosed with a minimum 6' high chain link fence with locking gate. The fence enclosure shall be a minimum of 4' away from all four sides of the backup generator for maintenance and repairs. Coordinate location requirements with Architect.
2. The backup generator will power the following equipment: (1) Emergency lighting, (2) HVAC circulating pumps, (3) Lighting in mechanical rooms, (4) Security alarm system, (5) Fire alarm system, (6) Public address system, to include cafeteria, gymnasium and media center sound systems, (7) Telephone/data communications, (8) Backup water heater (if installed), (9) Designated corridor outlets, (10) Walk-in freezer and walk-in refrigerator, (11) DDC controls, (12) Sump pumps (if installed), (13) clinic/first aid refrigerators, (14) cafeteria manager's office (1 plug); (15) mother's room (1 plug); and (16) coordinate minimum of four administrative offices with connections..
3. Backup Generators shall be sized as needed plus an additional 25% capacity. The minimum backup generator shall provide 100 kW, 125 kVA when operating at 277/480 volts, 0.8 power factor.
4. The generator controller shall have LED indicator lights for the following conditions: (1) Overcrank, (2) Low coolant temperature, (3) High engine temperature, (4) Overspeed, (5) Emergency stop, (6) Low fuel, (7) Low coolant level, (8) Master switch Not-In-Auto, (9) High / low battery voltage, (10) Battery charger failure, and (11) Common fault.
5. The generator is to be monitored and controlled by the Building Automation System. Ensure that there is specification language that requires coordination with mechanical/control contractor to provide programming interface as required to monitor / control 25 owner determined generator functions via the Building Automation System. In addition, there will be a fuel level sensor indicator tied to the Building Automation System with a remote annunciator panel located in the Mechanical room.
6. Generator Accessories will include the following: (1) Safeguarded circuit breaker system, (2) Main line circuit breaker, (3) 12-volt automatic float/equalizer battery charger, NEMA 1 enclosure, with DC voltmeter, DC ammeter, high float switch, low battery voltage relay and alarm board per NFPA 110, (4) Starting battery, 12 volt, industrial, lead-acid type, (5) Steel insulated rack for battery, (6) Heavy-duty battery cable set, (7) Flexible fuel line, (8) Flexible exhaust connection, (9) Exhaust silencer with bird screen and (10) Pre alarm senders.
7. Transfer switch gear will be manufactured by the same manufacturer as the generator.
8. Ensure that FCPS Maintenance personnel are notified in a timely manner for the generator start up testing.

26 41 00

#### FACILITY LIGHTNING PROTECTION

1. In general, lightning protection systems are to be utilized. Discuss with FD&C on whether or not to utilize a lightning protection system for the building.
2. If a lightning protection system is required, ensure that it meets the requirements of NFPA #70 and #780 and with UL's lightning protection standards.
3. Install arrestors as close as practical to the equipment they are protecting. Cables and conduits should be located internally where possible.
4. Install conductors with direct paths from air terminals to ground connections avoiding sharp bends and narrow loops.
5. Locate one Transient Voltage Surge Suppression (TVSS) on main switch panel with surge counter. A secondary integral TVSS shall be installed in all panels serving computers.

26 51 00

#### INTERIOR LIGHTING

1. Refer to 702 KAR 4:170 Facility Programming and Construction Criteria Planning Guide for interior lighting standards.
2. Lighting shall be provided in accessible plumbing chases as well as under bleachers.
3. All lighting over 12 feet above the floor shall be accessible by a one-man lift.
4. All lights in hard ceilings shall be accessible in order to be easily maintained. Recessed downlights may be used in hard finished ceilings, only.
5. Lighting types are to be discussed with FD&C prior to lighting systems design.

26 56 00

#### EXTERIOR LIGHTING

1. Refer to Kentucky High School Athletic Association (KHSAA) Lighting Standards for exterior lighting requirements at athletic fields.
2. The building address will need to be externally illuminated for nighttime visibility by the Fire Department.
3. All parking lot standards shall not exceed 25 feet in height.
  - a. If a power outlet is provided on these standards, it shall be turned off and on easily by the building manager.

## DIVISION 27 COMMUNICATIONS

### 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

1. Minimum dimension for a communications rooms are defined by the latest version of KDE's School Construction Technology Checklist. In general, rooms should be rectangular in shape. Contact FCPS Technology early in the design phase for evaluation of proposed spaces.
2. All communication rooms shall have direct access from a main corridor for maintenance and technology personnel. Communication rooms shall be located such that there are no threats of flooding from above or below. 4' x 8' x ¾" thick fire treated plywood shall be mechanically fastened to all walls of each room. Panels shall be mounted vertically starting at 6" above the finish floor. Each communication room shall have a minimum of one rack for mounted data, camera, and telephony systems.
3. All communications rooms shall be independently environmentally controlled (and tied to the emergency generator) to maintain the room environment at a temperature range of 50 to 75 degrees F with a maximum relative humidity level of 50 percent, 24 hours a day, 7 days a week. All communications rooms shall have a smoke detector that is connected to the building fire alarm system.
4. Each communication closet shall be provided with the following: Provide a quantity of outlets as required to power the communications equipment. Coordinate requirements with the FCPS Technology Provide a minimum of one quadraplex outlet on each wall with two outlets on walls greater than 6 feet. Provide two NEMA 30-amp receptacle for connection to rack mounted UPS. UPS will be provided by the owner. All outlets shall be connected to the emergency generator. Provide a minimum of two dedicated 20-amp circuits and one 30-amp dedicated circuit. The outlets shall be mounted flush to plywood backboard at a distance no greater than three feet from each 2-post rack. Contact FCPS Technology for specific NEMA configuration and rating.
5. Communications conduit, cable trays and wire ways shall be clearly identified and visible from the floor at every junction box via a painted section, or by use of conduit stickers indicating each conduit run; blue for data/voice, yellow for clocks, orange for access points, green for fiber optic. . All Intermediate Distribution Frames, Main Distribution Frames and connecting blocks shall be properly identified (i.e.: IDF Room # - Rack #). Marker is to be a flat piece of aluminum or stainless steel.
6. All cable trays shall be designed to accommodate communications cabling. Cable trays shall be grounded steel basket type. The minimum interior dimensions for a cable tray shall be 12" wide and 4" deep and shall be designed to carry a minimum of 80 pounds per linear foot. Within all communication rooms, cable trays shall be installed around the perimeter of the room with a section added to run from the perimeter tray to the top of each rack. Contract documents shall show cross section of the cable tray. Provide a minimum of 12" clearance from other utilities in the building. Consideration must be given for installation of other types of cables in a cable tray to prevent interference with unshielded cables. Cable trays are to be supported with all-thread rods in a trapeze fashion. Supports for cable trays larger than 12" in width shall be installed per manufacturer's suggested recommendations but at a maximum distance of 5' apart. Supports for cable trays 12" wide may be farther apart but must meet the manufacturer's suggested installation requirements. Provide 24" of clearance on top and one side for pulling cable.

7. Where possible, cable trays shall be a minimum of 12" above the ceiling and a minimum of 8' above the finished floor.
8. Install factory sweep 45's and 90's for all turns. Use "end of tray" terminations where wires drop down to walls.
9. Cable shall not be laid on the ceiling tiles. Do not tie wrap to existing conduit. Cables shall be supported a minimum of every 4'. If the cable sags more than 12", it must have additional support. In classrooms, cable distribution shall be done from the center of the room using a uniform drop strategy. Leave a 12" service loop of cable slack above the ceiling for each cable. J-hooks or bridle rings shall be used only for internal speaker cabling. Voice/Data cabling shall be located in conduit or cable tray. Tie wraps shall be plenum rated.
10. Include provisions for installation of 4" minimum diameter conduit riser from the MDF to each IDF with permanent labeling on both ends. A pull string and appropriate junction pull box shall also be provided in each conduit run to facilitate future installation of cable. All sleeves must protrude a minimum of 44" above and below finished floor and be firestopped at both ends. Conduit for telephone or computer outlets shall be terminated in a dual gang box with single gang plaster ring. All above slab communications conduit shall be 1" conduit, with a maximum of 180 degrees of bend, from the outlet to the cable tray, wire way or home run directly to the communications room. Use compression fittings at every joint. In case of a conduit terminating in a cable tray, the conduit shall be mechanically fastened to the side of the cable tray and the conduit end at the tray shall be terminated in a grounding bushing and wire bonded to the tray. If conduit terminates in the communications room, the conduit shall be terminated with a grounding bushing and wire bonded to the room ground bus bar.
11. To facilitate future cable installations, a new pull string, tied off at both ends, shall be installed in conduit simultaneously with the pull-in of cable. In general, all communication wire shall be minimum #24 AWG copper, CAT 6, unshielded twisted pair.
12. In each data closet the patch panel modular jack assemblies shall be organized by connection type and color coded with blue for data/voice, yellow for clocks, and orange for wireless access points.
13. Locate the Cable Television distribution headend in the Audio Visual Storage Room in the Media Center.
14. All cabling shall adhere to EIA/TIA Standard #568A Commercial Building Telecommunications Wiring Standard.
15. For the IDF racks not bolted to the floor provide a 4 post rack 24" away from the wall. Provide 64" between the 2-post rack and the 4-post rack.

27 13 00

#### COMMUNICATIONS BACKBONE CABLING

1. All fiber optic planning and installation shall be approved by FCPS Technology. When installing fiber optic cable, it shall be pulled in a protective liner (innerduct) inside the conduit to allow future use of conduit and also prevent damage to the cable. All new outside plant conduit shall include at least two conduit sleeved for Fiber Optics or use Tele-Duct. All fiber optic cables shall be terminated via a LC connector and properly connected to the distribution points in a fiber panel. Jumper or patch cords are to be used to connect different pairs of cables together for continuation of service. Fiber jumper or patch cables (2 meter LC to LC OM3 multimode or single-mode fiber, depending on length of fiber run) are to be provided at 100% of fiber terminations for connection to communications equipment. Between communication closets, run one

cable of twelve strands OM3 multimode fiber cable unless instructed to do otherwise by FCPS Technology (baseball/softball/football fields and field houses may require single mode fiber runs due to the distance between communication closets exceeding 2,822'). Manufacturer-certified installers shall only install fiber cable. No bends in fiber cable shall be made with a radius of less than 5". Provide minimum 24 position fiber termination boxes in equipment racks in communications closets for termination of fiber cables. Label cables at each end. Label shall indicate the origin and destination locations of the cable.

27 14 00

## IPTV SYSTEM

1. IPTV System General
  - a. Provide equipment and software necessary to stream IPTV from District Office for access via the LAN of the building.
  - b. Equipment must be compatible with the existing District Wide Solution.
  - c. All equipment and software shall be provided by Certified Dealer of equipment offered.
  - d. Dealer shall be located within 65 miles of District Head End.
2. Local Encoder
  - a. Encoder should be an appliance with a single channel for live streaming of audio and video.
  - b. Input shall be HDMI with embedded audio, HDMI with separate audio on 3.5mm input, and shall accept resolutions of 1920x1080p, 1920x1080i, and 1280x720p.
  - c. Output shall stream at H.264 compression up to 1080p with a frame rate of 30/60.
  - d. HTTP, RSTP, RTMP, HLS, UDP multicast/unicast outputs are available.
  - e. Bases of design shall be Discover Video Scorpion 1 channel. Provide 1 unit with 2-year extended warranty.
3. Stream Pump
  - a. Stream Replicator shall allow multiple viewers to watch from a single stream integrated to the DEVOS Enterprise Video Management System.
  - b. For Elementary School applications the Stream Pump shall contain and Intel Pentium Processor with Windows 10 OS and 2GB of memory. Provide Stream Pump Mini providing for up to 100 remote viewers.
  - c. For Middle or High School applications the Stream Pump shall contain Dual core Xeon CPU, Dual GigE Network, SSD 1TB Storage, Live Video Streaming RTMP & HLS and requires DEVOS. Provide Stream Pump Standard providing up to 1000 remote viewers.
  - d. Provide 4 Year Maintenance Contract coverage on Stream Pump provided which includes technical support service software updates, customer phone support during normal business hours and Web Support providing to the latest product documentation and application notes. Web Support shall allow for submission of requests for support via the internet. Maintenance does not extend 3 Year Limited Hardware warranty.
4. Remote TV Decoder
  - a. Set Top Box shall provide a user selection of desired content, and also operate as a server-controlled decoder.
  - b. The Set Top Box shall provide the following:
  - c. Provide a total of (4) units.
  - d. All devices are to be installed at locations as specified on drawings.
  - e. IP Addressing shall be provided by the owner and configured per owner's direction.



- f. All Category patch cables shall meet owners' specifications as outlined for infrastructure specifications and provided by IPTV contractor for termination to the LAN. HDMI Cables providing signal to display devices are to be provided by IPTV Contractor.
  - g. Data termination drops to closets provided by others.
  - h. CPU STI7105, 256Mb Ram, 265Mb Flash, Linux 2.6.x OS, USB 2.0, HDMI V1.4a, Composite, HDMI Embedded audio, 10/100 Ethernet, and H264/AAC from DEVOS.
5. Installation
- a. Final Configuration of Set Top Boxes and training shall not commence until all display devices are in place.
  - b. Allow 2 hours per device provided for training of personnel.

27 15 00

#### COMMUNICATIONS HORIZONTAL CABLING

1. The main distribution frame shall have a minimum of two 7' (EIA standard or equivalent) communication racks. Each intermediate distribution frame shall have a minimum of one 7' rack (EIA standard or equivalent) communication rack. Position the rack to maintain a minimum of 3' clearance from the front of the rack to the front facing room wall and 3' clearance from the rear of the rack to the rear facing room wall. If a row of racks is to be installed in a communications room, maintain a minimum of 2' clearance from the right most or leftmost rack to the opposing wall and a minimum of 4' from the back of the first rack to the front of the next rack. All racks shall be permanently affixed to the finished floor. Ground the rack to the communications room grounding bus bar with #6 AWG copper wires. Mount the fiber optic termination panel at the top-most rack position. The first patch panel shall be 48 ports and shall be mounted directly under the fiber panel. All other patch panels shall be no larger than 48 ports and shall be installed with two empty positions between each patch panel.
2. Each end of all cables and all pairs shall be labeled at their termination locations. Within each room, all modular jack assembly locations shall be marked alphabetically and begin clockwise around the room, all jacks within each location shall be labeled numerically, e.g., through the main entrance to the left, jacks shall read room number and data position, 102-A1, 102-A2, 102-B1, 102-B1, etc. All modular jack assemblies shall be labeled and identified.
3. The following cable and wiring manufacturers are recommended for use at Fayette County Public Schools: General Cable, Belden, or Panduit.
4. Voice and Data outlets shall be located based on KDE's School Construction Technology Checklist guidelines unless noted otherwise.
5. Classrooms shall have a minimum of 3 data outlets per room above the ceiling.
6. For all administrative offices and areas, including secure vestibules, consult with FCPS Technology on specific design needs.
7. For all mechanical rooms consult with FCPS Technology on specific design needs.
8. For all non-typical spaces consult with FCPS Technology on specific design needs.
9. Conference Rooms shall have a minimum of 5 data outlets per room. Four (4) outlets shall be located close to the conference room table center and end points. One (1) outlet shall be located at the front of the conference room to connect the interactive flat panel. One (1) outlet shall be located at the front of the conference room to connect the interactive flat panel.
10. Kitchen/Cafeterias shall have 3 data outlets at a single location in the cafeteria managers' office. Additional outlet requirements for serving or dining areas shall be

determined based on size and in the design of the cafeteria but at a minimum each serving line cash register location shall have 2 data outlets and each dining area shall have a minimum of 4 data outlets.

11. Labs and maker spaces shall have raceways with both electric and data. All computer workstations in the lab shall have both data and electrical service from the wall. The use of power poles is not acceptable. Labs shall be wired with 30 data outlets for workstations, 4 data outlets for network printers and teacher management stations. Consult with FCPS Technology on specific design needs.
12. Storage Rooms shall have 2 modular jack assemblies at a single location. This is to be the minimum for any room not wired based on one of the above standards.
13. Contractor shall provide 12" CAT6 gray patch cables for 60% of terminations in the Communications Room. Contractor shall provide 10' CAT6 gray for 30% of the workstation terminations and shall provide 5' CAT6 gray for 30% of the workstation terminations.
14. Outlets are to be mounted at standard industry heights and positions, unless otherwise specified by FCPS Technology. standard mounting height of communication outlets is 18" from the floor. Electrical outlets shall be located within 4' of communication outlets.
15. All connections shall be clearly labeled at both ends. The total wire path length from the outlet to the communications room, including loss due to terminations, must not exceed 275'.
16. Unshielded twisted pair category 6 or higher shall be used. Use only RJ-45 category 6 connectors. Minimum twelve-strand OM3 multimode fiber (single mode if run exceeds 2,822') optic cable with LC connectors shall be used.
17. Use EIA/TIA 568A standards for termination.
18. At final Communication Network Design approval, FCPS Technology shall provide a list of required active network components to be contractor supplied and owner installed. These devices shall be specified that meet compatibility standards with FCPS and KETS Standards. Substitutions of electronic components without prior approval of FCPS Technology shall not be allowed.
19. Data drops to WAPs will be terminated in ceiling with female RJ45 jack and 6' service loop. There shall be 3 modular jack assemblies at each designated WAP location. The modular jack assembly shall be labeled room number and numerical order according to the position of the jack; 102-AP1, 102-AP2, 102-AP3, etc. All ceiling WAP locations shall be labeled on the closest ceiling grid location with the words "WAP."

27 41 16

#### INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

1. For all instructional spaces, coordination and conduit associated with the audio visual equipment are to be part of the Contractor's scope of work. Coordinate requirements with FCPS Technology.
2. Typically, Media Centers are to be equipped with ceiling mounted multimedia projectors (Owner furnished.) Each projector is associated with a manually operated projection screen that is part of the Contractor's scope of work. The projection screens are to be 16:9 HDTV format with a typical size being 161" diagonal. Coordinate requirements with FCPS Technology.

27 41 30

#### CABLE TELEVISION DISTRIBUTION SYSTEMS

1. The Contractor shall be responsible to have the local cable company install new entrance cable for cable television when needed or to have the existing cable re-

directed to the new headend location. Cable television headend is typically located in the Media Center.

27 51 00 PAGING INTERCOM SYSTEMS & CLASSROOM AUDIO

1. Basis of design is Audio Enhancement - EPIC (Education, Paging & Intercom Communications) System TM. FCPS FD&C shall file appropriate purchasing paperwork with Superintendent.
  - a. Consult with FCPS Technology and Electronics for specific design.
2. Externally mounted speakers, as well as those located in Gymnasiums, shall have wire protective screening.
3. All outside speakers shall be tied to a separate circuit. Outside speakers shall not be tied to any other speaker circuit. Coordinate location of outdoor paging speakers with FCPS FD&C.
4. All speaker lines shall be labeled at the main intercommunications rack as to the location of its speaker.
5. Intercommunications and master clock training shall consist of the following, but not limited to: All Page, Zone Page, Ringing of Bells, and how to set time of day, etc.
6. Intercommunications headend shall be located in the MDF/IDF room.

27 51 10 SOUND SYSTEMS

1. Independent sound reinforcement systems shall be provided at all Gymnasiums, Cafeterias, and Media Centers.
2. Personal Assisted Listening Systems shall be included in the systems noted above.
3. Tie to emergency generator.

27 53 13 POE CLOCK SYSTEM

1. Ensure that clock system components are designed to operate as part of a complete system and include "fail-proof" design to ensure power interruption does not cause system failure.
2. Ensure system synchronizes all clocks and devices to each other.
3. Clocks must work with the existing FCPS Sapling software.
4. Acceptable manufacturers include:
  - a. Sapling, Inc.
  - b. ThreeSixty
  - c. Engineer to provide a third manufacturer, if there is one that compares.

28 05 37

**EMERGENCY RESPONDER RADIO COVERAGE SYSTEM**

1. The system shall include, but not be limited to all labor, material, equipment, and related design services necessary to design and install an Emergency Responder Radio Coverage System including Donor Antenna (exterior), Interior Antennas, Processing and Amplification Equipment, passive Distributed Antenna System (DAS), cables, junction boxes, connections, and anything else required to make the system a complete operating system.
  - a. The design intent is to provide an in-building Radio Coverage System capable of transmitting all public safety radio frequencies assigned to the jurisdiction and be capable of using modulation technology in use by the local municipality.
    - i. It will be connected to the fire alarm panel for monitoring purposes.
    - ii. It should include a battery back-up and connected to the emergency generator, if available.
    - iii. Coordination with other trades such as electrical and fire alarm will be required. Include defined areas for head end equipment and pathways in base bid. Pathways for roof-mounted antennae feeds shall be two-hour rated.
    - iv. Once the system is completely installed, the system shall be tested with the Authorities Having Jurisdiction (AHJ.)
    - v. Identification and labeling is required.
    - vi. Certification - Submit statement signed by certified installing contractor confirming that - The system was installed and tested in accordance with the requirements of the specification and requirements of the municipality.
    - vii. Include record documents with test results. Provide test results—including a description of the conduct of the tests, test date, the equipment used and the procedures followed—and system setting as required for confirmation of specification compliance and for maintenance. Layout and location of equipment should be part of the close out.
2. The design team shall include the following in the contract documents for existing and new buildings:
  - a. Full system design shall be developed using the following:
    - i. The tested signal strength at the project location during design phase.
    - ii. Confirm frequencies used by the public safety agencies.
    - iii. Software simulated radio propagation modeling with heat maps showing the predicated signal coverage levels within the building.
    - iv. If the design team is uncomfortable or unable to perform the required testing and modeling, an RFP shall be issued for this service during the design phase.
      - a) The RFP shall be issued to entities able to provide these services after the building floor plan is established and wall construction types are known. It is anticipated this information will be known at the end of the Design Development phase.
      - b) The design team shall assist FCPS in preparing an RFP for this service and FCPS will issue.

- v. The information gathered from the building model shall be utilized to design the system.
  - vi. It is understood that the final building testing and verification of the modeling cannot be done until near the end of construction.
    - a) Consideration should be given to providing an allowance or utilizing unit prices to credit/add any deviations that may occur between the design based on the simulated model versus the field testing. Review the amount of the allowance with FD&C.
    - b) Radio Frequency (RF) Survey/Testing the new construction or existing building shall be included in the base bid and conducted prior to system installation.
  - vii. Perform an RF survey of the required coverage area. This survey shall be completed after the building shell is erected, interior walls are constructed, and exterior glass has been installed. This shall be done in a timely manner so as not to require a time extension in the project.
  - viii. To do testing contact the local AHJ, typically Lexington Fayette Urban County Government Public Safety (Division of Fire and EMS).
    - a) LFUCG has stated in the past it MUST do the testing and it is at no cost. This shall be confirmed by the design team.
3. The system design shall be modified as necessary based on actual field testing.
- a. Warranties shall include all labor, material, and travel time.
    - i. Provide during the warranty period 24-hour by 7-day acknowledgement via telephone of service calls within one hour of notification and on-site response within 24 hours of telephone acknowledgement. This Service Agreement shall be with an authorized service provider for the installed equipment.
    - ii. Submit to the User Agency, a list of services—including maintenance contracts and annual testing options—available for the installed system after the expiration of the warranty period. Such maintenance contracts and/or testing are the responsibility of the user agency and are not included in work covered under this section.
    - iii. Provide and maintain a list of contact personnel—including phone numbers—at the system equipment location(s). The contact personnel shall have knowledge of the building and the radio coverage system and be available to respond to the building in the case of a radio coverage system emergency
  - b. Follow-up Service
    - i. During the warranty period -but no earlier than 6-month after substantial completion of the project—provide at no additional cost one (1) on-site diagnostic/adjustment service to the installed system(s) to re-confirm operation, settings, etc. This service visit shall be made on a weekday during normal working hours.
    - ii. Check all active components of the in-building radio system, including but not limited to:
      - a) Amplifier(s) to ensure that the gain is the same as it was upon initial installation and acceptance. Document the original gain and any change in gain.
      - b) Back-up batteries and power supplies. Test under load to verify that they will operate during an actual power outage.

- c) Other Active components to determine that they are operating within the manufacturer's specifications for their intended purpose.
  - iii. Documentation results to agency and municipality.
- c. Owner training on the system is required.
- d. Approved manufacturers: (These are some of the known partners, Honeywell/Fiplex can be basis of design and other suggestions are listed below) Manufacturers shall have a minimum of five (5) years of documented experience in designing, manufacturing, delivering, and supporting the specified material.
  - i. Honeywell/Fiplex
  - ii. Siemens/RSI
  - iii. Johnson Controls/Westell
  - iv. EST/ADRF
  - v. Notifier/Potter
  - vi. Nextivity
  - vii. Comba
  - viii. SOLID
  - ix. Commonslope

28 13 00

#### ACCESS CONTROL

1. Access Control requirements shall be discussed with FCPS Maintenance and FD&C prior to design.
2. All security systems shall be Sonitrol. This includes cameras and door access controls. This is to be included as an additive alternate to the project.
3. The Secured Vestibule access is to provide one main door to be monitored by weatherproof, vandal resistant cameras, with one phone monitor, to be verified with FCPS FD&C and FCPS Electronics. System is to provide at each camera location, an exterior, weatherproof, vandal resistant intercom station with call-in switch, to be utilized to gain access to the building. System is to allow an attendant/ administrator inside the building to be called on the intercom station and to view the monitor to visually verify and approve the person(s) wishing to gain access to the building. The door lock release solenoid shall be wired to an audio buzzer at the door location, which shall be activated when the door's latching bolt has been opened.
4. Contractor shall be responsible for maintaining existing door access control system during construction.
5. The main entrance to the school shall be provided with an intercom station and video camera. The intercom station shall be a flush mounted vandal and weather resistant station with a call button to initiate a conversation. The exterior intercom station shall be tied into the school's intercom system such that a call initiated by pressing the exterior call button shall be received at the reception desk intercom access handset/equipment. The exterior intercom station and camera shall be located to the right (when facing the doors from the exterior) of the main doors and the door release button shall release the right most leaf of the doors. The door release button for this door shall be mounted at the reception desk and is to be installed by the company installing the secured vestibule access system.
6. The exterior video camera shall also be vandal and weather resistant and shall be located to view a visitor's face as they talk to the exterior intercom station.

28 23 00

#### VIDEO SURVEILLANCE

1. Video, infrared and/or motion detecting surveillance equipment shall be provided. 4 hours of training and inclusion of programming and maintenance software/books is mandatory.
2. All security systems shall be Sonitrol. This includes cameras and door access controls. Interior cameras are to be fixed with selected locations being monitored by the monitoring service. Exterior cameras may be fixed or pan tilt zoom type depending on need. There are to be 4 to 6 door access points with card readers, one of which shall be the main kitchen door. Security cabling shall be located in cable trays. Four (4) hours of training and inclusion of programming and maintenance software/books is mandatory.

28 31 00

#### FIRE DETECTION AND ALARM

1. The fire detection and alarm system shall be Notifier. Main panel is to be Notifier #NFS2-640 and shall include an Ethernet card for remote viewing. The main panel is typically mounted in the Electrical Room and shall have a dedicated circuit labeled as "Fire Alarm."
2. The fire detection and alarm system remote annunciator shall be located at the main entry to the building in a flush mounted cabinet.
3. Ensure that the specifications call for a connection between the fire alarm system and the Building Automation System to allow for monitoring of the fire alarm system.
4. Provide a smoke detector in all communications rooms.
5. Provide a smoke detector in all return air vents.
6. The fire detection and alarm system shall have two dedicated telephone lines. These telephone lines are not to pass through any type of building/school district telephone switch gear.
7. Fire alarm cabling leaving to the exterior of the building (such as to the sprinkler pit) shall be protected from lightning.
8. Fire detection and alarm systems cabling shall be routed in conduit.
9. The fire control communicator shall be Silent Knight Model #5104.
10. All fire alarm horns and strobes shall be flush mounted where possible and utilize red back boxes. Provide wire guards over fire alarm horns in ganged restrooms and the gymnasium.
11. Ensure that the specifications call for a one year contract with a UL listed central monitoring service, including all system programming. The one-year period commences upon substantial completion of the entire facility.
12. Training of FCPS personnel on the fire detection and alarm system programming is mandatory, as is providing copies of programming software and service/maintenance software. All training is to be videotaped, with two copies provided to the Owner.
13. The original copy of the Fire Alarm Certificate of Completion shall be given to FCPS Division of Maintenance.
14. Schedule and coordinate all fire alarm systems inspections with FCPS Division of Maintenance so that are on site during said inspection.

## DIVISION 31 EARTHWORK

### 31 10 00 SITE CLEARING

1. Ensure that all stumps, roots, obstructions, and debris extending to a depth of 18" below exposed subgrade are removed and disposed of offsite.
2. Use of explosives or blasting as a construction practice is prohibited.
3. Chip removed tree branches and dispose of offsite.
4. Remove sod and grass before stripping topsoil. Topsoil is to be stripped in a manner to prevent intermingling with underlying subsoil or other waste materials. Topsoil is to be stockpiled and covered to prevent windblown dust. Topsoil is not to be stockpiled within tree protection zones.
5. Do not excavate within the tree protection zone (drip line of tree) of trees that are scheduled to remain. Use hand methods for grubbing within tree protection zone.
6. Trees and vegetation scheduled to remain that are damaged by construction operations are to be replaced.
7. Do not indicate that existing mulch is to be salvaged by the Contractor.

### 31 20 00 EARTH MOVING

1. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than five percent (5%) for a minimum distance of 10' measured perpendicular from the wall. Transitions around entrances and means of egress may be reduced to 2% slopes to meet accessibility guidelines.
2. The Geotechnical Engineer shall determine suitability of fill material by inspection and approval. Topsoil is not permitted as fill or backfill within structure limits or under paved areas.
3. Excavation shall include the removal and disposal of all materials encountered regardless of the nature, condition, or the manner in which the materials are excavated. The classification of sites is to be discussed with the owner in order to make a fitting determination.
4. Typically, structures are to bear on stiff or better natural soils or newly placed and compacted fill. If rock is encountered with 24" of the bottom of footing excavation or 12" of the bottom of floor slab excavation, the rock shall be undercut and excavation backfilled with compacted fill to the design bottom of footing or slab excavation in order to provide a cushion. In no cases shall footings or slabs bear on both rock and soil. It is important to remember that the Geotechnical Report is not considered part of the Construction Documents. It is for reference only and shall not be used in the contract documents in any way that misconstrues its original purpose.
5. Prepare phasing plans that are coordinated with the building phasing that indicate utility lines that are to remain in operation during certain phases as well as vehicular traffic flow considerations during phased construction.
6. Storm Water Pollution Prevention Plans are required. The plan shall include certifications that must be signed and submitted by the contractor and appropriate sub-contractors prior to approval of the first application for payment.
7. Erosion control measures are to be indicated on the plans. These measures are to include installation of silt fencing, installation of rock check dams and erosion control blankets on steep banks. All disturbed areas are to be sodded or seeded for permanent stabilization. The contractor is to provide stabilization as soon as final grading has been completed.



31 31 16

TERMITE CONTROL

1. In new construction as well as additions to existing structures, provide soil treatment prior to construction that contains a concentrated termiticide that dilutes with water. Provide a five (5) year warranty period starting at project substantial completion that certifies that applied soil termiticide treatment will prevent infestation from subterranean termite activity. If activity is found during the warranty period, the Contractor will re-treat soil and repair or replace any damage caused by termite infestation.

## DIVISION 32 EXTERIOR IMPROVEMENTS

### 32 05 00 COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS

1. Preschool playgrounds are typically 60' x 80' in dimension and contain a paved surface equal to one third the size of the playground area. The entire preschool playground area shall be surrounded by a 48" h galvanized chain link fence. The fence shall have two gates, one standard 36" wide gate and one double drive 10' wide gate. All playgrounds are to have 12" of hardwood mulch with concrete borders that allow an accessible entrance into the play area. The play equipment structures are not part of the construction contract. Verify requirements with FCPS Plant Operations.
2. Verify with the FCPS Grounds & Custodial Services whether or not existing play equipment structures are to remain on site and who is to be responsible for relocating play equipment if required due to phasing / construction.

### 32 12 16 ASPHALT PAVING

1. Hot mix asphalt producers shall be qualified through the Kentucky Transportation Cabinet (KTC) as an approved Asphalt Mix Producing Firm.
2. Comply with the provisions of KTC Standard Specifications Section 403.03.01 for temperature requirements of placing hot mix asphalt.
3. Proof roll the subgrade and ensure all necessary rolling and compacting to obtain a firm, even subgrade surface. Fill and consolidate depressed areas. Remove incompatible materials and replace with clean fill and compact to a minimum of 95% of the maximum dry density in accordance with ASTM D698 Standard Proctor Method.
4. The aggregate base shall be a dense grade aggregate (DGA) complying with Section 805 of the KTC Standard Specification. Compact to a minimum of 95% of the maximum dry density in accordance with ASTM D698 Standard Proctor Method.
5. The asphalt binder should be AASHTO MP 1, Performance Graded Binder PG 64-22 for general applications.
6. Tack Coats shall comply with the provisions of KTC Standard Specification Section 406.
7. Hot laid, hot mix asphalt plant mixes shall meet the requirements of KTC or Asphalt Institute (AI) MS-2.
8. The Base Course shall be KTC mixture designation Class 2 Base or a Marshall mixture from AI MS-2 with a nominal maximum aggregate size of 0.75".
9. The Surface Course shall be KTC mixture designation Class 2 Base or a Marshall mixture from AI MS-2 with a nominal maximum aggregate size of 0.38".
10. Comply with applicable provisions of KTC Standard Specification Section 403 for delivery, placement, spreading and compaction of the mixture. The average density should be 92% of reference maximum theoretical density according to ASTM D 2041, but not less than 90%.
11. Compact each course to produce the thickness indicated on the drawings within the following tolerances: Base Course: +/- 1/2" for 10'-0". Surface Course: +/- 1/4" for 10'-0".
12. Parking lots are to be designed for a minimum fall of 1% to facilitate drainage. (2% is recommended.)

32 13 13

#### CONCRETE PAVING

1. Concrete paving shall be utilized for walks, ramps, curb and gutters, dumpster pads, and loading docks.
2. Exterior concrete paving and flatwork shall have a positive drainage away from the building.
3. All concrete sidewalks are to be a minimum of 4' in width and 4" in depth. They shall have a non-slip (broom) finish and the surface shall be ½" to 1" above the adjacent grade to facilitate trimming and snow removal. Expansion joints will be spaced a maximum of 40' on center and control joints cut at a maximum of 5' on center. Sidewalks will be reinforced with the appropriately sized wire mesh.
4. Concrete dumpster aprons shall extend a minimum of 20' in front of the dumpster pad and shall be composed of minimum 7" reinforced concrete paving with a heavy broom finish. Provide expansion joints every 15' with control joints cut every 5' on center. Refer to Lexington Fayette Urban County Government (LFUCG) municipal code for additional dumpster enclosure requirements.
5. Subsurface preparation for exterior flatwork / sidewalks shall include removal of all organic materials and poor quality soils and a minimum of 4" compacted dense grade aggregate.
6. All exterior concrete paving shall be a minimum of 4500 psi design strength with 6% +/- 1% entrained air content in order to resist freeze-thaw damage.
7. Ensure that sidewalks adjacent to buildings do not encroach upon the area required for operable windows to open.

32 14 00

#### UNIT PAVING

1. Detectable warning pavers shall be either brick or concrete units. Precast concrete units are also acceptable. Brick units are to be rated for light traffic, ASTM C 902, class SX, Type 1, Application PX. Concrete units are to comply with ASTM C 936. Provide a 4 ½" minimum thickness reinforced concrete slab below pavers. If this area is to be used for vehicular access, provide a 6" minimum thickness reinforced concrete slab.
2. Permeable pavers shall be either clay or concrete units set on a minimum 2" stone bedding course (typically #8 stone), over a 4" – 8" base course of #57 stone over 12" minimum sub-base course of #2 stone. Utilize a non-woven geotextile filter fabric over the sub grade that has been compacted to a minimum of 95% proctor per ASTM D 698.
3. Permeable pavers shall be rated for vehicular use and shall be ADA compliant.

32 31 13

#### CHAIN LINK FENCES AND GATES

1. Fabric will consist of 9-gauge galvanized wire; 2" mesh (1" mesh at Preschool playground enclosures). Vinyl coated fabric is not to be used unless permission from FD&C is first gained.
2. Top and bottom rails shall be 1.625" OD galvanized steel pipe, 2.27 lbs. per linear foot. Line posts shall be 2.375" OD galvanized steel pipe, 3.65 lbs per linear foot. End, corner and pull posts shall be 2.875" OD galvanized steel pipe, 5.79 lbs. per linear foot. Gate posts shall be 4" OD galvanized steel pipe, 8.65 lbs. per linear foot. Gate frames shall be 2" OD galvanized steel pipe, 2.72 lbs. per linear foot.
3. Rolled or pressed steel dome caps on corner and gate posts.
4. Rail ends will be brace type.
5. Gates will have industrial type hinges where possible.
6. Fence ties will be 9-gauge.

7. Height of posts will be determined by the size of the mesh being used.
8. All posts will be installed with concrete to a minimum depth of 18". Fencing taller than 72" should be set 30" deep. Holes for all posts will be 12" diameter.
9. Upon installation the fabric will be raised off the ground 2".

32 92 00

#### TURF AND GRASSES

1. Specify that all unpaved areas disturbed by construction activities not indicated to receive planting be considered as lawn areas and shall be seeded or sodded. Existing lawns shall be restored when compacted during construction. Repair any ruts or depressions left by equipment or storage of material. Remove and replace any topsoil containing foreign materials resulting from contractor's operations.
2. Specify that areas to be seeded or sodded will be properly prepared with a rototiller to the depth of 6". All rocks, gravel, dirt and turf clods are to be removed prior to seeding / sodding.
3. Newly planted lawns shall be maintained by watering, fertilizing, weeding, mowing, trimming and replanting if needed for a period of 60 days following project substantial completion. Lawns shall be kept uniformly moist to a depth of 4" for a minimum of three weeks after seeding / Sodding or throughout the maintenance period. Provide a minimum irrigation rate of 1 inch per week including rainfall to maintain lawn growth. The Contractor shall provide the water or reimburse the Owner for water usage.
4. Fescue shall be used on all school grounds, with the exception of athletic fields. Rye grass and Blue grass may be used on athletic fields with irrigation systems. Fescue grass must be used on non-irrigated sports fields.
5. All chemicals used on school grounds must be applied by a certified and licensed applicator. No EPA restricted herbicides are to be applied to school grounds.

32 93 00

#### PLANTS

Priorities: Address the educational function of the building. This priority shall address the renovation or additions of buildings and grounds to enable improved educational facilitation and flexibility or the location of certain subject areas in proximity to others. Projects assigned this priority will add to the efficiency and / or effectiveness of the building.

1. Trees, shrubs, groundcover, or any other landscaping shall be safe for children and low maintenance. Only dwarf or ornamental trees shall be planted within 50' of any school building or any other permanent structure; trees that will reach heights above 20' are to be located at least 50' from any building. Trees and shrubs with thorns are prohibited as are those with poisonous berries or fruit. Only trees and shrubs that are suitable for the Kentucky climate (plant hardiness zone 6) are to be scheduled for planting. Orchard fruit trees are prohibited.
2. Consider minimizing impervious surface to reduce FCPS stormwater fees.
3. Outdoor learning provides numerous instructional, social-emotional and wellness benefits. During building programming, consider outdoor learning opportunities to include:
  - a. Proximity of Nature Studies/Science classrooms to available green space
  - b. The school Outdoor Learning Team's programmatic goals
4. Lexington's tree canopy has an immense impact on our shared environment, economy and society [<http://Lexingtonky.gov/node/15136>]. In support of LFUCG's goal of 30% urban tree canopy, consider:
  - a. Renovation: increasing tree canopy by 10% or more 20 years after planting
  - b. New Construction: 20% tree canopy 20 years after planting

5. Recommended Shade Trees (include but are not limited to):
  - a. Maple- Acer species (excluding Acer negundo, Acer platanoides and Acer saccharinum)
  - b. American Yellowwood- Cladrastis kentukea
  - c. Fagus species, Beech species.
  - d. American Sweet gum- Liquidambar species Rotundiloba variety only.
  - e. Oak- Quercus species- Sawtooth oak, White oak, Swamp white oak, Bur oak (except Quercus palustris)
  - f. Bald cypress- Only in wet areas at least 60' from any structure
  - g. Sugar Hackberry – Celtis laevigata
  - h. Blackgum- Nyssa sylvatica
  - i. Hornbeam, Muscledwood, Bluebeech- Carpinus species
6. Recommended Ornamental Trees (include but are not limited to):
  - a. Eastern Redbud- Cercis canadensis
  - b. White Fringe tree- Chionanthus virginicus species
  - c. Dogwood Kousa- Cornus kousa, Cornus mas
  - d. Foster Holly- Ilex atropurpureus
  - e. Witch Hazel- Hamamelis
  - f. Magnolia- Species that are zoned for Kentucky
  - g. Sourwood- Oxydendrum
  - h. Maple – Acer pamtatum
  - i. Japanese Tree Lilac – Syringia reticulata
7. Recommended Evergreens (include but are not limited to):
  - a. Pine – Pinus species – Limber, Eastern White, Lacebark (excluding Pinus sylvestris)
  - b. Spruce – Picea species – Norway, Serbian, Oriental, Colorado Blue
8. Recommended Shrubs (include but are not limited to):
  - a. Little Leaf Boxwood- Buxus species
  - b. Bottle Brush Buckeye- Aesculus parviflora
  - c. Butterfly bush- Buddleia
  - d. Chamaecyparis- Shrub type only
  - e. Dwarf Fothergilla
  - f. Forsythia- Only dwarf type, minigold, arnold dwarf etc.
  - g. Hydrangea
  - h. Inkberry- Ilex glabra
  - i. Winterberry- Ilex verticillata
  - j. Possumhaw- Ilex decidua
  - k. Fragrant Sumac- Rhus aromatica
  - l. Viburnum- All except Viburnum rhytidophyllum or other hybrids
  - m. Button Bush- Cephalanthus occidentalis
  - n. Northern Bayberry- Myrica pensylvanica
9. Forked trunks on trees are not acceptable.

**DIVISION 33 UTILITIES**

33 XX XX Utilities design to be coordinated with possibility of future expansion.

33 XX XX ALLOWANCES

1. Include needed utility tap fees under Allowances (01-21-00).