

6th Edition

January 2016

GUIDELINES
for
DESIGN AND CONSTRUCTION
of
EDUCATIONAL FACILITIES
for
THE SCHOOL BOARD
of
VOLUSIA COUNTY FLORIDA

FACILITIES SERVICES

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**INTRODUCTION TO THE
GUIDELINES
for
DESIGN AND CONSTRUCTION
of
EDUCATIONAL FACILITIES
for
THE SCHOOL BOARD OF VOLUSIA COUNTY FLORIDA**

**6th Edition
January 2016**

The purpose of this manual is to provide the design professional with a general listing of design criteria from a technical, facilities perspective. The manual is divided into chapters, which reflect the Construction Specification Institute (CSI) Master Specification Format. It is not the intent of this manual to direct design or insist upon any proprietary products, but merely to serve as a basis of quality and standardization needs for the district. Volusia County Schools Division 0 standards are available on the District website and are to be incorporated into your documents.

Design contracts awarded after January 1, 2016 shall comply with this document.

Design professionals are expected to incorporate the criteria set forth in this manual into all projects. Variances from the items listed herein should be coordinated with the VCS Construction Project Manager and confirmed in writing.

The VCS Construction Project Manager is the designee responsible for administering a project and is the Owner's Representative. All contact with the Owner and all direction to the Architect/Engineer shall be through this representative, herein after referred to as Owner.

Any comments, suggestions for improvements in the content of this manual are encouraged and always appreciated. We hope this guide will be of assistance to you and your staff and look forward to a successful project to improve the quality of education for the students of Volusia County Schools.

The acronyms below are abbreviations referenced throughout this manual.

ADA	Americans with Disabilities Act
A/C	Air Conditioning
A/E	Architect / Engineer
AGC	Application Generic Controller
AHU	Air Handling Unit
AI	Analog Input
AIA	American Institute of Architects
AMCA	Air Movement and Control Association
AMR	Automated Meter Reading
AO	Analog Output
API	Application Program Interface
ASC	Application Specific Controller
ASHRAE	American Society of Heating, Refrigeration & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASCE	American Society of Civil Engineers
ASP	Application Service Provider
ASTM	American Society for Testing and Materials

AWG	American Wire Gage
AWI	Architectural Woodwork Institute
BAS	Building Automation System
BTU	British Thermal Unit
CAC	Custom Application Controller
CATV	Cable Television
CCTV	Closed Circuit Television
CFM	Cubic Feet / Minute
CHWR	Chilled Water Return
CHWS	Chilled Water Supply
CMU	Concrete Masonry Unit
CPU	Central Processing Unit
DC	Direct Current
DDC	Direct Digital Controller
DDE	Dynamic Data Exchange
DEP	Department of Environmental Protection
DI	Digital Input
DO	Digital Output
DOE	(Florida) Department of Education
DTMF	Dual Tone Multi-Functional
DWV PVC	Drain Waste Vent Polyvinyl Chloride
DX	Direct Expansion
ECC	Engineering Control Center
EEPROM	Electronically Erasable Programmable Read Only Memory
EIFS	Exterior Insulation and Finish System
ELL	Elbow
EMS	Emergency Management System
EMT	Electric Metallic Tubing
EP	Electric-pneumatic
ESE	Exceptional Student Education
FAC	Facilities (Volusia County Schools Facilities Services)
FACP	Fire Alarm Control Panel
FBC	Florida Building Code
FCC	Fire Command Center
FDOT	Florida Department of Transportation
FISH	Florida Inventory of School Houses
FMT	(Volusia County Schools) Facilities Maintenance Technician
FPA	Florida Product Approval
FS	Florida Statute
GA	Gauge
GC	Global Controller
GPS	Global Positioning Satellite
GUI	Graphical User Interface
HID	High Intensity Discharge
HTTP	Hypertext Transfer Protocol
HVAC	Heating, Ventilating and Air Conditioning
IDF	Intermediate Distribution Frame
IEEE	Institute of Electrical and Electronic Engineers
I/O	Input / Output
IP	Internet Protocol
ISA	The Instrumentation Systems and Automation Society

ISS	Intelligent Space Sensor
ITV	Intercom and Television
KMC	KMC Controls
LAN	Local Area Network
LC	Local Controller
LED	Light Emitting Diode
MC	Metal Clad
MDF/IDF	Main Distribution Frame / Intermediate Distribution Frame
MEP	Mechanical, Electrical, Plumbing
MERV	Minimum Efficiency Reporting Value
MDF	Medium Density Fiberboard
NEC	National Electric Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NWMA	National Woodwork Manufacturers Association
ODBC	Open Database Connectivity
O & M	Operating and Maintenance
OSHA	Occupational Safety and Health Act
OTDR	Optical Time Domain Reflectometer
PC	Personal Computer
PE	Pneumatic-electric
PID	Proportional-Integral-Derivative
PLC	Programmable Logic Controller
PPM	Parts per million
PVC	Polyvinyl Chloride
RAM	Random Access Memory
RF	Radio Frequency
RH	Relative Humidity
RPZ	Reduced Pressure Zone
RTD	Resistive Temperature Device
SBS	Styrene - Butadiene - Styrene
SDI	Steel Door Institute
SI	System Integrator
SID	Supervisory Interface Device (Gateways)
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMS	Short Message System
SMTP	Simple Mail Transfer Protocol
SPD	Surge Protective Device
SREF	State Requirements for Educational Facilities
ST	Single Termination
TAB	Test and Balance
TCP/IP	Transmission-Control Protocol / Internet Protocol
TUC	Terminal Unit Controller
TVP	Television Production
UC	Unitary Controller
UL	Underwriters Laboratories
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VAC	Volts Alternating Current
VAV	Variable Air Volume

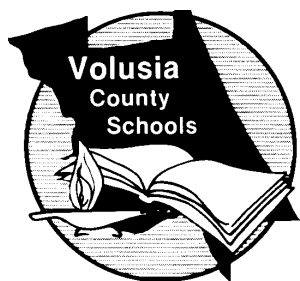
VCS	Volusia County Schools
VCSB	Volusia County School Board
VCT	Vinyl Composition Tile
WAN	Wide Area Network
WET	Web-Enabled Technology
XIF	External Interface File
XML	Extensible Markup Language

GENERAL INFORMATION / DESIGN ELEMENTS

1. These guidelines apply to all new, existing, renovations, remodeling and maintenance projects for Volusia County Schools.
2. The forms in the "Form" section of this manual are PDF forms. To use this feature, extract the page, save to your computer, fill in the form, then print.
3. All design and construction drawings shall be no larger than 30" x 42". All details shall be clearly shown and accurately referenced on the construction drawing.
4. Upon successful completion of bidding and award of the construction contract Architect shall submit the following to the Owner: two complete printed sets of the most current construction documents including plans, specifications and all addenda; and digital documents of all drawings on CD or DVD in AutoCAD (.dwg format), and PDF, **read-only files are not acceptable**. AutoCAD drawings shall be bonded drawings with no external references allowed; include with each disc set copies of Architect's plot configuration, special fonts, digital images and a Word or PDF document of the Index to Drawings. AutoCAD file names shall be identical to the sheet it represents.
5. Prior to any demolition work, the Owner shall prepare a list of items to be salvaged by the Owner. Owner maintains first right of refusal.
6. A list of major codes (with date of each code) utilized on the project shall be included on the drawings.
7. Each project shall include a site plan or at least partial site plan showing relative locations of existing buildings.
8. The A/E Team shall comply and develop practical design solutions that are functional and cost effective as described in Florida Statute 235.002(1)b.
9. Volusia County School Board endorses and supports the Teaming Program and expects all design team members and construction team members to actively participate and work towards maintaining a positive relationship among all team members throughout the project duration.
10. All radon protection requirements shall be clearly noted and detailed on the construction drawings. The Radon Resistant Construction Guidelines published by Florida Department of Health and Rehabilitative Services, current edition, is recommended.
11. The structural floor plans shall clearly show all floor drain locations and the extent/limits that the concrete slab requires pitching towards the drain (i.e. emergency showers, mechanical rooms, etc.) The floor at all locations within toilet spaces shall be sloped to a drain.
12. Exterior wall assemblies shall be CMU construction with exterior bituminous damp proofing and rigid insulation with brick veneer, split face CMU veneer; all cavity systems shall include weep holes and flashing with mortar netting.
13. All exterior walls shall be continuous to the underside of the roof deck assembly. Do not design soffits venting into an attic space above interior spaces. Above ceiling spaces shall be designed air tight to prevent outside air from entering ceiling space. Roof insulation shall be designed in the roof deck assembly and not placed on ceiling assemblies.
14. Parapet walls shall not be used in design unless the roof membrane is continuous up to, and counterflashed by, the coping. The parapet wall shall not extend more than 2' above the adjacent roof elevation. The coping will be continuous along the cap line and not be of masonry / precast construction without written approval. Parapet shall not completely enclose a roof so as to prevent drainage to the eave(s).

GENERAL INFORMATION / DESIGN ELEMENTS

15. Metal roof systems or roofs that drain over the perimeter face of the building shall be designed with gutters and discharge into an underground collection system, where applicable. Discuss and decide on a direction pertaining to this item with the Owner during design.
16. EIFS wall systems shall not be specified for any location.
17. Please note the difference between "owner furnished" and "owner provided".
 - A. "Owner Furnished": the owner will specify and order the equipment and insure that it is on site for the contractor to build-up, install and test.
 - B. "Owner Provided": the owner will specify, order, build-up, install and test.
 - C. It is normally our intention to utilize "owner furnished" equipment.
18. A bronze dedication plaque will be specified on new construction and major redevelopment projects. An example can be found in the Attachments section of this manual.
19. Re-number buildings: if a project requires existing buildings to be re-numbered, the changes will need to be reflected on the electrical panels, fire alarm panel, intercom, energy management, security, local law enforcement, fire department, F.I.S.H., etc.
20. Contractor to provide Post and Placard Box for permits on jobs, as required.
21. A/E to check and review the most recent VCS Comprehensive Safety Inspection Report, Environmental Reports, Asbestos Reports, and ADA Survey for items that may be included in project design.
22. Maximum weight of a set of plans shall be 35 lbs. Break plans into sections so no one section exceeds this weight.
23. ESE changing tables will be Owner furnished equipment. A space shall be provided for one as required. Space shall be a minimum of 3' x 6'-6".
24. Provide Key Management System to include lockable key cabinet or cabinets on new facility construction and on major renovation projects. Provide one space for each door. Provide key tags; include tags for fifty percent (50%) future expansion.
25. If domestic appliances are a part of the project, they should be included in the contract.
26. Assure door openings are sufficient for replacement or moving of appliances in and out. (Example: washers and dryers for the athletic department.) Provide double doors with removable center mullion, if required.
27. Provide document cameras for demonstration areas instead of demonstration mirrors (science class, demonstration kitchens, etc.).
28. Refer to FS 255.2575 for green building requirements for public schools.
29. Specify at least three (3) products for each item specified or note approved equal. Exception: door hardware, closers, panic / exit devices.
30. Any "Performance Specified" structural item shall be clearly listed on the A/E project plans along with the code criteria to which the plans are designed.
31. Verify that all products that require Florida Product Approval (FPA) are so approved before specifying. Provide FPA number for each such product on the drawing.



DIVISIONS

FACILITIES SERVICES

DIVISION 0

BIDDING REQUIREMENTS, CONTRACT DOCUMENTS, AND CONDITIONS OF THE CONTRACT

1. The following represents the standard documents of inclusion for Division 0; in some instances a notes of explanation (*in italics*) may follow document title.
 - A. Cover Page
 - B. Table of Contents
 - C. Index of Drawings
 - D. Advertisement for Bid
 - E. Instructions to Bidders
 - F. Bid Form
 - G. Bid Bond Form (AIA Document A310-1970)
 - H. List of Subcontractors
 - I. Bidder Project Data for Self-Performed Projects Form
 - J. Trench Safety Act Form
 - K. Bid Protest Bond Form
 - L. Standard Form of Agreement Between Owner and Contractor (AIA Document A101-2007)
This document has been modified by VCS and should be used for projects with an estimate of \$100,000 or more; should the design professional desire other modifications or items of inclusion he/she should present those to the VCS Construction Project Manager for review.
 - M. General Conditions of the Contract for Construction (AIA Document A201-2007)
This document has been modified by VCS and should be used in conjunction with the A101-2007 and the A133-2009; should the design professional desire other modifications or items of inclusion he/she should present those to the VCS Construction Project Manager for review.
 - N. Standard Form of Agreement Between Owner and Construction Manager (AIA Document A133-2009)
This document has been modified by VCS and should be used for construction management projects; should the design professional desire other modifications or items of inclusion he/she should present those to the VCS Construction Project Manager for review.
 - O. Standard Form of Agreement Between Owner and Contractor for a Small Project (FAC 625)
This document should be used for projects with an estimate of \$25,001 to \$99,999.
 - P. Performance and Payment Bond
 - Q. Contractor's Direct Material Purchase Affidavit
 - R. Contractor Acknowledgment Form (Asbestos Survey)
 - S. Notice to Proceed
 - T. Application and Certification for Payment (AIA Document G702-1992)
 - U. Application and Certification for Payment (AIA Document G703-1992)
 - V. Architect's Field Report
 - W. Architect's Supplemental Instructions
 - X. Proposal Request
 - Y. Change Order
 - Z. Consent of Surety to Reduction in or Partial Release of Retainage (AIA Document G707A)
 - AA. Certificate of Substantial Completion
 - BB. Consent of Surety to Final Payment (AIA Document G707-1994)
 - CC. Contractor Affidavit
 - DD. Receipt and Release
2. The documents and forms listed above are available at the VCS website or from the Facilities Design & Construction department.

DIVISION 1

GENERAL REQUIREMENTS

1. Typical general requirements may vary with the size and complexity of any given project; coordinate items of inclusion with the Owner.
2. Subcontractors shall be required to attend a pre-installation meeting with the Contractor and Owner before beginning their work.
3. The architect shall state in the contract documents all permits (i.e., School Board of Volusia County Florida Building Permit, Water Management District, Site, utility, Right of Way Access, etc.) that are applicable to each project.
4. The contractor shall coordinate all inspections required during construction.
5. As-built site drawings submitted to the Owner shall be certified by a professional land surveyor and clearly show all as-built conditions, elevations and utilities.
6. The contractor shall be required to submit a complete set of as-built drawings in AutoCAD and PDF format in addition to the field maintained record set, or copy thereof, as required in AIA Document A201.
7. The architect shall require the contractor to submit material safety data sheets for all hazardous products and make them available at the job site.
8. Subcontractors listed on bid form shall not be changed without Owner approval. List shall include contractor name, address, phone number and state license number.
9. The contractor is expected to work in a safe manner.
10. The utmost consideration to safety shall be given while working around students and staff.
11. Barricades shall be maintained where required while construction is occurring and checked regularly. Contractor is required to submit a safety barrier plan to the VCS Building Department before a Building Permit is issued.
12. Access to and from the construction area needs to be planned and agreed upon by all involved.
13. Clean construction debris daily.
14. Interaction with students and staff is prohibited.

DIVISION 2 SITE WORK

1. The following considerations shall be addressed in the site design of a school.
 - A. The allowance of future building expansion and the accommodation of ten (10) portable classrooms (grading, circulation patterns, water, sewer, electric, fire alarm, intercom, ITV and computer stub outs.
 - B. The development of circulation patterns that separate pedestrian from vehicular traffic, the bus drop off from parent drop off, and staff parking from student parking.
 - C. Provide a minimum turn radius of 60' at bus loops with a double width lane where possible. Allow for adequate stacking of vehicles.
 - D. Athletic areas should be easily accessible from parking (i.e. for community use).
 - E. Main building entrances which are readily identifiable;
 - F. Building orientations, which conserve energy and allow for natural light and ventilation.
 - G. Providing handicapped accessibility.
 - H. The identification and preservation of natural site features.
 - I. Site plans will be reviewed by local jurisdiction. This shall be coordinated with the Facilities Site Acquisition and Intergovernmental Coordination Department.
 - J. Concrete pads for up to six (6) dumpsters shall be provided; gates for dumpsters (if provided) should be swing rather than roll type.
 - K. Entrance gates should be swing rather than roll type (when appropriate).
 - L. Demolition on our sites will require permits from the VCS Building Department.
 - M. Playground equipment is to meet VCS specifications available from the Maintenance Safety Department. Plan for level area with no underground utilities.
 - N. Depending on complexity - consider GPS coordinate identifier for all valve boxes.
 - O. Vegetation buffers and areas to remain uncleared shall be clearly noted on the drawing. The Contractor shall be required to protect these areas during construction.
 - P. Consider the use of recycled crushed concrete as a substitute for lime rock.
2. Construction/site clearing debris shall be disposed of off-site unless specifically noted otherwise. This shall be the basis for bidding. Burning tree/shrub debris may be permitted with Owner approval. Note for A/E: Should the Contractor determine that burning is allowable with the local fire authorities and the Owner feels that allowing burning would best serve the Owner's financial interest, a credit shall be received from the Contractor. The Contractor is responsible for permits. No burns allowed in location of future buildings.
3. Soil cement base shall not be specified without written approval by the Owner.
4. Type SP 905 asphalt shall be specified in all vehicular traffic areas. Consider the use of recycled asphalt whenever possible. Provide 1 ½" asphalt for general driveways and 2" asphalt in bus loop.
5. All PVC utilities and main irrigation lines shall have #10 GA copper tracer wire located directly above the line and terminate on a metal device accessible from the surface without excavation. In addition, plastic marker tape indicating the type of line shall be located no less than 2' directly above the utility line. The tape and wire/terminations shall be inspected by the Owner prior to backfill. On main irrigation lines provide marking tape half way between pipe and grade.
6. "Free draining soils" shall be used for all fill material. "Free draining soils" are defined as: clean sand containing five percent (5%) or less by dry weight of material passing the US Standard No. 200 sieve size.
7. All storm water outfalls shall have protection grates and horizontal energy dissipation pads per FDOT specifications. All grates shall be hot-dipped galvanized.
8. Provide Florida Accessibility Code for Building Construction compliant foot traffic grates at all trench drains and inlets at areas of pedestrian traffic.

9. Site design should minimize the use of fencing. The front of the school shall not fenced unless directed by the Owner.

10. TENNIS COURTS

- A. Fencing shall be vinyl, black or green-coated galvanized fabric.
 - B. Court shall run north/south.
 - C. Surfacing shall be Plexi-Pave or equal over asphalt.
11. Chain Link fence shall be minimum 9 GA galvanized fabric thickness at all locations. All posts shall be set in concrete bases. Tension wire in lieu of bottom rail shall be specified for all locations. Top and bottom selvage shall be knuckled/turned into the fabric. Provide minimum one gate 60" wide all locations for lawn mower. Galvanize fabric prior to weaving. New fencing shall match existing fencing at an existing school / facility.
 12. Athletic courts shall be asphalt. Provide basketball goals on courts.
 13. All Exterior athletic courts shall have flexible base material specified. Soil cement shall not be specified as a base material for any exterior athletic courts.
 14. In addition to bacteriological water testing that may be required by DEP, a minimum of 1 bacteriological test for the interior of each floor and building shall be taken at a point directed by the A/E and at the contractor's expense.
 15. The specification shall clearly state any requirements for DEP permit clearances prior to activation of any potable or waste water system service. The specifications shall clearly require the contractor to submit test results and sealed as-built site utility drawings to the engineer. Upon acceptance of the system, the engineer of record shall submit the request form and supporting documents to DEP for system clearance. The engineer shall enforce this requirement under the construction contract. The engineer will clearly specify any requirements for similar action for any systems that are under the jurisdiction of local municipalities and will enforce these requirements.
 16. Refrigerant shall not be vented during demolition and shall be captured, handled and disposed of per DEP regulation.
 17. Disposal of fluorescent tubes and magnetic ballasts shall be performed in accordance with Federal and State recycling regulations.

18. SITE DRAINAGE / GRADING

- A. The construction drawings shall clearly show (with appropriate spot elevations) finish grades in the areas of structures/buildings and shall be designed to shed surface runoff away from the structures/buildings. The A/E shall ensure that the finish floor elevations shall be a minimum of 8" above adjacent finish site grades to ensure positive runoff away from the structures/buildings and 12 inches (12") above the base flood elevations.
 - 1) Provide finished grade elevations at designated playground areas.
 - 2) No water shall be designed to sheet flow over sidewalks from landscape areas or roofs; design to flow away from sidewalks.
- B. Renovation projects shall be designed to make modifications to spaces and adjacent grades such that the above criteria are met. Swales and runoff collection systems shall be designed and clearly shown on the construction documents to ensure drainage away from all buildings.
- C. Design for storm drainage away from buildings, parking areas and driveways. Consider flow of concentrated storm drainage, design to slow down velocity. Concentrated drainage across sidewalks shall not be allowed, nor will ponding be allowed. Discharge from roofs and canopies

shall be directed away from buildings and walks or tied to an underground storm drainage system.

- D. Take roof rain leaders to underground systems (when appropriate) utilizing a sleeve flush with grade.
- E. Install storm drainage collection devices with a positive outfall in all areas where water can be trapped, especially in closed basin such as between buildings, interior courtyards and other similar conditions.
- F. The contractor shall obtain a copy of the St. Johns River Water Management District drainage and driveway permits and comply with all provisions therein.
- G. All storm drainage pipe installed shall comply with FDOT and Volusia County material and construction specifications.
- H. As built drawings, signed and sealed by a Florida registered surveyor, will be required upon completion of the retention basins and storm drainage system. Drawings shall include all invert and grate elevations of all storm pipe and structures and representative top of bank and bottom elevations on the retention basins.
- I. Do not use under-drains.
- J. When sodding next to pavement or sidewalk, always set/lay the top of the sod 2"-3" lower than the pavement finish grade. This will prevent sod from trapping water on the pavement or sidewalks. Slope grade a maximum of three percent (3%) for first five (5) feet.
- K. Sod the side slopes of a retention basin or swale to reduce erosion, but seed and mulch the bottom to maximize percolation.

19. TERMITE PROTECTION

- A. The general contractor will schedule a meeting, at the site, with the owner, architect and pest control operator to discuss procedures, chemicals and ratios of mix.
- B. Termiticide treatments shall not be applied at existing facilities during occupied hours.
- C. Termite protection chemicals shall be brought to the site in sealed containers and mixed on site with the Owner present. Owner to witness breaking of seal.
- D. All applications are to be witnessed by the Owner. 24-hour notice shall be given to the Owner of scheduled treatments. Prior to application the contractor will be responsible for calculating the square footage, lineal footage and any other dimensions needed to determine the proper ratios of mix being applied.
- E. If termite activity is discovered during the warranty period of five (5) years, the Contractor will re-treat soil and repair or replace damage caused by termite infestation, without cost to the Owner. The Contractor shall pay the entire cost of retreatment if required, including the costs of providing access to the soil, repair of resulting damage to concrete, and project details.

20. LANDSCAPE PLANTING

- A. Xeriscaping no maintenance preferred; otherwise minimal landscaping.
- B. All landscaping shall have root ball wraps cut back prior to planting.
- C. A/E's are encouraged to consider sodding throughout entire site. Use proper sod to match soil conditions. Bahia sod shall be used unless other type is approved by Owner.
- D. All spaces between newly placed sod shall be filled in with organic material, rolled and fertilized as deemed necessary.
- E. Renovation/addition projects, the A/E shall require the Contractor to isolate and protect existing planting not involved in the project.
- F. All species should be native to or acclimated to Central Florida, hearty, drought tolerant and require low maintenance (see attachments).
- G. Warranty trees and shrubs through indicated maintenance period, and until final acceptance.
- H. Warranty trees and shrubs for a period of one year from the date of substantial completion against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Landscape Installer's control.

- I. Require Contractor to offer, as an alternate, a one-year maintenance contract for new landscaping.
- J. To the extent possible sodded areas should be easily accessible for mowing.
- K. Deciduous trees shall not be planted within fifty feet (50') of the perimeter of the building.
- L. Landscape mulch shall be all shredded Cypress mulch.

21. ATHLETIC FIELDS

- A. Baseball, Softball fields shall have a sand/clay ratio of 20/80 to 30/70 with surface additive.
- B. Dugouts shall consist of aluminum canopy chain link fencing and aluminum bench on concrete pad.
- C. Provide drinking water fountains at athletic fields.
- D. Restroom facilities available for users of the athletic fields shall be within 400 feet (400') of bleacher locations.
- E. Provide recessed hose bib (in valve box) in grass area directly behind pitcher's mound at baseball and softball fields.
- F. All new tracks shall be of FDOT 9.5 SP asphalt mix (no rubber coating) and laid out in the metric system (400 meters).
- G. Prefer a concrete apron curb at running tracks.

22. IRRIGATION

- A. Irrigation systems shall be designed by the A/E and clearly detailed on the construction drawings. Irrigation systems designed by the installer shall not be allowed. Use Rainbird, Hunter or equivalent unless approved by the Owner.
- B. Schedule 40 PVC pipe shall be specified for irrigation lines. Provide one inch (1") minimum supply line. All irrigation heads shall be pop-up type, regardless of application. Fixed head, stationary risers shall not be specified.
 - 1) New Irrigation lines connected to re-use water lines shall be "purple" pipe PVC.
 - 2) Existing irrigation lines connected to re-use water lines shall have purple sprinkler heads/caps.
- C. All irrigation wells shall have as a basis of bid, one-hundred (100) feet in depth. A unit cost (\$/FT of depth) shall be solicited for depths in excess of one-hundred (100) feet Pump and controls design shall be selected for ease of maintenance.
- D. Sprinkler systems shall be directed away from buildings and shall not spray on buildings.
- E. Existing systems should be evaluated and field inspected prior to new work being specified.
- F. Sprinkler systems shall not spray on or across sidewalks, driveways, running tracks or courts.
- G. Wipe clean all glue joints of excess adhesive.
- H. The pipe edge should be tapered on PVC 2" and larger.
- I. Irrigation Systems shall be designed and installed according to County Regulations (specifically the "Water Wise" ordinance 2004-2005).
- J. At substantial completion, demonstrate a control wire integrity test, assuring the minimum ohm requirements are satisfied.
- K. At substantial completion an Owner training session will be required.

23. Provide traffic grade caulking material over expansion joint material.

DIVISION 3 CONCRETE

1. Color/stained concrete shall not be used in design or specified without written approval.
2. ACI 318 and other code requirements shall be clearly noted on the construction drawings. The structural engineer of record shall verify this and any additional requirements (including all certifications) with the VCS Building Department.
3. Minimum 3000 psi at 28-days.
4. Location of all expansion/control joints will be shown on plans. Sawn control joints shall be cut as early as possible and with 24-hour maximum.
5. Owner's testing laboratory will perform field quality control tests and submit test reports. The testing service will make additional tests of in-place concrete when test results indicate need. The Contractor shall pay for the additional tests when unacceptable concrete is verified.
6. For under-slab vapor barriers use widest practical widths, lapping should be a z-lock not less than 6 inches wide with taped lap placed in the direction of the spreading of the concrete.
 - A. Under-slab vapor-barrier shall be used under all slabs on grade.
 - B. Under-slab vapor-barrier shall be used under all sidewalks and include welded wire mesh reinforcing.
7. Specify tooled control joints for exposed concrete sidewalks or plaza areas. Saw cut tooled joints to achieve designed depth.
8. Use of fiber mesh prohibited without Owner approval.
9. Driveways shall be sloped or crowned to prevent water from draining across sidewalks.
10. Weight room floors shall be reinforced, six inches (6") thick, 4,000 psi concrete.

DIVISION 4 MASONRY

1. EXTERIOR WALLS

- A. Cavity wall (masonry veneer on concrete masonry unit back-up) construction is to be used unless other system is approved by the Owner. Veneer shall be of durable material, such as, brick or split-face block and should be maintenance-free and resistant to vandalism.

2. INTERIOR WALLS

- A. Walls in student occupied spaces shall be of block construction. Eight inch (8") block is preferred as it provides greater cavity space for conduit and plumbing. Other interior walls may be gypsum wallboard on metal studs. Finish of walls shall be durable and easily cleanable.
- 3. Wall ties specified for brick veneer cavity wall systems shall be hot dipped galvanized hook and eye type. Corrugated metal ties and continuous joint reinforcing bridging the cavity space shall not be allowed.
 - 4. Bituminous damp-proofing shall be specified as a troweled, rolled or sprayed on application. If a sprayed on application is considered acceptable, it shall be specified to be applied in no less than 3 separate coats per approved manufacturer's recommendations and verified to the Owner's satisfaction. Specify mill thickness in addition to number of coats (tolerances).
 - 5. Brick or CMU veneer joints shall be tooled concave. Raked joints shall not be specified unless approved in writing by the Owner.
 - 6. Weep hole shall be open head joints.
 - 7. All exterior brick support angles where the underside of the angle is exposed (i.e., lintels, windows, etc.) shall be specified to be hot dipped galvanized or stainless steel.
 - 8. All control/expansion joints shall be shown on the plans. Architect to show brick joints and engineer to show CMU joints. Engineer to provide all locations for control joints and expansion joints on approved documents.
 - 9. Through-wall flashing systems shall be detailed on the drawings.
 - 10. Split-face block shall be used as veneer only, not for solid unit load bearing walls.
 - 11. Glass block will not be specified for any location without written approval.
 - 12. The building code requires a clear air space between brick veneer and its supporting wall. The air space shall be a full one-inch minimum dimension, be open, and be clean (no mortar or insulation in the air space). Specification shall require the contractor to keep this air space clean during construction.
 - 13. For consistency, use face of brick. Saw cut as needed. Avoid turning and using end of brick to eliminate color variations (zipper effect).
 - 14. Sprayed on waterproofing for masonry restoration shall be water based only.

DIVISION 5 METALS

1. All structural steel welds shall be specified to be properly cleaned and coated with zinc chromate primer.
2. Steel members exposed to the exterior and weather shall be specified as receiving hot-dipped galvanized coatings. Fastening hardware to be hot dipped galvanized or stainless.
3. Structural steel specified shall have minimum yield strength of 36 ksi (ASTM 36).
4. Contractor shall be responsible for scheduling all weld testing per plans/specs and manufacturers recommendations.
5. All welding shall be done with certified welder per applicable work and shall have current certification on site available to Owner.
6. All material per this division shall be stored off the ground.
7. Signed and sealed design drawings for any performance specified work of this division shall be required and shall be submitted to and approved by the VCS Building Department prior to the commencement of said work. Design drawings shall be reviewed and approved by the A/E and the construction plans submitted to the VCS Building Department.
8. Trusses shall be certified by a Florida Registered Engineer to meet wind load criteria of ASCE 7, current edition as adopted by the Florida Building Code.
9. Exterior soffit and fascia shall meet Florida Product Approval as exterior components.
10. Structural design and placement drawings for all performance designed roof trusses, bar joists, and pre-stressed concrete tees/slabs shall be signed and sealed by a Florida Registered Engineer. Signed and sealed placement drawings shall be part of the specialty engineer's design drawing submittal.
11. All light gauge metal framing shall be designed by the A/E of record on the project plans.
12. Metal roof and floor deck shall not be fastened with pneumatic or powder activated fasteners.
13. All dowels or anchor bolts set in epoxy require submittal to and approval by the VCS Building Department.

DIVISION 6

WOOD AND PLASTICS

1. Fire resistive treated lumber shall not be specified.
2. Bases for cabinets shall be 2 x 4 (minimum) pressure treated material.
3. All materials in cabinets shall be specified as plywood, typical three-quarter inch ($\frac{3}{4}$ "), with the exception that doors may be specified as commercial grade high density particle board, three-quarter inch ($\frac{3}{4}$ ") minimum meeting AWI standards.
4. All exposed surfaces of cabinets shall be laminated in accordance with AWI standards.
5. Miter protruding corners of counter tops.
6. All surfaces of cabinets that are not exposed shall have a balance sheet.
7. All adjustable standards shall be recessed.
8. Shelves on adjustable standards shall be fastened to the standard to prohibit forward movement.
9. Back wall metal standards shall not be specified.
10. The A/E shall ensure the coordination of millwork with the MEP items for proper heights and locations to meet all code and ADA requirements.
11. All millwork work shall conform to "Custom" grade as defined in the latest edition of the AWI "Quality Standards" unless detailed as a higher grade. Millwork shall not be delivered until the building and storage areas are sufficiently dry so that the millwork will not be damaged by excessive changes in moisture content.
12. Individual storage room shelves shall not exceed three feet (3') span between supports and be capable of supporting fifty (50) pounds per lineal foot.
13. Pressure treated wood shall not be exposed to contact.
14. The A/E shall design and detail the method / pattern of anchorage of wall cabinets to the wall.
15. Counter tops to be laminate or "Quartz"; "Corian" counter tops shall not be specified.

DIVISION 7

THERMAL & MOISTURE PROTECTION

1. PREFERRED ROOFING SYSTEMS

A. Modified Bitumen (SBS) Roofing

- 1) The roof system will have a minimum of one one-hundred eighty pound (180 lb.) inner-ply and one two-hundred fifty pound (250 lb.) cap sheet which will have a granular surface. Install roof system over minimum one-quarter (¼) per foot slope.
- 2) Twenty (20) year total roof system warranty inclusive of roofing materials from roof deck to finish membrane. Provide non-deductible roofing warranty inclusive of all material and labor.
- 3) If the manufacturer fails and/or refuses to issue the required roof warranty, the contractor surety shall make repairs or take corrective action as required of the manufacturer so that the intended warranty is delivered to the owner.
- 4) Roofing contractor will contract either directly with Owner or indirectly as a subcontractor to warrant work against leaks and faulty or defective materials and workmanship for two years from final completion.

B. Single Ply Membrane Flexible Sheet Roofing

- 1) Minimum twenty two (22) gauge metal deck
- 2) Fifteen (15) year labor / material warranty
- 3) Manufactures
 - a) Fibertite
 - b) Bond Cote Systems
 - c) Sarnafil Inc.
- 4) Use manufacturer clad metals.
- 5) Roofing contractor will contract either directly with Owner or indirectly as a subcontractor to warrant work against leaks and faulty or defective materials and workmanship for two years from final completion.

C. Metal Roofing

- 1) Metal roof system shall be installed with no less than two (2) and twelve (12) slope, with continuous panel run from ridge to edge installed over a solid deck design with a peel and stick membrane, i.e. Ice and Water Shield or equal.
- 2) Twenty (20) year leak free system warranty.
- 3) Roofing contractor will contract either directly with Owner or indirectly as a subcontractor to warrant work against leaks and faulty or defective materials and workmanship for two years from final completion.
- 4) Provide a stainless steel tie-off located near the ridge of sloped roofs. This tie-off should project through the roof and be designed to accept a safety harness hook. Load rating equals three hundred (300) pounds.
- 5) Metal roof panels shall not be roll formed on the job site unless approved by the Owner. Metal roof panels shall be roll formed in the manufacturer's permanent factory and transported to the job site.
- 6) All roof curbs shall be provided and installed by the roof system manufacturer and be designed for that specific roof system.
- 7) All lighting arrestor system parts shall be secured to the metal roof standing seams with anchor clips acceptable to or provided by the roofing manufacturer. Do not "glue" anchors to the metal roof. Penetrations shall be kept to a minimum.

D. Asphalt Shingle Roofing

- 1) If chosen, asphalt shingle roofing systems shall be specified as a minimum, around a thirty (30) year architectural, fungus resistive shingle.
- 2) Roofing contractor will contract either directly with Owner or indirectly as a subcontractor to warrant work against leaks and faulty or defective materials and workmanship for five years from final completion.

E. All roofing is to meet a specific roof assembly per Florida Product Approval, per FS 553.

2. FLASHING AND SHEET METAL

- A. Aluminum: ASTM B 209-90, Alloy 3003, Tempe H14 AA-C22A41 baked on enamel finish 0.040" thick, at edge detail and 0.050" at coping.
 - B. Stainless Steel: ASTM A 167-91 Type 304, soft temper, twenty four (24) gauge thick, smooth 2B finish if not painted.
 - C. Manufacturers laminated metal twenty four (24) gauge stainless steel for all flashing areas on single ply roofs.
 - D. All metal flashing shall meet current SMACNA guidelines.
 - E. Metal decking scheduled to receive light weight concrete shall be designated G90.
- 3. Coping shall be aluminum or stainless steel and mechanically fastened to the structure.
 - 4. Maintenance/walkway pads shall be specified around all sides of HVAC equipment on single ply and modified bitumen capped asphalt built-up roofs. (Contrasting color suggested).
 - 5. Pitch pans shall not be used.
 - 6. Avoid as much as practical roof mounted HVAC equipment.
 - 7. Sprayed on waterproofing for masonry restoration shall be water based only.
 - 8. Provide roof access hatches ladders and fall suppression systems for high roof areas, example: auditorium roofs, gymnasium roofs, cafeteria roofs and multistory classroom roofs.
 - 9. Conduit on roofs shall not be allowed.

DIVISION 8 DOORS AND WINDOWS

1. For aluminum windows, all extrusions shall be 0.125" minimum thickness with stainless steel hardware and fasteners. Screens shall be included and specified as aluminum.
2. Architect shall specify hollow metal doors and frames in lieu of aluminum storefront. The use of heavy-duty aluminum entrance doors (store front) shall require the prior approval of the Owner.

3.	Acceptable Manufacturers		
	PRODUCT	ACCEPTABLE MANUFACTURER	ACCEPTABLE SUBSTITUTE
	Butt Hinges	Stanley	Hager
	Locksets, Latch sets, Privacy sets, Deadlocks, Cylinders	Schlage Lock Co.	None (School District Standard)
	Exit Devices (Panic Devices)	Von Duprin	None (School District Standard)
	Door Closers	LCN	None (School District Standard)
	Overhead Stops & Holders, Magnetic Holders	Rixon-Firemark	Glynn-Johnson
	Push Plates, Pull Plates, Kickplates, Wall Bumpers, Floor Stop & Holders	Rockwood Mfg. Ives	Quality, Brookline
	Threshold, Weather Strip, Transom Astragal, Sound Seal, Light Seal, Automatic Door Bottoms	Pemko Mfg.	Zero, Reese, Guard

4. Locksets for interior and exterior doors shall be D-series with Primus interchangeable core. Provide keys as follows:
 - 6 Grandmaster
 - 4 Building sub-masters (per building)
 - 3 Classroom change keys (per classroom)
 - 3 Control keys
5. Double doors with panic hardware use 99 or 98 series with removable mullion (keyed).
6. All panic hardware use 99 or 98 series.
7. Steel doors shall comply with the Steel Door Institute (SDI).
8. Steel doorframes shall be eighteen (18) gauge interior and sixteen (16) gauge galvanized exterior with mitered continuous weld at corners. All door and window frames set in masonry shall have the interior field coated before installation with a brushed applied bituminous coating and grouted solid during installation. Frames set in CMU masonry construction shall have four (4) inch heads. (New work: tie frames to block-work rather than bolting.) Steel door frames shall not be allowed to sit in standing water. Water on floors shall be removed immediately. Rusted frames shall be removed and replaced.
9. Interior doors shall be specified as wood veneer, solid staved core conforming to NWMA with a minimum stile width of two (2) inches. Closure hardware shall be fastened with through bolts and finish washers. The top and bottom of wood doors shall be coated at the jobsite after hanging with clear varnish to seal the exposed wood. This shall be required even if doors are "Factory Sealed".
10. Exposed vertical riser bars on doors with panic devices shall be specified as stainless steel with stainless steel vertical rod guards. Aluminum shall not be specified or accepted.
11. Backing for hinges on metal doors should be at least three-sixteenth (3/16) inch steel (continuous hinges acceptable).

DIVISION 8

12. Door butts shall be stainless steel with removable pins, provide ball bearing butts at all doors with closers.
13. Provide stainless steel kick plates on doors minimum ten (10) inches x full width of door.
14. Identify that exterior doors and windows have Florida Product Approval (typ.) before specifying. Provide Florida Product Approval number for each selected door or window on the specifications or the plans.

DIVISION 9 FINISHES

1. Plaster and stucco lath shall be hot dipped heavy duty galvanized weighing at least 3.4 # / yd² (unless approved by the Owner). Stucco stops, control joints, etc shall be PVC.
2. Stucco finishes shall be specified as "sand finish" only, unless matching existing. Use alkaline resistant glass or polypropylene fibers 1/2" long.
3. Cementitious wallboard shall be specified for metal stud walls to receive tile in areas exposed to moisture.
4. Ceramic floor tile specified shall be minimum 2" x 2" size, non-slip, with large radius cove base.
5. If a color banding or pattern in tile is desired, the banding / pattern shall be clearly detailed on the construction drawings. This also applies to VCT.
6. Where quarry tile is specified, it shall be non-slip type with matching bull nose base.
7. Poured epoxy flooring may be pursued as an option in group restrooms, locker rooms and custodial rooms.
 - A. Provide a 4' x 4' sample to include cove base on two sides with corner detail. Sample to show texture, finish, thickness, coving material, etc.
 - B. If floor drain is involved, sample board to include scooping to drain.
 - C. Sample to be approved by owner and architect prior to start.
8. Acoustic tile ceilings shall be 2' x 2', exposed grid with lay-in tile; moisture resistant finish in wet areas.
9. CARPET
 - A. Materials: Spec. No. MC-1.4
 - 1) Tufted, yarn or solution dyed nylon carpet. Intended for general educational facilities use as an interior finish as certified by the Department of Agriculture and Consumer Services Commodity Testing Laboratory, as conforming to the specifications, for the Florida Department of Education Product Evaluation Program.
 - 2) Pile fiber shall consist of 100% branded soil hiding and static resistant continuous filament nylon with a pile weight of 28 oz. minimum.
 - 3) Backing shall be 100% synthetic material for both primary and secondary backings; 100% synthetic unitary backing is acceptable.
 - 4) Carpet fiber shall be 100% continuous filament soil-hiding nylon with integral anti-static and anti-microbial treatments.
 - B. Installation:
 - 1) Carpet shall be installed using glue down method with a non-toxic, non-flammable multi-purpose adhesive approved by the carpet manufacturer. All labor shall be warranted for three years.
 - C. Carpet certification shall be provided with project closeout documents.
10. VINYL COMPOSITION TILE (VCT)
 - A. 12" x 12" x 1/8" and 24" x 24" x 1/8" vinyl composition tile with homogenous color and pattern using waterproof adhesives as recommended by flooring manufacturer.
 - B. Labor on installation shall carry a three-year warranty.
 - C. Allow minimum 1/2 full size tile width at room or area perimeter.
 - D. Do not specify Armstrong VCT.

DIVISION 9

11. VCT shall be specified for all classroom spaces except pre-kindergarten through kindergarten spaces shall have a 10' x 12' carpeted area at the white board area. All corridors in all school facilities shall be VCT.
12. Band rooms shall receive anti-microbial carpet at instrument performing locations.
13. Provide vinyl base complying with FSSS-W-40, Type II, with molded corner units. Base shall be a minimum 4" high and 1/8" thick with a coved bottom. Color shall be homogenous. Fill voids along top edge of base with manufacturer's recommended adhesive filler material.
14. Rubber Textured Stair Tread: Type A Rubber, FSRR-T650E complete with pre-molded stair nosing.
 - A. Gauge: minimum 1/4"
 - B. Manufacturer / length / nosing type color:
 - 1) Length shall be entire run of stair
 - 2) Pre-molded nosing types: square, round or adjustable nosing
 - 3) Color to be homogenous
15. Dance room and gymnasium floors shall be cushioned wood.
16. Ceramic tile on wall surfaces shall be full height if on metal studs and cement backer board, provide ceramic tile wainscot on block walls.
17. Vinyl wall coverings shall not be specified for any location.
18. Carpet shall not be used on vertical surfaces (completely or partially) as a wall finish or base.
19. No oil based paints shall be used.
20. All interior wall surfaces shall be painted with acrylic semi-gloss or epoxy.
21. Exterior wall surfaces shall be painted with 100% acrylic paint.
22. Exterior doors, columns and trim shall be painted with 100% acrylic enamel.
23. Each coat of paint on surfaces shall be tinted slightly different from the previous coat to verify the application of subsequent coats.
24. Oil base wood sealer for gymnasium floors is acceptable. Provide proper ventilation.
25. If the project includes a weight room or other use that requires the use of rubber floor matting, they shall be designed into the project with care taken to provide proper transitions at door openings.
26. Weight room floors shall be strengthened (6" thick concrete 4000 psi).

DIVISION 10 SPECIALTIES

1. The A/E shall coordinate the interior signage with the Owner, to ensure it is consistent with existing and proposed Florida Inventory of School Houses (FISH) designation. Room numbers on the drawings and on schedules shall be designated and accurately reflect FISH designations. The FISH number shall be specified for installation on the center of the door header (black background with white letters) in addition to the signage required by Florida Accessibility Code. The number on the header shall be affixed to the frame with stainless steel, vandal resistant screws. The Architect shall complete DOE documents necessary to update the FISH database as a result of a project's additions, renovations and / or demolition(s) and furnish to the Owner any revisions / additions on the Owner's schematic building and site plan in the following:
 - A. One letter (8 ½" x 11") size print set (or other appropriate size)
 - B. AutoCAD file(s) on CD or other appropriate digital device
 - C. PDF file(s) on CD or other appropriate digital device
2. All rooms shall have a permanent identification sign at the appropriate location next to the entrance door to the room. Room name, room number and Braille characters shall be on each sign. Size of sign and characters shall meet FBC Accessibility / requirements.
3. All electrical, mechanical and systems rooms shall have a permanent sign on the entrance door stating "No Storage Allowed"
4. All signage required by SREF and the Florida Building Code (FBC) shall be clearly detailed and locations shown on the construction drawings (i.e., Fire Alarm Pull Station Inside, Fire Extinguisher Inside, Secondary Egress, etc.).
5. WALKWAY CANOPIES
 - A. Aluminum walkway canopies shall not be specified in custom extrusions.
 - B. Aluminum walkway canopy shall have a minimum 0.7 mils finish.
 - C. Walkway canopy lighting shall be specifically included with the electrical contractor. Electrical conduit shall be installed under the walkway and concealed with cover plates from fixture to fixture.
 - D. Provide raised section for vehicular access to courtyards.
6. Accordion folding partitions shall have support structural details clearly delineated in the construction drawings.
7. Fire extinguisher cabinets shall not be located on the exterior of any building. A "FIRE EXTINGUISHER INSIDE" sign shall be used for exterior corridor type facilities as allowed in FBC Section 423. Fire extinguisher cabinets shall be non-lockable and have plastic lens rather than glass lens. Recess cabinets when possible.
8. If included in the program, student book lockers shall be 3-tier at high schools and 2-tier at middle schools. Construction will be heavy gauge steel, unless approved otherwise, without built-in locks with continuous hinges. Tops shall be sloped.
9. Toilet room partitions shall be solid plastic type similar to "Santana Products, Inc."
 - A. Vandal & theft resistant hardware.
 - B. Stainless steel / aluminum hardware.
 - C. Cap sharp edges.
 - D. All privacy screens including urinal screens to be attached to floor with floor anchors.
 - E. Color: black marble preferred.

10. Inverted "V" or "Y" sight proof louvers and vents shall be used.

- A. All exterior louvers shall meet Florida Product Approval, per FS553.

11. Toilet and Bath Accessories

- A. Materials to be Stainless Steel, commercial grade, seamless welded.
- B. Towel dispensers and waste receptacles in student restroom should be recessed into the walls where possible.
- C. Single fold towel cabinets only.
- D. Polished Stainless Steel mirrors shall be specified for student toilet spaces in all schools.
- E. A bookshelf shall be provided in-group student toilet room.
- F. Heavy duty (institutional model) high volume hand dryers, minus heating element, preferred in group toilet rooms.
- G. See below for list of preferred products for renovation projects:
 - 1) Flat Towel Dispenser 6/CTN Continental 630W
 - 2) Toilet Tissue Dispenser 12/CTN Continental RT22
- H. ESE student restrooms may require special equipment. Coordinate with Owner.
- I. Foam soap dispensers will be Owner provided in restrooms.

DIVISION 11 EQUIPMENT

1. All Owner furnished equipment shall be clearly noted on the schedules and construction drawings.
2. All permanent interior basketball goals shall be operable with an easily accessible electric winch, and shall be provided with a safety strap.
3. Benches in locker rooms shall be permanent type. Wood or metal benches shall not be specified.
4. Exterior basketball goal posts shall have minimum wall thickness of schedule 40 with a hot dipped galvanized coating. Meet wind-loading requirements.
5. Revolving dark room doors shall not be used. Use a "maze" entrance hallway.
6. Cubical curtains shall not be full height or shall be provided with mesh uppers.
7. Changing tables where provided shall be adult size with waterproof mat.
8. Exterior benches shall maintain minimum corridor width criteria.

DIVISION 12 FURNISHINGS

1. Metallic, vertical or horizontal blinds shall be specified for all interior and exterior windows in administrative areas, horizontal metallic in all other spaces. Plastic type shall not be specified.
2. Telescoping bleachers shall be extended / recessed through a motorized system. Designs shall utilize modular systems in lieu of custom manufactured type. Wheelchair seating area shall be permanently open for wheelchairs; not convertible regular seats.
3. Provide heel-proof FBC Accessibility compliant, recessed foot grilles at direct entry doors into a wood gym floor.
4. Medicine cabinets shall be lockable.
5. Provide locks on all laboratory casework doors and drawers.

DIVISION 14 ELEVATORS

1. School elevators shall be key operated (provide 12 keys) or key pad operated as well as being capable of being operated normally.
2. A cargo elevator with an extended ceiling height should be considered.
3. Tile flooring.
4. A bumper approximately eighteen (18) inches above floor shall be provided to protect walls from handcarts, etc.
5. Do not use elevators that have priority operating systems. They must use a universal operating system program accessible to any service company.
6. A five-year service warranty shall be provided.
7. ELEVATOR TELEPHONE STANDARDS
 - A. When the emergency push button is pressed, the elevator emergency phone will activate the line and place a call to a pre-programmed telephone number. If during the dialing process the number does not answer the call, the elevator emergency phone can be set to dial an alternative number. The elevator emergency phone will cycle between the programmed emergency numbers until it connects a call. Once this happens the digital voice announcer messages is given (so the remote party knows the location of the emergency). Communication is now established between the remote party and the location of the elevator emergency phone.
 - 1) The emergency telephone can be programmed remotely from any Touch Tone telephone.
 - 2) The emergency telephone must have the capability of dialing more than one emergency number automatically. If a Ring no answer call is detected, the phone will try dialing with the next available number, until a call is connected.
First Emergency telephone number to Security:
From the Westside of Volusia County 8-1-386-943-7626
From the Eastside of Volusia County 9-226-7852
Second Emergency telephone number: 9-911
 - 3) The emergency telephone must have a voice announcer included as a standard, which is used to identify the location of the calling elevator. The message is recorded directly from any remote touch tone telephone (DTMF). The voice announcer message format is school name, building number, and a detailed description of the elevator location. Example voice announcer messages: "This call is being placed from the Deland High School elevator located in building 1, South side, the Auditorium".
 - 4) Elevator emergency phone telephone system must meets all code requirements.
 - B. Suggested elevator equipment room station cable termination requirements
 - 1) Horizontal distribution of voice cabling shall be via 4 pair Category 6 unshielded twisted pair cabling. Cables shall originate at horizontal patch panels located in the respective IDF and terminate at a jack installed in the elevator equipment room.

DIVISION 15 MECHANICAL

LISTED MANUFACTURERS

1. These design guidelines list PREFERRED manufacturers and MANDATORY manufacturers for various products. The project design engineer shall provide project specific specifications that contain the preferred and mandatory manufacturers listed in these design guidelines for products that apply to the project. Where preferred manufacturers are indicated in the design guidelines, the engineer shall list those manufacturers plus additional manufacturers deemed acceptable to the engineer. Where mandatory manufacturers are indicated in the design guidelines, the engineer shall only list those manufacturers in the specifications.
2. Prior to the issuance of the final project addendum, the engineer shall confirm the acceptability of all the manufacturers specified.

GENERAL GUIDELINES

1. CODE COMPLIANCE

- A. All work shall comply with the latest version of the Florida Building Codes.
- B. The Architect and Engineer shall select and specify insulation systems that satisfy the minimum energy standards as defined by the Florida Building Code. The A/E shall provide the energy code verification forms that are required to be submitted with a building permit application.

2. OCCUPANT COMFORT

- A. Temperature Control
The HVAC system shall provide classrooms and other significant spaces with independent temperature control. Thermostats shall be located on wall separate from computers. Thermostats shall be auto changeover with separate heating and cooling set points. Occupant range of control shall be:
 - 1) Cooling: 75 – 78 degrees Fahrenheit (75° – 78° F).
 - 2) Heating: 68 degrees Fahrenheit (68° F)
- B. Humidity Control
 - 1) Systems shall be designed to provide indoor design conditions that comply with the Florida Building Code (latest edition) and ASHRAE Standard 55-92. Indoor humidity shall not exceed 60% RH during full or part-load cooling conditions.
- C. Part Load Analysis
 - 1) Provide a psychrometric analysis of air-conditioner cooling performance during full and partial loads (75%, 50%, and 25%) for each air-handling unit. This information shall be provided for review prior to Phase II documents submission.
- D. Noise
 - 1) The HVAC system shall be designed to generate noise levels at or below the noise level standards established by ASHRAE for the applicable occupancy type. Noise levels shall be carefully considered in the selection of all mechanical equipment. Where required to meet the ASHRAE noise standard, measures such as sound attenuating walls, ceilings, attenuators, etc. shall be applied in the design.
- E. Ventilation Air Control
 - 1) Ventilation rates shall comply with ASHRAE guideline 62 including all addenda.
 - 2) HVAC systems for classrooms shall be designed to provide a separate low-occupancy operating mode that will maintain the space temperature and humidity at occupied set points but ventilation air shall be off. This function shall be based upon a time of day schedule.
 - 3) Non-dehumidified outside air shall not be delivered into any occupied space other kitchens (through hoods).

3. DESIGN PRACTICES**A. Building Pressurization**

- 1) All buildings shall be designed to operate in a positive pressure state using conditioned outside air to achieve pressurization. Under no circumstances shall buildings be designed to operate in a negative pressure state during occupied or unoccupied periods.

B. Equipment Locations

- 1) Air conditioning units, piping, and conduit shall not be installed on roofs unless the Owner gives prior written approval. Rooftop power ventilators shall not be installed on roofs with a slope greater than 1:4.
- 2) Air handling units, fan coil units, etc., shall not be installed in ceiling spaces or inside classrooms without prior written approval from the Owner.

C. Maintenance

- 1) Air handling units shall be installed in mechanical rooms of sufficient size to provide manufacturer's recommended service and maintenance clearance.
- 2) Do not use desiccant based energy recovery systems.
- 3) Include separate training for school-based users and maintenance technicians on all mechanical equipment.
- 4) Provide receivers on catwalks for portable davit crane.

D. Direct Expansion Equipment

- 1) Utilize multiple compressors with unloaders or hot gas bypass where possible.
- 2) Utilize multiple circuit split face coil with the first stage of cooling on the bottom of the coil for multi-stage equipment. Row split and intertwined coils are only acceptable in VAV applications.
- 3) Use hot gas reheat where conditions require reheat for humidity control.

E. Chilled Water Systems

- 1) Use control valves for the cooling coils with a minimum close off pressure of 30 psi or 1.5 times the pump dead head pressure, whichever is greater.
- 2) Provide a minimum of 100% redundancy for primary pumps, distribution pumps, and condenser water pumps.
- 3) Utilize split face coils for multi-circuited units with the first stage of cooling on the bottom of the coil. Row split and intertwined coils are not acceptable.
- 4) Specify 10 fins per inch maximum on cooling coils.
- 5) Coils must be piped counter-flow to airflow on cooling coils.
- 6) Provide chilled water temperature control to provide adequate low temperature water for dehumidification.
- 7) Chilled water temperature reset shall not be used.
- 8) Design shall deliver chilled water at design temperature at part-load conditions: do not bypass water through an inactive chiller.
- 9) Provide a balancing valve, strainer, and flow-measuring device at each coil.
- 10) Specify pipe-flushing velocities to remove sand and debris prior to system start-up: main 10 f.p.s., branch piping 15 f.p.s.
- 11) Provide accessible isolation valves for each building.

F. Condensate Disposal

- 1) Condensate drain piping shall be 1" minimum, sloped ¼" per foot to storm system and shall be designed to allow individual blowout of each line.
- 2) Separate drain lines are preferred. If drain lines are combined, provide full port valves on each line prior to combining.
- 3) Drywell collection systems shall not be specified on new facilities.
- 4) Where drywells must be used, specify horizontal drain fields of adequate size for the intended discharge quantity. May require County or DEP permit.

G. Document Information

- 1) Indicate CFM for all diffusers, return air grilles, and supply and exhaust fans on plans.

H. Exterior HVAC Components

- 1) All exterior HVAC components shall be secured to resist wind load. A/E shall provide details on drawings.

4. SPECIAL OCCUPANCIES

A. MDF rooms campus computer server rooms and dry good storage rooms

- 1) Shall be provided with independent split DX units that can operate 24 hours a day.
- 2) Provide separate temperature sensor for the campus DDC system to monitor space conditions.
- 3) Preferred Manufacturers:
 - a) Carrier
 - b) EMI
 - c) Airdale

B. Mechanical Rooms

- 1) Provide floor drains, hose bibs, 110v electrical outlet and adequate lighting for each room.

SECTIONS

The sections below must be verified on the Division 15 Conformance Statement located in the Forms area of this manual.

1. 15010 - BASIC MECHANICAL REQUIREMENTS

A. Operations & Maintenance (O & M) Manuals

- 1) Operation and maintenance manuals shall include as a separate submittal item, preventive maintenance requirements with time schedule(s) for each item. The equipment master project manual information sheet shall be filled out for each piece of equipment and included in the operation and maintenance manual. Three sets of operation and maintenance manuals shall be turned over to the owner.

2. 15015 - SUPPLEMENTAL MECHANICAL CONDITIONS

- A. If construction is to occur while the school is in session, require the contractor to coordinate with the onsite staff for any shutdowns of utilities, noisy work, and any work that will affect campus operations.

3. 15020 - SPECIAL PROJECT PROCEDURES

- A. VCS shall have right of first refusal for all existing equipment that is scheduled to be removed. The contractor shall dispose of items refused by VCS.

4. 15060 - PIPES AND PIPE FITTINGS

5. 15100 - VALVES

6. 15120 - PIPING SPECIALTIES

- A. All chilled and hot water valve actuators shall be specified to be mounted in the vertical position.
- B. Expansion tanks shall be mounted on neoprene isolators.

7. 15140 - SUPPORTS AND ANCHORS

- A. All base-mounted motorized equipment shall be isolated from cabinets with neoprene or spring isolators.

8. 15160 – PUMPS

- A. Follow ASHRAE guidelines for pump support requirements (inertia bases).
- B. Preferred Manufacturers
 - 1) B&G
 - 2) Taco

9. 15240 - MECHANICAL SOUND AND VIBRATION CONTROL

10. 15250 - MECHANICAL SYSTEM INSULATION

- A. Fiberglass pipe insulation may not be used to insulate cold pipes.
- B. Control valves and condensate drainlines shall be insulated.

11. 15301 - FIRE PROTECTION

- A. Fire protection systems shall be designed and installed in conformance with the FBC and NFPA standards.

12. 15371 - WET CHEMICAL EXTINGUISHING SYSTEM

- A. Preferred Manufacturers:
 - 1) Ansul

13. 15400 – PLUMBING

- A. Fixtures
 - 1) Wall hung toilets are not acceptable (use floor mounted) and wall hung urinals must have accessible chase.
 - 2) Specify urinals with strainers built into the casting of the product.
 - 3) Whenever possible on renovations and in all new facilities provide floor sinks in all custodial closets.
 - 4) Preferred Manufacturers
 - a) Sloan
 - b) Royal
 - 5) Provide in wall fixture carriers as required.
 - 6) Provide water efficient fixtures including self closing faucets and low flush toilets and urinals.
- B. Domestic Water
 - 1) Provide isolation valves for each building on exterior wall in valve box, if practical, or in-ground valve box, including isolation valves for long runs and main veins between buildings when appropriate.
 - 2) Stop valves are required on all fixtures.
 - 3) Do not put flush valves in walls, unless chased and accessible for maintenance.
 - 4) Plumbing Equipment Pipes in kitchens should be exposed.
 - 5) Use Type K soft copper under slab for potable water supply.
 - 6) Use Type L hard copper above slab.
 - 7) All copper water lined through walls and floor slabs shall be sleeved.
 - 8) Preferred Manufacturers
 - a) Chicago

- 9) Boosters
 - a) Install booster heaters for dish machine final rinse so there is no need for mixing valves.
 - b) Preferred Manufacturer
 - 1. Hatco
- 10) Re-circulating Pumps:
 - a) Preferred Manufacturers
 - 1. Taco
 - 2. Armstrong
 - 3. Bell & Gossett
- 11) Water Coolers:
 - a) Preferred Manufacturers
 - 1. EBCO
 - 2. OASIS
- 12) Backflow Preventers:
 - a) Main waterlines shall have a dual backflow system (two backflow preventers of the same size). The two together shall equal the water flow of the supply line.
 - b) Use only RPZ type.
 - c) Backflow preventers shall be no less than twenty-four inches from lowest point on back flow to ground.
 - d) Backflow preventers shall have four test cocks.
 - e) Backflows should be enclosed in a fenced area fenced with a gate for access.
 - f) Backflow preventers shall have freeze protection installed at 7" above grade on the school side of the preventer.
 - g) Preferred Manufacturers
 - 1. Watts
 - 2. Febco
- 13) Valves:
 - a) Provide quarter ($\frac{1}{4}$) turn shut-off at all fixture supplies
 - b) Provide above ground water shut-off at all buildings
- C. Sanitary
 - 1) Piping under slabs shall be both cast iron hub and spigot with elastomeric joints or ASTM 2665-D, DWV PVC.
 - 2) Acid Waste systems shall be fused seal type plastic pipe. Glass waste pipe shall not be specified.
 - 3) Use deep seal traps in lieu of trap primers.
 - 4) Use tamper proof vent caps on the roof plumbing vents.
 - 5) Provide clean-outs every fifty (50) feet inside and one hundred (100) feet outside of Buildings.
 - 6) All emergency showers shall be designed with floor drains connected to the plumbing waste collection system. Floors shall be properly sloped toward drain.
 - 7) Grease Traps:
 - a) Must be accessible by truck from pavement.
 - b) Set so storm water does not run in at the cover.
 - c) Kitchen floor drains shall drain into the grease trap.
 - d) Trees should not be planted near the grease trap.
 - e) Provide reverse clean out at all grease traps.
 - f) Shall be cleaned of all sand gravel before accepting.
 - 8) The installation of natural and liquefied propane lines shall be specified to be performed by a state licensed contractor, certified to install gas line systems. Contractor shall submit certification for approval.

14. 15510 - HYDRONIC PIPING

- A. All chilled and hot water piping shall be welded schedule 40, black iron pipe conforming to ASTM A53 or A106. Piping must have the ASTM label. Piping 1-1/2" diameter and less can be hard drawn copper, Type "L", ASTM B88.
- B. Dielectric unions shall be specified where copper pipes connect to black iron.
- C. All copper pipes shall be brazed using 15% silver solder (95% soft solder is not acceptable).
- D. Underground piping shall be pre-insulated with a PVC jacket.

15. 15530 - REFRIGERANT PIPING

- A. All refrigerant piping in concealed chases for split DX units shall be soft drawn type K copper. Service fittings for refrigerant lines shall be specified to be concealed, tamperproof or located in a manner to be inaccessible from the public.
- B. Refrigerant line length shall not exceed manufacturer's recommendation. If at all possible, run refrigerant lines above ground and when passing under sidewalks use an accessible cast iron cover so the lines can be replaced easily at a later date. Also, show complete routing of refrigerate lines on plans.
- C. No solder joints underground under 100 feet minimum.
- D. Identify and label each refrigerant line on both ends when it goes underground.

16. 15550 – BOILERS

- A. Preferred Manufacturers
 - 1) A.O. Smith
 - 2) Lochinvar
 - 3) Cleaver Brooks
- B. Specify gas or oil fired boilers for domestic hot water (not electric). Gas fired boilers are preferred.
- C. Provide proper documentation on state forms with serial numbers.
- D. Size accordingly for need. (Current kitchen usage requires less hot water.)

17. 15575 - BREECHINGS, CHIMNEYS, AND STACKS

18. 15650 - FUEL OIL EQUIPMENT

19. 15680 - WATER CHILLERS

- A. Centrifugal Chillers
 - 1) Specify a ten (10) year complete (parts and labor) product warrantee including a full product preventative maintenance at the end of the warrantee period.
- B. Air Cooled Chillers
 - 1) Condenser Coils shall have protective coatings via a dip and bake process on the assembled coil. Pre-coated fin stock is not acceptable.
- C. Preferred Manufacturers
 - 1) Carrier
 - 2) Trane
 - 3) York
 - 4) McQuay

20. 15710 - COOLING TOWERS

- A. Specify a five-year full maintenance contract on cooling towers.
- B. Tower panels and basin shall be stainless steel.

- C. Cooling towers shall have makeup water meters specified to determine water consumption.
- D. Open cooling towers shall be designed at a sufficient height to insure net positive suction at pumps.
- E. Cooling tower shall be located a sufficient distance away from ventilation air intakes to prevent contamination of the intake air.
- F. Preferred Manufacturers
 - 1) Marley
 - 2) Baltimore Air Coil
 - 3) Evapco
- G. Cooling tower shall be provided with ladder, work platform and service door.

21. 15715 - WATER TREATMENT

- A. Equipment necessary to provide water treatment chemicals shall be included for all HVAC hydronic systems. Specify all necessary test kits to be provided by contractor.
- B. Contractor shall provide complete water treatment services during 1-year contractor warranty period. Chemicals shall be provided by VCS through separate contract.

22. 15781 - SPLIT DX AIR CONDITIONING EQUIPMENT

- A. On all DX units 10 tons and larger, the condenser coils shall be provided with one of the following protective measures:
 - 1) Copper fins
 - 2) Blygold treatment
 - 3) Precoated epoxy fin stock
 - 4) Assembled coil dip and bake epoxy coating
- B. Hot gas (reheat and bypass) and suction lines shall be insulated separately.
- C. Refrigerant pipe chases shall not have any 90° ELL's in them: i.e. 45° ELL's up to grade.
- D. Condensing units shall be mounted on neoprene vibration isolation pads to isolate the metal from the concrete equipment pad.
- E. Provide refrigerant liquid line filter drier and sight glass for all units.
- F. 15% silver alloy brazing materials shall be used for all copper-to-copper and copper to brass fittings.
- G. "A" or single bank configuration evaporation coils are preferable to "W" coils to facilitate cleaning.

23. 15783 - 100% O/A PACKAGE DX EQUIPMENT

- A. Condenser Coils shall have protective coatings via a dip and bake process on the assembled coil. Precoated fin stock is not acceptable.
- B. For units to be installed east of Interstate 95, the evaporator coils shall have a protective coating provided by the equipment manufacturer.
- C. Preferred Manufacturers
 - 1) Aaon
 - 2) Desert Air
 - 3) Des Champs

24. 15785 - PACKAGED A/C FOR COMPUTER EQUIPMENT

- A. Preferred Manufacturer
 - 1) Liebert

25. 15815 - ELECTRIC DUCT HEATERS

- A. Preferred Manufacturers

- 1) Redd-I
- 2) Brash
- 3) Electric Duct Heaters

26. 15835 - FAN COIL UNITS

- A. Fan coil units that are intended to condition more than 10% outside air shall be specified with a preconditioning outside air coil.
- B. Units located inside classrooms shall be specified with float switches that shut down the supply air and close chilled water valves.

27. 15855 - AIR HANDLING UNITS

- A. Air handling units shall be double wall construction with removable panels. The primary condensate drain pan shall be stainless steel.
- B. Filter access panels shall be sealed with gasketed doors.
- C. Filters shall be MERV 6 rated and sized with minimal air by-pass.
- D. Close outside air intakes with low leakage dampers and de-energize exhaust fans during unoccupied hours.
- E. Preferred Manufacturers
 - 1) Carrier
 - 2) Trane
 - 3) York
 - 4) Mcquay

28. 15858 - PACKAGED INDOOR AIR CONDITIONER AND UNIT VENTILATORS

- A. Unit ventilators are undesirable and shall not be specified unless they are capable of maintaining 60% RH in the space and can provide consistent temperature throughout the space.

29. 15859 - PACKAGED DX ROOFTOP UNIT

- A. On all DX units 10 tons and larger, the condenser coils shall be provided with one of the following protective measures:
 - 1) Copper fins
 - 2) Blygold treatment
 - 3) Precoated epoxy fin stock
 - 4) Assembled coil dip and bake epoxy coating
- B. Preferred Manufacturers
 - 1) Carrier
 - 2) Trane
 - 3) McQuay
 - 4) York

30. 15870 - POWER AND GRAVITY VENTILATORS

- A. Label all emergency exhaust fan switches with a Bake-O-Lite tag directing occupants to open the door upon activation. A switch with an indicator light is preferred.
- B. All exhaust fans shall be provided with back draft dampers or motorized dampers.
- C. Preferred Manufacturers
 - 1) Cook
 - 2) Greenheck
 - 3) Penn

31. 15871 - GREASE HOOD SYSTEM

- A. All grease hoods shall be specified with an integral makeup air system and fire suppression system.
- B. Grease hood exhaust duct to be welded stainless steel.
- C. Preferred Manufacturers
 - 1) Greenheck
 - 2) Grease Master

32. 15885 - AIR CLEANING

- A. Filters shall be MERV 6 rated and sized with minimal air by-pass.
- B. Provide filter back grilles for all AC units and AHU's larger than 3,000 CFM. Filter back grilles shall have standard sized "poly" filters.

33. 15890 – DUCTWORK

- A. All supply, return, exhaust and outside air branch or run-out ducts shall be provided with manual dampers for air volume control and adjustment.
- B. Permanently mark all balancing dampers to indicate balance position and location in ductwork
- C. Design all ductwork with radius style elbows and tees.
- D. Specify an insulated return air duct access door just before the unit so the coil can be cleaned from both sides Specify an insulated access door in the first ten feet of supply air duct ductwork so it can be checked, cleaned and treated if necessary
- E. Ductwork shall be sheet metal sealed with high-pressure sealant, wrapped with batt insulation and sealed with stapled fabric tape and mastic.
- F. Maximum flex duct lengths shall be eight (8) feet.
- G. Dishwasher exhaust duct shall be welded stainless steel and slope back to dishwasher.
- H. Permanently label ceiling grid to identify concealed valves, equipment, and access panels Specify access doors for all motorized dampers (i.e.: outside air dampers).
- I. Duct liner shall only be used where required for noise attenuation. Liner must have anti-moisture, anti-microbial coating.
- J. Flex connector shall be installed at unit.
- K. Air transfer grill shall not be used from restroom or custodial rooms to adjacent rooms.
- L. Round duct is preferred

34. 15892 - HVAC SYSTEM CLEANING

- A. Require ductwork cleanliness to be maintained throughout construction. All ductwork shall be wiped clean before being installed, and shall have all open ends temporarily sealed to prevent dust, dirt and water from entering. Installed registers shall be sealed until system is operational.
- B. Require contractor to provide complete ductwork cleaning if dirt or debris is found in ducts.
- C. Cleaning access doors should be installed at 20-foot intervals.

Note: this section is in standard specification format.

35. 15900 – HVAC INSTRUMENTATION AND CONTROLS

FOOD SERVICE AREA COOLER/FREEZER MONITORING, RECORDING AND ALARM

PART 1 GENERAL

1.1 MANUFACTURERS

- A. Basis of design: KMC Controls, Inc. Weblite

1.2 DESCRIPTION

- A. A web-based controller shall be provided to continually monitor temperature conditions in the walk-in type coolers and freezers used by the food services department. This controller shall be a standalone device, not requiring communication with any other computer to generate automatic email and/or text paging messages of critical alarm conditions. This controller shall be a Tier 1, Ethernet-ready direct digital controller that has an embedded HTTP server that is capable of providing graphics-based web pages to any Internet-ready device without special software. The controller can operate standalone or on a KMC peer to peer network.
- B. The controller must be compatible with existing kitchen/cooler monitoring/alarming format including screens, messages, and alarm limits at other Volusia County Schools facilities.
- C. Features
 - 1. Eight (8) Universal Inputs and eight (8) Universal Outputs – software selectable as analog or digital signals
 - 2. 12bit analog-to-digital conversion
 - 3. Pulse Counting up to 1000 Hz
 - 4. 10 user-definable Control Basic program areas
 - 5. Network points in:
 - a) 127 from LAN Controllers
 - b) 512 from sub LAN Controllers
 - 6. Network points out
 - a) 127 to LAN Controllers
 - b) 64 to sub LAN Controllers
 - 7. Eight (8) PID control loops with auto-tune capability
 - 8. 128 program variables software selectable as analog or digital with standard and custom units of measure
 - 9. Real time clock with power back-up for 72 hours
 - 10. Five (5) user-defined tables
 - 11. Custom graphics: 32 system groups each of which can manager 64 points with animated and color graphics (requires WinControl XL Plus)
 - 12. Two (2) megabyte non-volatile flash memory
 - 13. Two (2) megabyte RAM with six-hour back-up
 - 14. Communications
 - 15. Ethernet 10baseT supports 31 KMC LAN Controllers
 - 16. RS-232 connects directly to computer serial port or optional external modem
 - 17. RS-485 supports up to 32 KMC sub LAN Controllers
 - 18. Browser access using a standard internet browser to view and change the following: inputs, outputs, variables, controllers, system groups, trend logs, run time logs, weekly and annual schedules and alarm summary.
 - 19. E-mail requires access to SMTP e-mail server. Send text messages, logs and data points

Note: this section is in standard specification format.

36. 15910 – BUILDING AUTOMATION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Digital control equipment.
 - 2. Software.

3. Control panels.
4. Digital control devices.
5. Input/Output sensors.
- B. This section defines the basic materials and methods and minimum equipment and performance requirements for the Building Automation System (BAS) in order to provide the functions necessary for control of the mechanical and other specified systems on this project.
- C. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for device-level integration of material and equipment as well as workmanship and to provide a complete and operable BAS.
- D. The drawings are diagrammatic intending to show a workable general arrangement and location of components and are not necessarily complete or rigid in all details.

1.2 BID PROCEDURES

- A. The existing site BAS manufacturer is:
 1. List existing BAS here.
- B. The work occurs on a site with an existing BAS. Therefore, the manufacturer of the existing system is the only acceptable BAS manufacturer.
- C. As a prequalification for inclusion on the District's VCS acceptable System Integrator list, the SI has pre-negotiated labor and material costs with the District.
- D. The prime contractor's bid submittal shall include a full breakout of the labor and materials proposed by the SI for use on the project. A summary page shall be included where costs are shown to total the SI contractor's price to the prime contractor. A statement of compliance with the pre-negotiated pricing shall be included and signed by an official of the SI contractor.
- E. Failure to submit the required documentation with the bid package may result in bid disqualification.

1.3 SCOPE – GENERAL

- A. The Building Automation System (BAS) is to provide a peer-to-peer networked, stand-alone, distributed control system for building mechanical and electrical systems. The BAS shall include an operator workstation also known as Engineering Control Center (ECC), field programmable microprocessor based control units panels, instrumentation end control devices, wiring, piping, and related systems to provide centralized and facility wide control functions.
- B. The BAS shall be designed such that each mechanical and electrical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate under control.
- C. The System Integrator (SI) Contractor shall refer to the drawings and equipment specifications for coordination of factory installed control equipment in products furnished by others as they relate to this section.
- D. Provide all labor (direct employed or subcontracted), materials, programming and supervision necessary to install a complete Building Automation System (BAS) per the construction documents. Include provisions for the following:
 1. Mounting hardware for all control devices.
 2. Construction supervision.
 3. Startup and verify proper operation of control equipment.
 4. Point verification and testing of hardware and software.
 5. Work in conjunction with the TAB agent to calibrate and adjust devices as required.
 6. Warranty.
- E. The BAS as specified herein shall be provided in its entirety by the SI Contractor. The SI Contractor shall base their bid on the system as specified, the sequence of operation, the point's list (Input/Output Summary) and contract documents.

The documentation pertaining to the BAS is schematic in nature. The SI Contractor shall provide equipment and labor not specifically referred to herein or on the plans, that are required to meet the functional intent, shall be provided without additional cost to the owner.

- F. The SI shall provide all electrical control and interlock wiring connected to the controls and instrumentation systems.
- G. All 110 VAC or greater voltage power wiring to main control panels shall be provided by Division 16 Contractor (Electrical), and coordinated by this Contractor. Failure of this contractor to coordinate requirements with other divisions shall result in the SI contractor being responsible for any non-coordinated items.
- H. All 24 VAC control power to operate equipment shall be the responsibility of this contractor.
- I. All conduits in connection with the controls and instrumentation system shall be furnished and installed by this Contractor.
- J. The Control Contractor shall install all sensing and control components.
- K. Provide a comprehensive operator and technician-training program as described herein.
- L. Provide as-built documentation, software, and all DDC control logic and all associated support documentation on approved media, which accurately represents the final installed system.
- M. Adjustments of manual balancing devices, as required to obtain design air and/or water flows, shall be by the TAB Contractor. The controls contractor shall provide assistance to the TAB Contractor with control adjustments as required to obtain design flows by:
 - 1. Providing on-site instruction on the proper interfacing and operation of the equipment.
 - 2. Providing the necessary software for use with the balancing contractor's personal computer for interfacing with their control equipment. Where proprietary equipment is required, this equipment shall be provided for the Balancing Contractor's use.
 - 3. Provide 2-hours of onsite for the Balancing Contractor to instruct on proper use of the software and interface with the control system.
- N. To ensure compatibility and training standards with the present VCS Building Automation Systems, the BAS must be fully software certified at the time of installation to provide interoperability and backward compatibility to the BAS systems currently installed by the successful BAS manufacturer. The BAS must use only latest versions of database software and tools for area controllers, configuring the system, and for the present graphical user interface (GUI) which is used by the building operator.
- O. Demolition: The controls contractor shall remove all unused controls, including devices, controllers, conduit, control tubing, and wire. VCS shall have the right of first refusal for all hardware removed. Demolition shall be complete with exposed surfaces and finishes restored to match the surrounding area. Coordinate work with other trades.

1.4 SCOPE – CAMPUS-WIDE CONTROL SYSTEM

- 1. The System Integrator shall provide a complete campus-wide BAS with all materials and labor needed to control the equipment indicated in the Drawings in the manner indicated in the Sequence of Operations.
- 2. Include all labor and materials to provide the following:
 - a. Site software.
 - b. Site hardware.
 - c. Control database.
 - d. Graphical interface.

- e. All control devices shown on the drawings and required to meet the sequence of operations.
- f. Program control sequences.
- g. Interconnection to all buildings on campus with equipment or devices to be monitored and/or controlled by the BAS.
- h. Interconnection with Owner's Central Building Automation and Control System Department at the VCS Facilities Building via Owner's Ethernet system.
- i. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.5 SCOPE – EXPAND EXISTING CONTROL SYSTEM

- 1. The System Integrator shall expand the existing campus BAS hardware and software to incorporate equipment indicated in the Drawings and control it in the manner indicated in the Sequence of Operations.
- 2. The EMS expansion shall include all labor and materials to provide the following:
 - a. Upgrade existing site software, if required
 - b. Upgrade existing site hardware, if required.
 - c. Incorporate new equipment into the existing database.
 - d. Incorporate new equipment into the existing graphics hierarchy.
 - e. All controls devices shown on the drawings and required to meet the sequence of operations.
 - f. Program control sequences.
 - g. Interconnection to site control system.
 - h. Interconnect all onsite BAS devices with Owner's central Building Automation and Control System via Owner's Ethernet system.
 - i. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.6 RELATED DOCUMENTS:

- A. Sequence of Operations: Refer to Drawings.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions.
- C. Division-1, General Requirements, of these Specifications.
- D. The General Conditions of the Contract, Supplementary Conditions, and General Requirements bound herewith are a part of these Specifications and shall be used in conjunction with this Division as a part of the Contract Documents. Consult them for further instructions pertaining to this work. Contractors shall be responsible for and be governed by all requirements thereunder.

1.7 ABBREVIATIONS

- A. The acronym shown below are abbreviations used or referenced throughout this section of the specification.
 - 1. AGC Application Generic Controller
 - 2. AI Analog Input
 - 3. AMR Automated Meter Reading
 - 4. AO Analog Output
 - 5. API Application Program Interface
 - 6. ASC Application Specific Controller
 - 7. ASP Application Service Provider
 - 8. BAS Building Automation System
 - 9. CAC Custom Application Controller
 - 10. CPU Central Processing Unit
 - 11. DDC Direct Digital Controller
 - 12. DDE Dynamic Data Exchange

13.	DI	Digital Input
14.	DO	Digital Output
15.	EP	Electric-pneumatic
16.	FACP	Fire Alarm Control Panel
17.	FCC	Fire Command Center
18.	GC	Global Controller
19.	I/O	Input/Output
20.	IP	Internet Protocol
21.	ISS	Intelligent Space Sensor
22.	LAN	Local Area Network
23.	LC	Local Controller
24.	ODBC	Open Database Connectivity
25.	PE	Pneumatic-electric
26.	PID	Proportional-Integral-Derivative
27.	PLC	Programmable Logic Controller
28.	PPM	Parts per million
29.	SI	System Integrator
30.	SID	Supervisory Interface Device (Gateways)
31.	SMS	Short Message System
32.	TCP/IP	Transmission-Control Protocol/Internet Protocol
33.	TUC	Terminal Unit Controller
34.	UC	Unitary Controller
35.	WAN	Wide Area Network
36.	WET	Web-Enabled Technology
37.	XIF	External Interface File
38.	XML	Extensible Markup Language

1.8 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All publications shall be the latest edition that is recognized and accepted by the local governing authorities.
 1. Air Movement and Control Association (AMCA)
 - a. AMCA 502 – Damper Application Manual
 - b. AMCA 610 – Methods of Testing Airflow Measurement Stations for Ratings.
 2. American Society of Heating, Refrigeration, & Air Conditioning Engineers, Inc.
 - a. ASHRAE 114 – Energy Management Control System Instrumentation
 - b. ASHRAE Guideline 4 – Preparation of Operating and Maintenance Documentation for Building Systems.
 - c. ASHRAE Guideline 14P – Measurement of Energy and Demand Savings
 3. American Society of Mechanical Engineers (ASME)
 - a. ASME CSD-1 – Control & Safety Devices for Automatically Fired Boilers
 - b. ASME PTC-22 – Digital Systems Techniques
 4. American Society for Testing and Materials (ASTM)
 5. Institute of Electrical and Electronic Engineers (IEEE)
 - a. IEEE std 1143 – Guide on shielding Practice for Low-Voltage cable
 - b. IEEE STD 37.13 – standard for Low- Voltage AC Power Circuit Breakers Used in Enclosures.
 - c. IEEE STD 37.14 – Standard for Low – Voltage DC Power Circuit Breakers used in Enclosure.
 - d. IEEE std 62.22 – Guide for the Application of Metal-Oxide surge arresters for Alternating Circuit Systems

- e. IEEE std C62.34 – Standard for Performance of Low-Voltage surge Protective Devices
- f. IEEE std C62.36 – Standard Test Methods for surge-protectors used in Low-Voltage AC Power Circuits
- g. IEEE std C62.41 – Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits
- h. IEEE STD C62.45 – Guide on Surge Testing for Equipment Connected to Low – Voltage AC Power Circuits.
- i. IEEE std C62.62 – Standard Test Specification for Surge – Protective Devices for Low – Voltage AC Power Circuits
- 6. The Instrumentation Systems and Automation Society
 - a. ISA 575.01 Flow Equation for Sizing Control Valves
- 7. National Electrical Contractors Association
 - a. NECA 101 – Standard for Installing Conduit (Rigid, IMC, EMT)
 - b. NECA 1 – Standard for Good Workmanship in Electrical Contracting
- 8. National Electrical Manufacturers Association (NEMA)
 - a. NEMA WC57 – Control Cable
 - b. NEMA WD6 – Wiring Devices-Dimensional Requirements
- 9. National Fire Protection Association (NFPA)
 - a. NFPA 70 – National Electrical Code
 - b. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilation Systems
 - c. NFPA 90B – Standard for the Installation for Warm Air Heating and Air Conditioning Systems
 - d. NFPA 92A – Recommended Practices for Smoke Control Systems
- 10. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - a. SMACNA – Energy Systems Analysis and Management
 - b. SMACNA – HVAC Systems – Applications
 - c. SMACNA – HVAC Systems – Commissioning Manual
 - d. SMACNA – Indoor Air Quality – A Systems Approach
- 11. Underwriters Laboratories (UL)

1.9 QUALITY ASSURANCE

A. Products:

- 1. All products of the BAS shall be provided with appropriate agency approvals. With the submittal documents, verification that the approvals exist for all submitted products shall be provided. Systems or products not currently offering one or more of the following approvals are not acceptable:
 - a. UL-916; Energy Management Systems
 - b. UL-873; Temperature Indication and Regulating Equipment
 - c. UL-864, Subcategories UUKL, UOXX, UDTZ; Fire Signaling and Smoke Control Systems
 - d. FCC, Part 15, Subpart J, Class A Computing Devices Emissions Requirements
- 2. Electrical Standards: Provide electrical products that have been tested, listed and labeled by UL and comply with NEMA standards.
- 3. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electrical control systems.
- 4. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.
- 5. National Codes: Perform Work in accordance with the Florida Building Code.

- B. Manufacturers:
 - 1. Firms regularly engaged in the manufacture of products specified, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- C. System Integrator:
 - 1. The SI Contractor shall provide Licensed Trade Technicians to furnish, engineer, and install the BAS. They shall be skilled and factory trained, certified, and authorized by the manufacturer for debugging, start-up, diagnostics, training, service and repair of all components to ensure interoperability.
 - 2. The SI Contractor shall be designated by the BAS Equipment Manufacturer as a current Authorized Agent for their products in the territory where the equipment is to be installed.
 - 3. The SI shall be regularly engaged in the service and installation of the BAS proposed for the project and shall have a minimum of three (3) years of verifiable field experience with commercial controls in central Florida. The SI shall have sufficient staff to administer current workload plus proposed workload.
 - 4. The SI shall have an office within 50 miles of Volusia County that is staffed with BAS designers trained in integrating interoperable systems and technicians fully capable of providing BAS instruction and routine emergency maintenance service on all system components of the system to be installed.

1.10 SYSTEM PERFORMANCE

- A. Performance Standards. The system shall conform to the following:
 - 1. Graphic Display. The system shall display a quality graphic with the capability for a minimum of 20 dynamic points. All current data shall be displayed within 10 seconds of the request. The graphic shall be intuitive and shall present data in a graphical, not tabular, format.
 - 2. Graphic Refresh. The system shall update all dynamic points with current data within 10 seconds.
 - 3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 10 seconds. Analog objects shall start to adjust within 10 seconds.
 - 4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current, within the prior 60 seconds.
 - 5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds.
 - 6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
 - 7. Performance. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
 - 8. Multiple Alarm Annunciation. All workstations on the network shall receive alarms within 5 seconds of each other.

1.11 COORDINATION

- A. The following products are to be furnished by the controls contractor and installed by others. The controls contractor shall coordinate installation locations.

1. Hydronic Piping Components:
 - a. Control valves.
 - b. Immersion wells.
 - c. Flow switches.
 - d. Temperature sensor wells and sockets.
 - e. Gage taps.
 - f. Flow meters.
 - g. Couplings for flow and pressure switches
2. Ductwork Components:
 - a. Automatic control dampers
 - b. Connection of damper end switches.
 - c. Airflow meters.
- B. The Mechanical Contractor is responsible for providing and installing blank-off plates if needed when the control application requires dampers smaller than duct size. The controls contractor shall coordinate this requirement.
- C. The controls contractor shall be responsible for the following:
 1. Coordination of all controls items with other trades.
 2. Coordination of wall space for panels.
 3. Coordination of all wall-mounted sensor locations with furniture.
 4. Coordination of space sensors to avoid diffuser throw patterns.

1.12 SUBMITTALS

- A. General:
 1. Pre-Submittal Conference: After award of the Construction Contract, and prior to delivering submittal data to the Engineer, the BAS Contractor shall schedule a pre-submittal conference with the Engineer. The purpose of the pre-submittal conference is to review the proposed system concept and to discuss the sequence of construction activities.
 2. Refer to the specification Division 1 – General Requirements for submittal format.
 3. Coordinate with the Mechanical contractor to determine the number of submittals required. Provide a minimum of five copies of all submittal data.
 4. Product Requirements: Provide 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. When manufacturer's cutsheets 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 cutsheets to fulfill submittal requirements. Select and show in submittal quantities of products appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work.
- B. The following data/information shall be submitted for review (prior to ordering any hardware or software items):
 1. Overall system interconnecting diagrams showing all remote panels (PCs, Field Panels, and LAN devices), and power/surge protection locations and Uninterrupted Power Supply (UPS).
 2. Distributed panel locations (site and/or building plan, as appropriate to identify physical locations).
 3. Valve and damper schedules showing size, configuration, capacity, Manufacturer and location.
 4. Data sheets for all hardware and software control components.
 5. Thermostat/sensor locations.

6. A brief written description of the methodology used to keep graphics files on various PC terminals updated and consistent with one another.
(Remote computer graphics vs. site computer)
 7. A detailed point-to-point diagram of circuitry of all DDC panels. Submit on a per distributed panel basis. Typical are accepted, provided all applicable units are listed and the units are identified.
 8. A list of connected data points, including connected control unit and input or output devices.
 9. A detailed Sequence of Operations derived from the design intent shown on the Contract Drawings. Retyping the Sequence of Operations in the Contract Drawings is not acceptable.
 10. Detailed documentation on the specific field equipment to be supplied by the Controls Contractor shall be submitted and approved prior to installations; including, but not limited to, actuators, valves, temperature sensors, surge protection, and damper operators.
 11. The control valve schedule shall include each valve's unique identifier, size, flow coefficient Cv, pressure drop at specified flow rate, actuator size, close-off pressure data, dimensions, and access and clearance requirements data. Valve schedules may be submitted in advance but shall be included in the complete submittal.
 12. The damper schedule shall contain each damper's and each actuator's identifier, nominal and actual sizes, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The Damper Schedule shall include the maximum leakage rate at the operating static-pressure differential. The Damper Schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements. Damper schedules may be submitted in advance but shall be included in the complete submittal.
 13. All schemes and methods proposed to provide lightning protection for the DDC system, entering and leaving each building shall be submitted for review and approval.
 14. Complete bill of materials to identify and quantify all devices.
 15. Submit a color printout of each graphic. The graphic shall show temperature, status, position and all data points that will appear on the screen. If acceptable to the engineer, the graphics may be submitted on disk in a standard graphic format.
- C. Record Submittals:
1. Within one week after substantial completion, submit final copies of the record submittals modified to reflect all changes during construction. Electronic data shall be submitted in AutoCad 2010 format on CD. Provide one original and one duplicate.
 2. Submit five (5) copies of record submittals.
 3. All programs, code, databases, graphic files, AutoCad drawings, and symbol libraries generated for operation of the system shall be included as part of the system documentation. This information shall be submitted both in hardcopy bound format and two (2) copies in digital format on CD.
 4. Complete original issue documentation, installation, operation manuals, and supporting software for all third-party hardware and software furnished and installed as part of the system or required for the operation of the system, including remote terminals, user's computer work station, monitors, graphics and memory boards, network servers, printers, and modems.
 5. All software licenses, warranty certificates and documentation for all hardware and software including third party hardware and software shall be provided.

1.13 WARRANTEE

- A. The entire BAS provided under this contract, including all control devices provided by this Contractor, shall be warranted to be free of defects in workmanship and material for a period of two (2) years from the date of Substantial Completion. Any equipment found to be defective during this period shall be repaired and/or replaced without expense to the Owner. The Contractor shall accomplish this work during normal working hours.
- B. The Contractor shall respond to all warranty items within one working day from when they are reported. Provide a report to the VCS Maintenance Department identifying the problem, the devices affected and the nature of the repair or replacement.
- C. The warranty shall cover all costs for parts, labor, associated travel, any software sequence modifications, and expenses throughout the warranty period.
- D. Throughout the duration of the prime contractor's warrantee, all BAS warrantee issues and communications shall be routed through the prime contractor. After the prime contractor's warrantee expires, the SI shall coordinate directly with the VCS Maintenance department regarding warrantee issues for the duration of the BAS warrantee.

1.14 PREVENTATIVE MAINTENANCE INSPECTIONS

- A. Blank

1.15 BASE ACCEPTANCE PROCEDURE

- A. The SI shall perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets, which shall be submitted prior to acceptance testing. Commissioning work, which requires shutdown of system or deviation from normal function, shall be performed when the operation of the system is not required. The commissioning must be coordinated with the owner and prime contractor to ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the owner and prime contractor are present throughout the commissioning procedure.
- B. After control devices have been commissioned (i.e. calibrated, tested and signed off), each BAS program shall be put on line and commissioned. The SI Contractor shall, in the presence of the owner's representative and/or engineer, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy's. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.
- C. The SI Contractor shall submit printed graphical trend logs of Building Automation System (BAS) points to demonstrate that the HVAC systems are functioning as designed. Trend intervals shall be typically on an hourly basis, and trends shall be run for a minimum of 2 weeks, 24 hours a day. Trended points shall include as a minimum:
 - 1. All temperature points (air and hydronic) and active setpoints
 - 2. All relative humidity points
 - 3. Damper and valve position points
 - 4. Selected status points.
 - 5. All ventilation airflow rates and active setpoints
- D. A variety of historical data collection utilities shall be provided to manually or automatically sample, store, and display system data for all system points:

1. Digital Controllers (DC's) shall store point history data for selected analog and digital inputs and outputs:
 - a. Any point, physical or calculated, may be designated for trending.
 - b. Any point, regardless of physical location in the network, may be collected and stored in each Digital Controller's (DC's) point group.
2. Each Digital Controller (DC) shall have a dedicated RAM-based buffer for trend data and shall be capable of storing data samples.
3. The Network shall contain sufficient trend storage capacity, either in memory or on hard drive, to retain the last 72 hourly values for every system point shown on the Input/Output Summary, including software points. Trend data shall be displayed at the printer or at any network terminal.

1.16 TRAINING

- A. Training sessions shall be provided for Owner's personnel by the SI Contractor's factory trained control engineers and technicians.
- B. The SI Contractor shall conduct an 8-hour on-site training course for designated Owner's personnel in maintenance and operation of control system.

1.17 CLOSEOUT PROCEDURES

- A. Provide a duplicate of the final resident software on CD, along with instructions on downloading procedures and long-term storage of the media.
- B. Provide pre-programmed access codes to all levels. Subject to Owners approval.
- C. Ownership of proprietary material: All project developed hardware and software shall become the property of the Owner. These include but are not limited to:
 1. Project graphic images,
 2. Record drawings,
 3. Project database,
 4. Job-specific application programming code,
 5. All documentation for project hardware and software.
- D. Provide the following closeout information:
 1. Operating and maintenance data.
 - a. Manufacturer' catalog data and specifications on components used in system.
 - b. Detailed instructions for operations of system.
 - c. Operator's reference table listing addresses of connected input points and output points. Show settings where applicable.
 - d. Programmer's manual including information necessary to perform programming functions.
 - e. Language manual including information necessary to perform programming functions.
 - f. Flow charts of software programs utilized in DDC system.
 - g. Complete program listing file and parameter listing file for programs.
 - h. Copy of warranty.
 - i. Operating and maintenance cautions and instructions.
 - j. Recommended spare parts list.
 2. Owner instruction report.
 3. Performance verification report.
 4. Guarantee letter.

PART 2 PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS/SYSTEM INTEGRATORS:**

- A. Carrier / Carrier Corporation
- B. KMC Controls, Inc. / ABC Controls

- C. Trane / The Trane Corporation
- D. Reliable Controls / Precision Automation Inc.

2.2 COMMUNICATIONS

- A. On-site communications between BAS components shall be accomplished via a dedicated Local Area Network (LAN). Individual BAS components shall pass data to the network by the use of directly connection to the network or by passing data through higher level building control units.
- B. The BAS shall connect to the existing district-wide peer-to-peer network for remote communications. Modem dial-up systems are not acceptable.
- C. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the LAN. Program and test all cross-controller links required to execute control strategies specified on Drawings. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
- D. LAN capacity shall be not less than 60 stations or nodes.
- E. Minimum LAN data speed shall be 38 Kbps.
- F. Transmission Medium within buildings shall be fiber optic or single pair of solid 24 gauge twisted, shielded copper cable inside buildings.
- G. The Communications network between buildings shall be fiber optic, run underground and in conduits. If existing communication medium is available that meets these requirements and the Owner approves, the SI may be utilized it for BAS communications. If existing communication medium is not available or usable, the SI shall provide the medium. The minimum conduit size for underground communication shall be one (1) inch diameter. Install two extra spare pairs in each conduit run.
- H. System shall automatically synchronize controller time clocks daily from an operator-designated controller via the LAN. If applicable, system shall automatically adjust for daylight saving and standard time.
- I. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.
- J. Provide updated software on the master host PC located Facilities Services, Maintenance department and any on-site PC's as necessary for site-based Maintenance FMT's or administration access as required by the location.

2.3 OPERATOR INTERFACE

- A. Revise 15910, 2.3.A to: The Owner shall furnish the PC for the on-site Operator's Interface to the BAS (location to be determined during the pre-construction meeting).
- B. Provide interconnection between the BAS and the onsite PC.
- C. The PC shall have the following minimum specifications:
 - 1. Microsoft Windows Compatible
 - 2. 2 GHz Intel Pentium Processor
 - 3. 24 Bit Graphic Resolution Card.
 - 4. 10/100 Ethernet Card
 - 5. 40 GB Hard Drive
 - 6. 24x speed CD Read/Write Drive
 - 7. 17" SVGA Monitor
 - 8. Inkjet Printer with paper
 - 9. 600 KVA UPS
 - 10. Quality surge suppression strip with all PC components connected to it.
 - 11. Factory installed Microsoft Windows compatible with VCS operating system
- D. Software: The operator interface panel software shall be compatible with Microsoft Windows compatible with VCS operating system. All operating system software, control software, and graphics generation software shall be provided,

along with required usage licenses. All software shall be provided for the Owner to make any changes to the system without Control Contractor support. (i.e. if the Owner needs to change a graphic, provide the graphic software that generated the original)

- E. Provide all hardware and software necessary to allow remote communications via Internet to off-site locations.
- F. System Graphics. The Operator Workstation Software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen.
- G. The system graphics shall be able to be modified while on line. An operator with the proper password level shall be able to add, delete, or change dynamic points on a graphic.

2.4 SYSTEM APPLICATIONS

- A. Each Workstation shall provide for an operator interface and off-line storage of system information. Provide the following applications at each workstation.
 - 1. Manual Database Save and Restore: A system operator with the proper password clearance shall be able to archive the database from any system panel and store on magnetic media. The operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
 - 2. System Configuration: The Workstation Software shall provide a graphical method of configuring the system. The user with proper security shall be able to add new devices, assign modems to devices, and obtain a visual riser diagram of the system. This shall allow for future system changes or additions.
 - 3. On-Line Help: Provide a context sensitive, on line help system to assist the operator in operation and editing of the system. On line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
 - 4. Security: Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time shall be set per operator password. All system security data shall be stored in an encrypted format.
 - 5. System Diagnostics: The system shall automatically monitor the operation of the Workstation, printer, modem, network connections, and Control Panels. The failure of any device shall be annunciated to the operator workstation.
 - 6. Alarm Processing: Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.
 - a. Alarm Reactions: The operator shall be able to determine what actions, if any, are to be taken, by object (or point), during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, providing audible annunciation or displaying specific system graphics. Each of these

- actions shall be configurable by Workstation and time of day. An object in alarm that has not been acknowledged within an operator specified time period shall be re-routed to an alternate operator specified alarm receipt device.
- b. Binary Alarms: Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to disable alarming when the associated equipment is turned off or is being serviced.
 - c. Analog Alarms: Each analog object shall have both high and low alarm limits and warning limits. Alarming must be able to be automatically and manually disabled.
7. Trend Logs: The operator shall be able to define a custom trend log for any data in the system. This definition shall include interval, start-time, and stop-time. Trend intervals of 1, 5, 15, 30, and 60 minutes as well as once a shift (8 hours), once a day, once a week, and once a month shall be selectable. All trends shall start based on the hour. Each trend shall accommodate a minimum of 10 system objects. The system operator with proper password shall be able to determine how many samples are stored in each trend. Trend data shall be sampled and stored on the Building Controller panel and be archived on the hard disk. Trend data shall be able to be viewed and printed from the operator interface software. They shall also be storable in a tab delimited ASC II format for use by other industry standard word processing and spreadsheet packages.
 8. Alarm and Event Log: The operator shall be able to view all logged system alarms and events from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation.
 9. Object and Property Status and Control: Provide a method for the operator with proper password protection to view, and edit if applicable, the status of any object and property in the system. These statuses shall be available by menu, on graphics, or through custom programs.
 10. Clock Synchronization: The real time clocks in all building control panels and workstations shall be synchronized on command of an operator. The system shall also be able to automatically synchronize all system clocks, daily from any operator-designated device in the system. The system shall automatically adjust for daylight savings and standard time if applicable.
 11. Reports and Logs: Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archived on the hard disk for historical reporting. Provide the ability for the operator to obtain real time logs of designated lists of objects. Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer. Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title and the name of the facility.
 12. Workstation Editors: Each PC Workstation shall support full screen editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at the appropriate controller panels.
 13. Controller: Provide a full screen editor for each type controller and application that shall allow the operator with proper password to view and

- change the configuration, name, control parameters, and system setpoints.
14. Scheduling: An editor for the scheduling application shall be provided at each Workstation. Provide a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. The advance and delay time for each object shall be adjustable from this master schedule.
 - a. An operator with proper password level shall be able to modify the schedule. Schedules shall be able to be easily copied between objects and/or dates.
 15. Equipment Coordination: Provide a full screen editor that allows equipment to be grouped for proper operation as specified in the sequence of operations.
 16. Custom Application Programming. Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded. The programming language shall have the following features:
 - a. The language shall be English language oriented and be based on the syntax of programming languages such as BASIC. It shall allow for free form or fill in the blank programming. Alternatively, the programming language can be graphically-based using function blocks as long as blocks are available that directly provide the functions listed below, and that custom or compound function blocks can be created.
 - b. A full screen character editor/programming environment shall be provided. The editor shall be cursor/mouse-driven and allow the user to insert, add, modify, and delete code from the custom programming. It shall also incorporate word processing features such as cut/paste and find/replace.
 - c. The programming language shall allow independently executing program modules to be developed. Each module shall be able to independently enable and disable other modules.
 - d. The editor/programming environment shall have a debugging/simulation capability that allows the user to step through the program and to observe any intermediate values and or results. The debugger shall also provide error messages for syntax and execution errors.
 - e. The programming language shall support conditional statements (IF/THEN/ELSE/ELSE-IF) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
 - f. The programming language shall support floating point arithmetic using the following operators: +, -, /, x, square root, and xy. The following mathematical functions shall also be provided: natural log, log, absolute value, and minimum/maximum value from a list of values.
 - g. The programming language shall have pre-defined variables that represent clock time, day of the week, and date. Variables that provide interval timing shall also be available. The language shall allow for computations using these values.
 - h. The programming language shall have ability to pre-defined variables representing the status and results of the System Software, and shall

be able to enable, disable, and change the values of BACnet objects in the system.

2.5 GRAPHICAL INTERFACE (LOCAL AND REMOTE)

- A. Both the Local and Remote Graphical Interfaces shall provide the following:
 - 1. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the point.
 - 2. The graphics shall be of good quality and shall be consistent throughout the BAS interface providing the user with visual description of the status of the system.
 - 3. Links shall be provided to easily move between data screens. Cross-links shall also be provided to jump to central equipment screens.
 - 4. Provide "drill-down" ability to allow the user to obtain the desired information easily.
- B. Standard Building Display: Each floor of each building shall be provided with an independent BAS screen that displays all sensed space temperatures and relative humidity levels. If any space temperature is more than 2 degrees from setpoint, the space shall be displayed as Yellow in color. If any space is more than 4 degrees from setpoint, it shall be displayed as Red in color. If any space relative humidity is above 65% RH, the sensed space shall be displayed as Red in color.
- C. Graphics shall display in Standard Inch Pounds.

2.6 CONTROL UNITS

- A. General: Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), and Smart Actuators (SA) that conform to the following:
- B. Communication:
 - 1. Service Port: Each controller shall provide a service communication port for connection to a Portable Operator's Terminal.
 - 2. Signal Management: BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
 - 3. Data Sharing: Each BC and AAC shall share data as required with each networked BC and AAC.
 - 4. Stand-Alone Operation: Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.
- C. Environment: Controller hardware shall be suitable for anticipated ambient conditions.
 - 1. Controllers used outdoors or in wet ambient conditions shall be rated for operation at 20°F to 140°F.
 - 2. Controllers used in conditioned space shall be rated for operation at 32°F to 120°F.
- D. Enclosures: Controller enclosures shall be of adequate size and style to allow all housed components to be easily serviced.
 - 1. Provide locking type, metal cabinet, with common keying. Panels screwed closed are not acceptable. The enclosures shall have a metal print pocket suitable for storing wiring, service and log information.
 - 2. Indoor panels shall be NEMA 1 enclosures with gaskets.
 - 3. Outdoor panels shall be NEMA 3R.

4. Outdoor panels installed East of US-95 or in cooling tower or chemically treated areas shall be NEMA 4X.
5. Enclosures shall physically isolate 120v power and 24v power and each shall be clearly labeled.
- E. Keypad: Provide a local keypad and display for each BC and AAC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and AAC, provide the software and any interface cabling needed to use a laptop computer as a Portable Operator's Terminal for the system.
- F. Real-Time Clock: Controllers that perform scheduling shall have a real-time clock.
- G. Serviceability:
 1. Controllers shall have diagnostic LEDs for power, communication, and processor.
 2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
 3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.
- H. Memory:
 1. Controller memory shall support operating system, database, and programming requirements.
 2. Each BC and AAC shall permanently retain application programming in nonvolatile memory in the event of power loss.
 3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss.

2.7 POWER SUPPLIES, LINE FILTERING, AND ELECTRICAL ACCESSORIES

- A. Power Line Filtering: Provide internal or external transient voltage and surge suppression for workstations and controllers.
 1. Surge protection shall have:
 - a. Dielectric strength of 1000 V 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 greater at 40-100 Hz
 2. Surge suppression shall comply at a minimum with manufacturer's requirements and shall include suppression on all lines entering and leaving each building.
 3. All communication channels between PC, Global and Unitary Controllers whether in conduits or overhead runs, shall have transient suppression networks installed. The transient (Surge) protection must meet IEEE standard C37.90a-1974. The suppression network shall be automatic, self-restoring and be on active duty at all times.
- B. Power Supplies: Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
 1. 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 150% current overload for at least three seconds without trip-out or failure.

- a. Unit shall operate between 32°F and 120°F. EM/RF shall meet FCC Class B.
 - b. Line voltage units shall be UL recognized.
 - c. Transformers shall be mounted in an auxiliary panel or other suitable accessible location with disconnecting means. Provide a pilot light for each transformer, to indicate the presence of load power.
- C. Controller Wiring Requirements:
 - 1. Provide all necessary 24 VAC transformers, 24 VAC power distribution wiring, etc. to controllers for a complete operating system.
 - 2. Terminal fittings or insulating bushings shall be used to protect wiring associated with controllers at enclosures, junction boxes, etc.
- D. Wiring and Conduit
 - 1. The contractor shall provide all DDC and related control wiring and conduit. Wire and cable shall be pulled from device or control point to the DDC, Auxiliary, or LPI panels. All wire and cable shall be labeled and tagged 4 inches down from the point at which the wire enters the cabinet with the corresponding point number.
 - 2. All indoor exposed control wiring shall be run in EMT; outdoor exposed control wiring shall be run in PVC conduit.
 - 3. All wiring routed in non-exposed (above ceiling) areas shall utilize plenum-rated cabling and be properly supported using J-hooks or cable rings.
 - 4. All cable runs exposed in return air plenums shall be smoke rated for the application and secured to the building structure.
 - 5. Control wiring for 24-volt circuits shall be rated for 300-volt service.
 - 6. All PVC and EMT conduit and outlet boxes shall conform to the requirements specified under Division 16, Electrical.
 - 7. All conductors shall be of stranded copper wire.
 - 8. Conduits shall be sized on a maximum fill of 40% capacity.
 - 9. Data transmission cabling and equipment grounding procedures shall meet the latest FCC guidelines for electromagnetic field generation.
 - 10. All control wiring sizes and types shall meet the equipment manufacturer's recommendations.
 - 11. DDC Wiring and Cable Requirements for New DDC Panels
 - a. Digital Output: Minimum #14 AWG THHN
 - b. Digital Input: Teflon jacketed twisted pair #16 -or- #16 AWG THHN minimum
 - c. Analog Output: Twisted pair NEC-rated CMP #20 AWG
 - d. Analog Input: Twisted pair NEC-rated CMP #20 AWG
 - e. Data Transmission: Teflon jacketed twisted shielded pair #24 AWG 12-1/2 pico-ferrad, 6 twists/foot
 - f. Wire sizes listed for lengths up to 750'.
 - 12. All junction boxes and couplings on conduit containing DDC related wiring shall be painted a sky blue color.

2.8 INPUT AND OUTPUT INTERFACE

- A. General: Hard-wire input and output points to BCs, AACs, ASCs, or SAs.
- B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.
- C. Binary Inputs: Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

- D. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.
- E. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- F. Binary Outputs: Binary outputs shall send an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation. Separate relays with HOA switches and status lights may be used to meet this requirement.
- G. Analog Outputs: Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Analog outputs shall not drift more than 0.4% of range annually.
- H. Tri-State Outputs: Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.
- I. Universal Inputs and Outputs: Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.9 ELECTRONIC SENSORS, INDICATORS, TRANSDUCERS AND COMPONENTS

- A. Temperature and Humidity Sensors:
 - 1. Temperature sensor assemblies shall consist of a Resistive Temperature Device (RTD's) with a 4-20 mA 2-wire transmitter and gasketed utility box enclosure. Sensing element shall be platinum with 10K ohms resistance at 32 deg. F. Accuracy shall be +/- 1/2 deg. F over the entire range.
 - 2. Single point duct temperature sensor shall be rigid bulb type with stainless steel (SS) sheath, aluminum tip, and have a calibrated span of 20-120 deg. F or 30-250 deg. F for heating applications.
 - 3. Average element duct mounted temperature sensor shall have a SS minimum 25 ft. long continuous element sensor along the entire length, and have a calibrated span of 20-120 deg. F or 30-250 deg. F for heating applications.
 - 4. Rigid averaging element duct mounted temperature sensor shall have a brass case, bendable sheath, continuous element sensor along the entire length, and have a calibrated span of 20-120 deg.
 - 5. Liquid immersion temperature sensors shall have 5 1/2" long probe with SS well, and weather tight enclosure. Transmitters for chilled water shall have a calibrated span of 20-120 deg. F or 30-250 deg. F for heating applications.
 - 6. Approved Manufacturers
 - a. System Integrator's brand named product
 - b. Hy-Cal
 - c. TCS
 - d. Siemens
 - e. Minco
 - f. ACI
- B. Outside Air Master Temperature Sensor
 - 1. Single point outside air temperature RTD shall be 1000-ohm thin film platinum resistor sensor with 4-20 mA 2-wire output transmitter with solar shield.
 - 2. Approved Manufacturers
 - a. System Integrator's brand named product

- b. Hy-Cal
 - c. Viasala
 - d. ACI
- C. High Precision Temperature Sensors: (for CHWS & CHWR temperature inputs used for BTU calculations)
 - 1. Temperature transmitter with 100 ohm platinum RTD sensor and 4-20 mA 2-wire DC output. Zero and span shall be continuously adjustable. Sensor and transmitter shall be a matched assembly. Accuracy shall be +/- 0.1% of calibrated transmitter span, including combined effects of repeatability, hysteresis and linearity. Calibrated range shall be 20 to 120 deg. F. Both CHWS and CHWR sensor/transmitter assemblies shall have the same span and shall be factory calibrated as a matched pair.
 - 2. Liquid immersion sensors shall have welded stainless steel thermowell. Transmitters shall be of the potted type or shall have a thermally isolated watertight enclosure. Length of sensor and thermowell shall be selected based on the diameter of the pipe to provide accurate, reliable and homogeneous sensing of the liquid temperature.
 - 3. Approved Manufacturers
 - a. System Integrator's brand named product
 - b. Hy-Cal
 - c. TCS
 - d. Minco
 - e. ACI
- D. Humidity Sensors
 - 1. Sensor element shall be thin film capacitive type or bulk polymer resistance type, accuracy of +/- 3% RH, range of 0-100% RH with 4-20 mA 2-wire linear output. Factory calibrate for maximum accuracy at mid-range of normal operating humidity. All humidity sensors shall be resistant to chlorine and other cleaning agents.
 - 2. Duct Sensors shall have duct probe and mounting plate.
 - 3. Approved Manufacturers
 - a. System Integrator's brand named product
 - b. Siemens
 - c. Hy-Cal
 - d. TCS
 - e. General Eastern
 - f. Viasala
- E. Vivarium Temperature and Humidity Sensors (for wet service):
 - 1. Room temperature RTD shall be 100 ohm platinum sensor with 4-20 mA 2-wire output transmitter. Transmitter shall be waterproof or shall be remote mounted. Cover shall be rustproof, and shall be protected by a SS "U"-shaped guard firmly attached to the wall.
 - 2. Room humidity sensor shall have a 4-20 mA 2-wire output transmitter, 0-100% relative humidity range, accuracy of +/- 2% RH, shall be waterproof, and shall be resistant to chlorine and other cleaning agents. Cover shall be rustproof, and shall be protected by a SS "U"-shaped guard firmly attached to the wall.
 - 3. Combination units shall comply with the above, but shall be mounted in a single, waterproof, rustproof enclosure, and shall be protected by a SS "U"-shaped guard firmly attached to the wall.
 - 4. Approved Manufacturers
 - a. System Integrator's brand named product
 - b. Hy-Cal
 - c. Viasala
 - d. TCS
 - e. General Eastern

- f. Siemens
 - g. ACI
- F. Pressure and Flow Sensors
 - 1. Air Differential Pressure Transducer
 - a. Variable capacitance type with ranges not exceeding 150% of maximum expected input. Transducer shall have zero and span adjustment. Output shall be 2-wire 4-20 mA with 24 VDC input.
 - b. Safe over pressure rating shall be minimum 5 times the range.
 - c. Temperature compensated with thermal error of not greater than 0.04% of full scale in temperature range of 40 to 100 deg. F.
 - d. Accuracy shall be 1% of full scale.
 - 2. Approved Manufacturers
 - a. Systems Integrator's brand name product
 - b. Air Monitor
 - c. Setra
 - d. Modus
 - e. Veris
 - f. Alta Labs
- G. Air Static Pressure Sensors
 - 1. Duct mounted sensors shall be easily removable for cleaning, have multiple sensing ports, and fabricated of aluminum, copper, or SS. Sensors used in outdoor or condensing environments shall not be copper.
 - 2. Wall or ceiling mounted sensors shall be shielded, suitable for surface or flush mounting, complete with multiple sensing ports, contain a pressure impulse suppression chamber, and fabricated of aluminum, paintable steel, or SS as required.
 - 3. Outside air mounted sensors shall be shielded, complete with multiple sensing ports, maintain sensing accuracy regardless of wind flow direction or pattern, and fabricated of aluminum or SS.
 - 4. Accuracy shall be 1% of actual pressure value.
 - 5. Approved Manufacturers
 - a. System Integrator's brand name product
 - b. Air Monitor
 - c. Siemens
 - d. Dwyer
 - e. Honeywell
 - f. Veris
 - g. Setra
 - h. Modus
- H. Electronic Airflow Sensors
 - 1. References: UL 873 – Temperature and Airflow Indicating Equipment
 - 2. Qualifications: The manufacturer of the products specified in this section shall have a minimum of five years experience producing products of this type.
 - 3. Special Product Warranty: Provide a manufacturer's parts warranty for 36 months from the date of unit shipment.
 - 4. Description
 - a. Each measurement device shall consist of one or more sensor probe assemblies and a single microprocessor-based transmitter. Each sensor probe assembly will contain one or more independently wired sensor housings. Multiple sensor housings shall be equally weighted and averaged by the transmitter prior to output. Pitot tubes and arrays are not acceptable. Vortex shedding flow meters are not acceptable.

- b. Temperature Sensors:
 - 1) Each temperature sensor shall be calibrated at a minimum of 3 temperatures and have an accuracy of +/- 0.15° F over the entire operating temperature range.
 - c. Temperature Sensor Assemblies:
 - 1) Each sensor housing shall utilize two hermetically sealed, bead-in-glass thermistor probes to determine airflow rate and ambient temperature. Devices that use "chip" type thermistors are unacceptable. Devices that do not have 2 thermistors in each sensor housing are not acceptable.
 - 2) Each sensor assembly shall be calibrated at a minimum of 16 airflow rates and have an accuracy of +/-2% of reading over the entire operating airflow range. Each sensor assembly shall be calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST).
 - 3) Operating Range: -20° F to 160° F and 0-99% RH (non-condensing).
 - d. Duct Sensor Probe Assemblies:
 - 1) A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter at a given measurement location.
 - 2) Sensor housings shall be mounted in an extruded 6063 aluminum tube probe assembly.
 - 3) Each sensor probe assembly shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to a remotely mounted transmitter.
 - 4) The number of sensor housings provided for each location shall be determined by the manufacturer based on the requirements of the application.
 - 5) Probe assembly mounting brackets shall be constructed of 304 stainless steel.
 - 6) Probe assemblies shall be insertion mounted through the side or top of the duct.
 - 7) The operating airflow range shall be 0 to 2,500 FPM unless otherwise indicated on the plans.
 - e. Transmitters
 - 1) The transmitter shall operate on 24 VAC and shall not require an isolated power source.
 - 2) The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be protected from weather and water.
 - 3) The transmitter shall be capable of communicating with the host controls via a linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire)
 - f. The measuring device shall be UL listed as an entire assembly.
 - g. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer's placement requirements.
5. Acceptable Products:
- a. Ebtron STA104 series

- I. Differential Pressure Airflow Sensor:
 - 1. Qualifications: The company manufacturing the products specified in this section shall have a minimum of five years experience producing products of this type.
 - 2. Special Product Warranty: Provide a manufacturer's parts warranty for 36 months from the date of unit shipment.
 - 3. Description:
 - a. Each device shall be designed and built to comply with, and provide results in accordance with accepted practice as defined for system testing in the latest revision of ASHRAE Handbook of Fundamentals as well as the latest revision of the Industrial Ventilation Handbook.
 - b. Airflow measuring stations shall be fabricated of 14 Ga. heavy galvanized steel welded casing with 90° connecting flanges in a configuration and size equal to that of the duct it is mounted into. Each station shall be complete with an air directionalizer and parallel cell profile suppresser across the entering air stream and mechanically fastened to the casing, equal-area and equal-weighted averaging total pressure sensors and manifold, bullet-nose shaped static pressure sensors with averaging manifold, internal piping, and external pressure transmitter ports. An identification label shall be placed on each unit casing listing model number, size, area, and specified airflow capacity.
 - c. The maximum allowable pressure loss through the unit shall not exceed 0.1"w.g. Each unit shall be capable of measuring the airflow rate within an accuracy of 2% as determined by U.S. GSA. Certification tests shall contain a minimum of one total pressure sensor per thirty-six square inches of unit measuring area.
 - d. Stations shall be installed in strict accordance with the manufacturer's published requirements. Final location shall be coordinated with the mechanical or the sheet metal subcontractor. These stations serve as the primary signals for the airflow control systems; therefore it shall be the responsibility of the Contractor to verify location and installation to assure that accurate primary signals are obtained.
 - e. The units shall have a self-generated sound rating of less than NC40, and the sound level within the duct shall not be amplified nor shall additional sound be generated.
 - 4. Acceptable Products
 - a. TekAir
 - b. Air Monitor
 - c. Kele
 - d. Ruskin
 - e. Preso
- J. Liquid Flowmeters (electro-magnetic type):
 - 1. Liquid flow measurement sensor shall be of the electro-magnetic flowmeter type and shall be bi-directional, microprocessor-based, and flange mounted.
 - 2. The meter shall be sized to the appropriately for the range of flow for the system. The flow sensor liner shall be suitable for the media it will be measuring.
 - 3. The electrodes shall be SS or Hasteloy C.
 - 4. The transmitter shall be provided with an integral universal wall/pipe mounting bracket and cable for remote mounting, integral LCD display, and NEMA 4X housing, shall indicate flow rate, totalize flow, and shall

have an isolated 2-wire 4-20 mA linear output signal and a pulsed output signal for totalization. Transmitter shall be located at the DDC panel array unless the maximum available cable length is exceeded.

5. The unit shall be factory calibrated for the specified flow and shall be calibrated in both directions if the application is bi-directional. Calibration shall be minimum three point.
6. The unit shall be mounted in an accessible location and shall be capable of being field calibrated and reprogrammed from the outside housing via magnetic probe or integral keypad menu switching. Unit shall have the capability to maintain flow total in non-volatile memory.
7. Power to the unit shall be 120 VAC, fed from an aux. control panel, with a separate disconnect and fuse. Disconnect and fuse to be located in the auxiliary panel.
8. The flow meter shall be provided with a 2-year warranty and application performance guarantee. The flowmeter and transmitter as a unit shall have the following minimum characteristics.
9. Flowmeter Liner:
 - a. Water: Polyurethane or Teflon
 - b. Accuracy: (Over an operating range of 30-120 deg. F.)
 - 1) At 1 to 33 feet per second velocity: +/-0.5% of rate.
 - 2) At 0.3 feet per second velocity: +/-2% of rate.
 - c. Unit shall provide two analog 4-20 mA signals or a single 4-20 mA signal and a digital contact closure on reverse flow.
10. Provide a phenolic tag for each transmitter to identify service (i.e. SECONDARY CHILLED WATER FLOW, etc).
11. Approved Manufacturers
 - a. Kent Taylor ABB (Magmaster)
 - b. Sparling
 - c. EMCO
 - d. Onicon

K. Pressure to Electronic Transducers

1. Provide transducers to convert linear proportional pressure signals to interface with the Siemens analog input modules. The transducer shall be a panel-mounted device, with input pressure snubber, as required, and gauge. Supply voltage shall be 19-26 VAC. Control signal shall be 4-20 mA. Accuracy shall be 1 percent full scale. Thermal effect shall be less than 1 percent full scale on zero and less than 1 percent of reading on span. Transducer shall have elastomer seals and SS wetted parts.
2. Approved Manufacturers
 - a. Siemens
 - b. Setra
 - c. Modus
 - d. ACI
 - e. Dwyer
 - f. Veris

L. Carbon Dioxide Sensors

1. Carbon dioxide sensing cell shall consist of a nondispersive infrared carbon dioxide gas cell that uses a pulsed source and has no free air optical path. Output shall be linearized 4-20 mA for use with 24 VDC input. The unit shall be specifically designed for the wall or duct application specified. Duct aspiration boxes shall be by the manufacturer. Unit shall have span adjustment. The unit shall have no moving parts.
2. Minimum requirements:
 - a. Range: 0-2,000 ppm
 - b. Accuracy: 3 % of full scale

- c. Repeatability: 1% of full scale
 - d. Power Consumption: less than 3 watts
 - e. Zero Drift at Constant Temp.: 100 ppm per 24 hrs(random not cumulative)
 - f. Maximum allowable Drift in 1 year: 20 ppm
- 3. Unit shall not require calibration for a period of 1 year or more.
- 4. Approved Manufacturers
 - a. System Integrator's brand named product
 - b. Valtronics
 - c. Telaire
 - d. Veris
- M. Current Sensing Switches
 - 1. Provide a solid state switch which closes when the current level sensed by the internal current transformer exceeds the trip point. Internal circuits are to be totally powered by induction from the line being monitored.
 - 2. All devices that are not "direct drive" (using flex couplings or belts) shall utilize adjustable threshold current switches to enable detection of changes in motor amp draw upon drive failure.
 - 3. The CS shall be a self gripping split-core type with optional mounting feet bracket; shall be isolated to 600 VAC rms; and shall have an adjustable mounting bracket for installation flexibility.
 - 4. Output shall be N.O., Solid State, 1.0 A @ 30 VAC/DC with a minimum aperture of 0.52"X0.68" for motor power feed.
 - 5. Approved Manufacturer
 - a. Veris Industries Hawkeye model #H800
- N. Refrigeration Leak Detectors
 - 1. Provide refrigerant leak detectors with remote sensor inputs, controller furnished complete with alarm relays and control relays for Start - Stop control of area makeup and exhaust fans.
 - 2. Sensors will be solid state and designed to detect R-22, R-123 and/or 134 to match selected chiller(s).
 - 3. Control unit to include visual alarms with discreet LED's for which sensor has caused the alarm. System will have a built in time delay to prevent false alarms. Provide panel with test buttons for audible and visual alarms.
 - 4. Detection system shall comply with ASHRAE Std. 15, latest edition.
 - 5. Approved Manufacturers:
 - a. System Integrator's brand named product.
 - b. MSA Instruments

2.10 INTELLIGENT DEVICES

- A. Intelligent devices shall be capable of interfacing directly with the RS-485 network.
- B. Microprocessor Based Space Sensor
 - 1. A microprocessor based space sensor residing on a RS-485 network shall provide the following field programmable functions.
 - a. Space temperature measurement and indication
 - b. Outside air temperature indication
 - c. Space temperature set-point adjustment
 - d. View the value of any input or output in the system
 - e. Change the value of any input, output or software point in the system
 - 2. The sensor shall include an RJ11 jack for connection of a PC to the entire LAN network.
 - 3. Approved Manufacturers

- a. System Integrator's brand named product

2.11 ELECTRIC COMPONENTS

- A. Components shall be Honeywell, Johnson, Siemens, or private labeled by manufacturer of the control system.
- B. Low temperature detection thermostats.
 - 1. Shall be duct type, fixed 5 deg. F differential, range 20 to 60 deg. F. Sensing element shall have a 20-foot long capillary tube responding to the lowest temperature sensed along any 12 inches of bulb length. Switch shall be SPDT 120 VAC, UL listed, rated for 10 amps at 120 VAC full load. Unit shall be manually reset. Provide one thermostat for every 20 square feet of coil surface.
- C. High temperature detection thermostats
 - 1. Shall be two-position type, range and element shall be suitable for the service, single or double pole, normally open or normally closed as required. Set point shall be adjustable over the full range. Switch shall be UL listed, rated for 10 amps at 120 VAC full load. Unit shall be manually reset
- D. Immersion electric thermostats
 - 1. Shall be two-position type, range and element shall be suitable for the service, single or double pole, normally open or normally closed as required, with stainless steel separable well. Set point shall be adjustable over the full range. Switch shall be UL listed, rated for 10 amps at 120 VAC full load.
- E. Remote-bulb electric thermostats
 - 1. Shall be two-position type, range and element shall be suitable for the service, single or double pole, normally open or normally closed as required, with stainless steel separable well as required. Set point shall be adjustable over the full range. Switch shall be UL listed, rated for 10 amps at 120 VAC full load.
- F. Wall-mounted electric thermostats
 - 1. Shall be two-position type, range and element shall be suitable for the service, single or double pole, normally open or normally closed as required. Set point shall be adjustable over the full range. Switch shall be UL listed, rated for 10 amps at 120 VAC full load.
- G. Differential Pressure Switches
 - 1. Differential pressure switches shall be furnished as indicated by the sequence for status purposes for either air or water applications.
 - 2. Provide single pole double throw switch with fully adjustable differential pressure settings. The switch shall have a snap-acting Form C contact rated for the application.
 - 3. The switch contact shall be rated for 5 amps at 120 volts as a minimum.
 - 4. Units shall be selected for ranges consistent with the application and shall be submitted for the Engineer's approval.
 - 5. Pressure rating of switch and connecting tubing.
 - a. Fan - Rated for 12 inches WC
 - b. Pump – Maximum deadhead system pressure
 - 6. Switches used for safety shutdown applications shall be of the manual reset type.
 - 7. Approved Manufacturers
 - a. System Integrator's brand named product.
 - b. Honeywell
 - c. Siemens
 - d. Dwyer
 - e. Cleveland Airflow
 - f. Mamac

H. Control Relays and Contactors

1. Relays shall be a minimum DPDT, of proper coil voltage, with neon indicator light, and of sufficient rating for specified purpose. Relay base shall be of the screwed terminal type.
2. Contactors shall be definite purpose type, have adequate number of poles, of proper coil voltage, and of sufficient rating for specified purpose. Contactors used for DDC interface control shall contain a Hand-Off-Auto switch.
3. Approved Manufacturers
 - a. System Integrator's brand named product.
 - b. Dayton
 - c. Siemens
 - d. Allen-Bradley
 - e. GE
 - f. Square D
 - g. Veris

2.12 AUXILIARY CONTROL DEVICES

A. Automatic Control Dampers

1. Automatic control dampers shall have interlocking blades and frames. Dampers shall be designed and constructed so that the blades, frames and linkage mechanism shall present a rigid assembly with free and easy action. Dampers shall be of galvanized steel blades and welded steel frame. The damper bearings shall be brass or oil impregnated nylon with brass bearing shafts. Where the damper blades are installed in a vertical position, a thrust type ball bearing shall be provided for the lower bearing. All bearings in ducts or casings to the outside shall have the top and bottom edges on both ends trimmed with replaceable neoprene seal fastened in an approved manner, so as to be practically air tight when closed. Closed dampers shall have leakage of not more than one-half percent at 4" of water column static pressure and 2,000 feet per minute velocity.
2. Dampers shall be suitable for operation between 20 F and 150 F. The Control Manufacturer shall submit leakage and flow characteristics plus a size schedule for all controlled dampers. Test leakage reports shall be in accordance with AMCA standard 500-75.
3. When dampers are located at fan discharge they shall be designed to operate properly without fluttering, at velocities up to 4,000 fpm and against a static pressure differential developed by the fan. Maximum deflection shall be no more than 1/50 of the unsupported span distance. The required number of modulating motors shall operate each automatic damper or section of damper if too large for one motor.
4. The Control Contractor shall furnish all the controlled dampers of the type and sizes indicated on the Drawings for installation by the Sheet Metal subcontractor or the Mechanical contractor.
5. All two-position control dampers shall be sized for minimum pressure drop, at the specified duct size.
6. All modulating dampers shall be sized for an effective linear airflow control characteristic within the angle of rotation and maximum pressure drop specified. Information shall be provided to the Sheet metal subcontractor for determining the proper duct reductions or baffles used.
7. Damper frames shall not be less than 13 gauge-galvanized steel, formed for extra strength, with mounting holes for enclosed duct mounting.
8. All damper blades shall be of not less than 16 gauge-galvanized steel formed for strength and high velocity performance. Blades on all dampers must not be over 8" in width. Blades shall be secured to 1/2" diameter zinc

- plated axles by zinc plated bolts and nuts. Blade side edges shall be sealed off against spring stainless steel seals. Teflon coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blade linkage hardware shall be constructed of corrosion resistant, zinc plated steel and brass.
9. Dampers shall be of the parallel blade design for two- position service and opposed blade design for modulating service.
 10. Approved Manufacturers
 - a. Metalaire
 - b. Ruskin
 - c. Greenheck
- B. Control Valves**
1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.
 2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings.
 - a. Two-way: 150% of total system (pump) head.
 - b. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head, whichever is greater.
 3. Water Valves
 - a. Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - b. Sizing Criteria
 - 1) Two-position service: Line size
 - 2) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
 - 3) Three-way Modulating Service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 5 psi maximum.
 - 4) Valves 1/2" through 2" shall be bronze body or cast brass ANSI Class 250, spring loaded, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc, or stainless steel ball.
 - 5) 2-1/2" valves and larger shall be cast iron ANSI Class 125 with guided plug and Teflon packing.
 - c. Acceptable Manufacturer
 - 1) Delta
 - 2) Belimo
 - 3) KMC
 - 4) Product by Specified Control System Manufacturer (with prior approval on each project only)
- C. Electronic Valve And Damper Operators**
1. Description
 - a. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
 - b. Where shown, an internal mechanical, spring return mechanism shall be built into the actuator housing.
 - c. All rotary spring return actuators shall be capable of both clockwise and counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.

- d. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.
- e. All 24 VAC/DC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 W for DC applications.
- f. All non-spring return 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 60 in-lb. torque capacity shall have a manual crank for this purpose.
- g. All modulating actuators shall have an external, built-in switch to allow the reversing of direction of rotation.
- h. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
- i. Actuators shall be Underwriters Laboratories Standard 873 listed.
- j. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.
- 2. Special Warrantee: Provide a 5 year materials warrantee.
- 3. Acceptable Manufacturers
 - a. Belimo
 - b. KMC
 - c. Product by Specified Control System Manufacturer (with prior approval on each project only)

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify equipment is installed and prepared for controls connections.
- B. Verify conditioned power supply is available to control units and to operator workstation.
- C. Verify field end devices, and wiring is installed prior to installation proceeding.

3.2 INSTALLATION

- A. General
 - 1. Install Work in accordance with the Florida Building Code.
 - 2. Remove any unused items that are part of renovations or demolition, including, but not limited to: conduit, wire, tubing, controllers, controlled devices, relays, enclosures, etc. Do not abandon in place.
 - 3. Locate all control components and accessories such that they are easily accessible for adjustment, service and replacement.
 - 4. The control system shall be completely installed and ready for operation.
 - 5. Dielectric isolation shall be provided where dissimilar metals are used for connection and support.
 - 6. Penetrations through and mounting holes in the building exterior shall be made watertight. Penetrations through fire and smoke rated assemblies shall maintain fire and/or smoke rating.
 - 7. Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturer's recommendations and as shown. Control devices to be installed in piping and ductwork shall be provided with required gaskets, flanges, thermal compounds, insulation,

8. piping, fittings, and manual valves for shutoff, equalization, purging, and calibration.
9. Where control devices are installed on insulated piping or ductwork provide standoff brackets or thermal wells sized to clear insulation thickness. Provide extended sensing elements actuator or linkages, and other accessories as required.
10. Install control systems and materials in accordance with manufacturer's instructions, industry standards, rough-in drawings, and detail drawings. Install electrical components complying with the requirements of Division-16. Mount all control panels at convenient locations and heights.
11. Identify each item, mounted on the face of a control panel, with an engraved nameplate (1/4" high engraved letters minimum). Identify each item of control equipment (except room sensors and thermostats), with stamped tape, firmly attached to equipment (1/4" high letters minimum).
12. Thermostats or sensors mounted on outside walls shall be mounted on 1" minimum thickness, rigid fiberglass insulating base (or equal).
13. All thermostat bulbs in water lines shall be installed inseparable wells, packed with heat conductive compound.
14. All controllers, relays, transducers, etc., required for stand-alone control shall be housed in NEMA and UL listed enclosures with a lockable door. The type of NEMA enclosure shall be based upon environmental requirements outlined in the specifications or on the drawings for this project.
15. DDC components that are to be factory mounted shall be provided by the SI Contractor and shipped to the equipment manufacturer for installation. Coordination of the factory installation shall be the responsibility of the SI Contractor. Proper operation of factory installed components shall be the responsibility of the SI Contractor.
- B. Communication and signal wire installation requirements.
1. Install all exposed wiring external to control panels, including low-voltage wiring, in EMT. Wiring shall be installed without splices between control devices and DDC panels.
2. Plan and coordinate routing with other disciplines.
3. Do not interfere with equipment access.
4. Provide flexible metallic conduit where equipment mounting is flexible.
5. Seal penetrations into air moving equipment including inside conduit.
- C. Enclosures
1. Use panduits in each control panel to organize and conceal all wiring.
2. Fuse all transformers.
3. Control panels shall be clearly identified by labels (2" lettering).
4. Provide and install as-built wiring diagrams to indicate the control points on all equipment.
5. Provide laminated point lists in all control panels.
- D. Control Units
1. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
2. Install software in control units and in operator workstation. Implement features of programs to specified requirements and appropriate to sequence of operation. Refer to Sequence of Operations.
3. Provide 120 volts alternating current, 15 amp dedicated power circuit to each programmable control unit.
4. Provide surge suppressor at each programmable control unit.
5. Install electrical material and installation in accordance with appropriate requirements of Division 16.

- E. Temperature and Humidity Sensors
 - 1. Install space temperature and humidity sensors where shown on drawings.
 - 2. Where sensors may be affected by diffuser throw patterns, coordinate with engineer to determine acceptable location.
 - 3. Strap-on temperature sensing elements shall not be used.
 - F. Outside Air Master Temperature Sensor
 - 1. Coordinate with Owner to determine location.
 - 2. Anchor securely to structure.
 - G. High Precision Temperature Sensors
 - 1. Install sensors in locations with adequate distance from mixing points to ensure complete mixing.
 - H. Pressure and Flow Sensors
 - 1. Install in locations that ensure accurate sensing.
 - 2. Avoid areas that will interfere with maintenance access.
 - I. Air Static Pressure Sensors
 - 1. Install where shown on drawings or 2/3 airway distance down main duct.
 - 2. Sensors should be installed with adequate "straight" duct upstream to ensure accuracy.
 - J. Air flow Sensors
 - 1. Install where shown on drawings and per manufacturer's instructions.
 - 2. Sensors shall have 3' of straight duct upstream and 2' downstream. Coordinate with duct installer. Notify Engineer in writing if required straight duct has not been provided.
 - K. Liquid Flowmeters
 - 1. Flowmeters shall be installed with at least 10 diameter of straight pipe length upstream and five diameter of straight pipe length downstream.
 - L. Current Switch
 - 1. Motor Status: The contractor shall provide and install a Current Sensing switch on any motor required to have motor status. One phase of the motor power feed shall be routed through the aperture of the current sensing switch.
 - M. Automatic Control Dampers
 - 1. Permanently mark shaft as to indicate damper position.
 - 2. Install in accordance with manufacturers written instructions, rough-in drawings, and detail drawings.
 - N. Control Valves and Actuators
 - 1. Install control valve actuator vertically (above the pipe) whenever possible.
 - 2. Valves installed such that the actuator is below a horizontal position will not be accepted.
 - 3. Provide ample maintenance access.
 - 4. Permanently mark shaft as to indicate valve position.
 - 5. Install in accordance with manufacturers written instructions, rough-in drawings, and detail drawings.
 - O. Damper Operators
 - 1. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.
 - 2. Actuators shall not be mounted in the air stream unless installed within an air handling unit.
 - 3. Multiple actuators operating a common damper shall be connected to a common drive shaft.
- 3.3 GRAPHICS
- A. The SI shall create site layout color graphics that form an intuitive dynamic hierarchal graphical interface for displaying data generally configured as follows:

- B. First Level – Campus-wide data:
 - 1. Campus site plan with drill-down links to individual buildings.
 - 2. Campus CHWS and CHWR temperatures for campuses with hydronic hot water systems.
 - 3. Campus HWS and HWR temperatures for campuses with hydronic hot water systems.
 - 4. If any space temperature or relative humidity level in a building is in an alarm state, the building graphic shall be displayed in red.
- C. Second Level – Building specific data:
 - 1. The second level graphic screen shall provide the building floor plan with the HVAC system ductwork and equipment diagrammatically shown.
 - 2. Individual space temperatures shall be displayed.
 - 3. The follow data shall also be displayed, if available.
 - a. Relative humidity levels
 - b. HVAC Supply air temperatures
 - c. Operating mode
 - d. For Central Plants, show equipment alarms
- D. Third Level – Equipment specific data:
 - 1. The third level graphic screen shall provide complete data for specific HVAC equipment.
 - 2. For Central Plants, provide complete system diagrammatically represented with all components. (i.e.: for an air-cooled chiller plant, diagram shall indicate all chillers and pumps connected by piping to represent the complete system. Separate major system onto independent graphic screens, such as chilled water and hot water systems.
- E. Data shall be displayed on the graphic in the location of actual measurement (i.e.: Chilled water bypass water temperature shall be shown next to a bypass pipe).
- F. Refer to the system point I/O summary for data to be displayed. If the I/O summary is not provided, all points required by the sequence of operations shall be displayed to optimize system performance analysis and speed alarm recognition. Provide as a minimum the following graphics.

3.4 VERIFICATION

- A. After control components have been installed and connected, test, adjust and re-adjust as required all control components in terms of function, design, systems balance and performance.
- B. Control devices, linkages and other control components shall be calibrated and adjusted for stable and accurate operation in accordance with the design intent and to obtain optimum performance from the equipment controlled.
- C. All control valves shall be stroked and spring ranges verified and set.
- D. All dampers shall be stroked to verify proper and smooth operation.
- E. Cause every device to automatically operate as intended to ensure its proper functionality. Make systems ready for acceptance tests.

3.5 DEMONSTRATION

- A. Demonstrate complete and operating system to Owner's representative.

37. 15930 - AIR TERMINALS

- A. Specify leaving air temperature sensors for VAV boxes.
- B. Preferred Manufacturers:
 - 1) Envirotec
 - 2) MetalAire
 - 3) Titus

4) Price

38. 15936 - AIR OUTLETS AND INLETS

- A. Intake louvers shall have 1/4" x 1/4" minimum mesh screen.
- B. Louvered supply diffusers are preferred. Perforated diffusers are not acceptable.
- C. Louvered return grilles are preferred. "Egg crate" or perforated return air grilles are not acceptable.
- D. Do not locate fresh air intake near pollutant sources such as bus loading docks, dumpsters, cooling towers, or exhaust stacks.

39. 15950 – SEQUENCE OF OPERATIONS

A. General

- 1) The refrigerated walk-in cooler and freezer shall be monitored by the Control Panel for alarm purposes and data recording. In the event of a temperature exceeding setpoint (Owner defined set-point) an alarm email shall be generated and sent to listed Facilities Services personnel, as supplied by Owner. Multiple levels of alarm shall be available, depending upon the severity of the conditions, and messages sent via email and/or text messaging to multiple operators. System shall be capable of sending messages to 32 different operators as a minimum. Owner shall have the capability to modify alarm messages and change programming to direct different levels of alarms to different operators as desired.
- 2) A visual indicator light shall be included on the monitoring control panel and shall be located in a highly visible location in the kitchen area.
- 3) Power for the monitoring panel shall be taken from the same circuit as power operating the freezer/cooler equipment or emergency power circuit as available. An uninterruptible power supply (UPS) shall be provided to allow operation of the monitoring panel for a minimum of 10 minutes after power failure and to enhance reliability of the system due to power fluctuations.
- 4) Data monitoring and trending graphs shall be provided to monitor each point in the system. All data shall be viewable through the district Ethernet using any computer in the network via a standard web browser (internet explorer). Security password protection shall be provided and shall including a minimum of 256 user defined operators.

40. 15955 - DDC CONTROL SYSTEM

A. General

- 1) All systems must be BACnet compatible.
- 2) Include sequence of operation on plans and in O & M manual.
- 3) Energy Management Systems that do not have a proven track record in the district must be evaluated by the Owner before the equipment may be specified.
- 4) DDC Control System Manufacturers:
 - a) Alerton (Brooks Air Systems)
 - b) Kreuter Manufacturing Corp. (KMC) (ABC Systems)
 - c) Trane (Trane – Orlando)

B. Software

- 1) The software shall be Microsoft Windows compatible with VCS operating system and use standard Windows command structure. Software shall backup all devices and data.
- 2) Software shall be provided as part of the project. One additional copy needed by offsite monitoring systems shall also be provided at no additional charge.
- 3) All software site licenses, dongles, hardware keys, and specialized cards shall be provided with the job.

- 4) Software shall enable graphic viewing of all commands and status; allow programming, schedule changes and over-ride command without leaving the program shell.
- C. Hardware
 - 1) Control device motors (dampers, etc.) shall be 24 volts ac type with all electrical power requirements and service lines/locations clearly noted on the construction drawings. The mechanical engineer shall ensure the drawings are coordinated with electrical.
 - 2) All control wiring shall be in conduit with the exception of concealed ceiling cavity areas where cable (plenum rated if necessary) may be utilized.
 - 3) Fiber optic cabling shall be used to interconnect buildings.
 - 4) Wall Temperature Sensors:
 - a) Shall be user adjustable.
 - b) Shall have software limits.
 - c) Shall provide LED display.
 - d) Shall have override capability.
 - e) Humidity Sensors
 1. Provide at least one space mounted humidity sensor for each AC unit or AHU.
- D. Unit Controls
 - 1) Shall be capable of stand-alone operation.
 - 2) Shall have trunk surge suppression built on board, optical isolation preferred.
 - 3) Shall operate satisfactorily with basic communications cable such as 18/2. Controllers needing low capacitance wire will not be used.
 - 4) Shall provide EEPROM backup (requiring no backup power or battery) to retain programming during extended power loss.
 - 5) Shall be backward compatible to previous revisions of firmware and software.
 - 6) Shall have header plugs that allow easy change out of controllers.
 - 7) Shall have an active status LED as well as a communications status LED for troubleshooting.
 - 8) Shall employ standard networking standards.
- E. Project Closeout
 - 1) At the completion of the job, the following items shall be included in the O & M manuals:
 - a) Trending: After substantial completion is awarded, the control system shall trend space temperature (actual and set point) and space humidity levels for two weeks. The engineer shall require the contractor to provide 14 one-day graphs for entire two-week period. Final completion shall not be granted until one week of acceptable space temperature and humidity trends are provided to the Owner.
 - b) Complete set of technical manuals.
 - c) Sequence flow charts and text descriptions of all programming logic.
 - d) Detailed circuit diagrams.
 - e) Verification of a minimum of 8 hours technical training to be provided to the Energy Management department, Facilities Maintenance Technicians and technical staff and a minimum of 8 hours general training for school personnel.
 - f) One complete back-up copy of the User Defined Program.
 - g) Equipment information form shall be completed (see attachments).

41. 15971 - ELECTRONIC TEMPERATURE CONTROLS

- A. Thermostat wire shall be a minimum of 18 gauge or larger depending on length of run.

42. 15975 - VARIABLE FREQUENCY DRIVE

- A. VFD's shall have a manual bypass feature.
- B. Preferred Manufacturers:

- 1) ABB
- 2) Square D
- 3) Danfoss

43. 15991 - CONTRACTOR TEST AND BALANCE

- A. The contractor shall schedule the Owner's TAB agent to perform an initial walkthrough 14 days prior to substantial completion.
- B. The construction documents shall specify that the mechanical contractor is responsible for coordinating their work with the owner's test and balance agent. All discrepancies, drive changes, etc. reported by engineer or owner's test and balance agent shall be corrected by contractor within five calendar days at no additional cost.
- C. The contractor shall provide a 3-ring binder labeled "Startup and Commissioning Forms" on-site with the permit drawings. During the course of construction, the contractor shall document the startup of each piece of equipment and file a copy of each startup form in the binder. The binder contents shall be reviewed by the engineer at each construction meeting and shall be made available to the TAB agent.

44. 15992 - OWNER TEST AND BALANCE

- A. VCS shall provide a test and balance agent through a contract separate from the project.
- B. The engineer shall coordinate with the TAB agent and provide plans, specifications, and technical assistance as required.

45. 15995 - SYSTEM STARTING / COMMISSIONING

- A. The contractor shall commission all mechanical systems and controls.
- B. The contractor shall provide copies of the Startup/Commissioning reports to the engineer and the Owner's TAB Agent.

NOTES

1. When possible, eliminate gravel and other materials in enclosure for air conditioning equipment. Concrete pad is preferred.
2. Provide a ten (10) year warranty on all screw compressors.
3. Factory performance testing (Witness Test) for two (2) Volusia County School District employees paid for by the Contractor for each high efficiency water-cooled and air-cooled chiller built.

DIVISION 16 ELECTRICAL

1. Provide appropriate number of spare lamps, fuses, etc. commensurate with scope of work.
2. Provide three (3) sets of Operating and Maintenance (O & M) manuals covering all systems and equipment.
3. On renovation projects, engineer shall require certification of disposal per Florida Statute 403.7186 for mercury containing lamps and devices.
4. All empty/spare conduits shall have pull strings with labeling tags at each end and sealed.
5. Surge protection shall be included on service entrance and all line voltage panels with breaker. Devices to be UL1449, 3rd Edition, and installed per the "Typical Surge Protection Device (SPD) Panel Installation" sketch (see Attachments section of this manual).
 - A. Use a voltmeter to check all voltages to ensure correct SPD.
 - B. If unit has Flush Mount option, refer to Flush Mount installation instructions following.
 - C. If SPD has dry contact, pre-plan its installation.
 - D. Remove power for panel. Confirm panel is deenergized.
 - E. Identify breaker location and SPD location.
 - F. Remove an appropriately sized knockout from panel.
 - G. Mount SPD, use appropriate weatherproofing equipment as needed.
 - H. Connect conductors as appropriate – short and straight as possible (note that Hi-Legs are Phase B).
 - I. Label or mark conductors as appropriate (neutral: white, ground: green, energized: black, hi-leg: orange).
 - J. Make sure system is bonded per NEC and is clear of hazards or faults before energizing (N-G bonding not per NEC will fail SPD: #1 cause of SPD failures).
 - K. Energize and confirm proper operation of indicators and/or options.
 - L. A sealing O-ring is provided. SPD can be chase-nipple mounted (nut is provided).
 - M. Note that any conduits must be installed correctly.
6. Surge protection shall be included on all low voltage system cables entering/exiting buildings that connect to electronic equipment.
7. Lightning protection shall be evaluated for all buildings including Physical Education (PE) pavilions per FBC Section 423.
8. The specifications shall require a pre-construction existing condition check of all equipment and system affected by a construction project. The contractor shall provide a written report to the owner noting all deficiencies. The contractor shall be responsible for all subsequent deficiencies not noted in the report.
9. BASIC METHODS AND MATERIALS
 - A. All conductors and buss bars shall be copper.
 - B. All raceways shall have an insulated copper equipment-grounding conductor sized per NEC.
 - C. Conduit fittings shall be steel.
 - D. Flexible metallic conduit shall be steel.
 - E. Electrical nonmetallic conduit (ENT) shall not be used.
 - F. Nonmetallic surface raceway shall not be used for power or fire alarm wiring.
 - G. Branch circuit conduit home runs shall be 3/4-inch minimum.
 - H. The conduit systems and junction boxes in non public or concealed spaces shall be color coded as follows:

Color Code for Junction Boxes	Paint Color
System Emergency 277 / 480 volt	Red
System Emergency 120 / 208 volt	Light Red
Fire Alarm	Orange

Color Code for Junction Boxes	Paint Color
Normal Power 277 / 480 volt	Brown
Normal Power 120 / 208 volt	Black
Fiber Optics	Purple
Sound System	Yellow
Clock	Light Blue
Intercom	Blue
Computer/Data	Gold
TV	White
Security / CCTV	Beige
HVAC Controls	Violet
Paint bands shall be 4" in length spaced at 20 ft. intervals.	

- I. Coastal areas (East of US 1) shall use PVC or PVC coated rigid conduit and NEMA 4X enclosures for exterior exposed locations. PVC shall not be used where subject to physical damage.
- J. Expansion fittings shall be provided in exposed conduit runs over 100 feet, at building expansion joints and in conduit runs between buildings.
- K. No splices shall be made in underground/flush in-grade pull boxes without approval by the Owner.
- L. Underground conduit shall be a minimum of 24" below grade.
- M. All trenching at existing facilities shall be done by hand unless approved as otherwise by the Owner.
- N. Conduit shall not be run on roofs without approval by the Owner.
- O. Wall plates shall be brushed stainless steel or nylon.
- P. Designated computer outlets shall be black.
- Q. Devices shall be specification grade 20 amps rated minimum.
- R. Exterior terminal cabinets shall have lockable covers.
- S. "MC" cable not permitted; exception may be made by Owner.
- T. Use Liquid Tight Steel Flex with appropriate fittings for motors in wet or damp locations.
- U. General purpose outlets in a classroom shall all be on the same circuit.
- V. Conduit or wiring shall not be allowed to run exposed across any roof.
- W. All junction boxes shall be labeled with panel and circuit designations.
- X. Limit use of floor outlets.
- Y. Provide appropriate access to all equipment for servicing.

10. SERVICE AND DISTRIBUTION

- A. Main service and distribution panels shall have minimum ten percent (10%) spare capacity, with twenty percent (20%) spare breakers. Spares are for Owner's use only, not the electrical contractors'. Provide volt/amp meter on all main service panels.
- B. Engineer shall show load calculation and panel schedules on plans.
- C. Equipment shall be limited to Square "D", General Electric, Seimens and Cutler Hammer.
- D. Design consideration shall be given to accommodations for non-linear loads including "K4" (minimum) rated transformers and oversized feeder neutrals. In multi-wire branch circuits that serve computers or other non-linear loads, a separate neutral conductor shall be installed for each circuit. The neutral shall be the same wire size as the branch circuit conductor. 20 Amp branch circuit conductors shall be sized as follows: lengths of 0-100 feet shall be #12 AWG, lengths of 101-175 feet shall be #10 AWG. All lengths are total length from circuit breaker to first outlet.
- E. Panel directories shall be typed for new installations or when circuits are added to existing panels.
- F. For new schools, engineer shall provide one 120/208 volt, 400 amp 3 pole circuit breaker with a 4-inch conduit stub-out for future portable classrooms. The breaker and conduit stub-out should be located as close to portable site as practical. This is not part of spare service capacity and should be included in service calculation as a load.
- G. All sources of strong electro-magnetic fields shall be located to minimize exposure in normally occupied space.
- H. Generator installations shall specify Kohler, Caterpillar and Generac generators. Diesel fuel is preferred, with an automatic transfer switch, exerciser and phase loss monitor.

- I. Provide generator power to all MDF/IDF locations per Premise Distribution section of these guidelines and fire alarm / intercom systems.
- J. Generator rooms should be provided with a battery powered light fixture.
- K. Generator installation shall include an amp meter located in the same room as the transfer switch.
- L. Provide isolation pads between generator legs and concrete to prevent rust.
- M. Protect generator against wind debris damage.
- N. All transformers to have copper windings.

12. LIGHTING

- A. Interior lighting shall be fluorescent type with Magnetek electronic ballasts and T8, 4100K, 80 CRI lamps or equal made in the USA.
- B. Two (2) lamp fixtures wired in a master/slave arrangement using one (1) four-lamp ballast should be used wherever possible. Fixtures shall be 2'X4'.
- C. Exit lights shall be LED type.
- D. Exterior lighting shall be LED type.
- E. Exterior lighting shall be controlled by the Building Automation System (BAS).
- F. Multiple switches should be provided in all classrooms: one switch to control 50% of all fixtures and one switch to control remaining fixtures. Occupant sensor shall turn lights off when room is unoccupied.
- G. Fixture lens shall be acrylic prismatic type unless matching existing conditions or otherwise directed by the Owner.
- H. Athletic fields: Musco lighting is preferred. Provide remote ballasts and a separate circuit for each pole.
- I. Use only high power factor ballasts, remotely mounted, on all HID fixtures intended of interior or exterior use.
- J. Contractor, at his option, may use UL listed flexible wiring system for lighting fixture branch circuitry above accessible lay-in ceilings. All homeruns, connections to light switches, and branch circuitry for all other ceiling conditions shall be in a conventional raceway system per specifications.
- K. See "Aluminum Canopy Light Fixture Installation" sketch in the Attachments section of this manual.

13. FIRE ALARM

- A. Fire alarm control panels shall be limited to Notifier NFS 320.
 - 1) All fire alarm work shall be done by a factory authorized engineered systems distributor within fifty (50) miles of Facilities Services.
- B. All wiring shall be color coded as follows:
 - 1) Initiating - yellow and brown
 - 2) Indicating - blue and red
 - 3) Control Relays - orange
 - 4) Door Holders - gray
 - 5) 24 Volt Power - black and white
- C. Pull stations shall be double action, non-break glass, DC operated.
- D. Provide interface with security transmitter for remote monitoring of alarm conditions.
- E. Provide fully addressable system with fiber optic backbone (fiber optic between buildings).
- F. Fire alarm operated gas line solenoids shall have key operated reset switches located to assure control by supervisor of service area.
- G. Control panel shall include a key operated HVAC shutdown by-pass and a key operated gas solenoid by-pass for use by service personnel.
- H. On new schools, engineer shall include a terminal cabinet with designated initiating and indicating zone wiring for future portable classrooms. It should be located as close as practical to portable site and include one 1 1/2" conduit stub out.
- I. Exterior unprotected horn/strobe units shall be installed with a "Safety Technology International" 1200 series weatherproof protective cover.
- J. Install "Hazmat" control switch for fire alarm. Provide key switch on remote enunciator in main office to shut down all air handlers currently tied to system and close all fire doors controlled by

the fire alarm system. This will not cause an audible alarm in the buildings and will not activate the fire alert to Security.

K. Install UL listed surge protection and approved grounding at all control panels.

L. Install smoke detector above fire alarm panel.

M. Notifier Fire Alarm Guide

1) Fiber Optic Cable

- a) Fiber type: 62.5/125 micrometers (multimode)
- b) Maximum link loss is 8dbm with 62.5/125 NM fiber
- c) Connectors: ST style
- d) Bend radius not less than 15 times the cable diameter
- e) Provide fiber termination cabinet (i.e.: Corning WCH-02P-1215T with 6 ST style connector or more as required). All fiber strands shall be termination cable (spare or future use)
- f) Fiber patch cable (from fiber term cabinet to fiber module) shall be ST to ST multimode duplex patch cable length as required.

2) Notifier Software

- a) Provide all software and firmware required for end user (Owner) technicians to fully program fire alarm panel(s) and all support devices.
- b) Software shall be "open architecture" version(s) and upgraded versions shall be made available to the Owner, as released by manufacturer of notifier equipment.
- c) Software password shall remain factory default only.

14. INTERCOM

- A. Equipment shall be limited to those systems manufactured by Rauland or Bogen.
- B. Normal line voltage power shall be provided by emergency service.
- C. Uninterruptible power supply (UPS) shall be provided.
- D. Microprocessor based systems only.
- E. Underground cable shall be West Penn "Aqua Seal" or approved exact equal.
- F. On new schools, engineer shall include a terminal cabinet with wiring for 10 portable classrooms. It should be located as close as practical to portable site and include one 2" conduit stub out.
- G. Provide fiber backbone between all buildings.
- H. Administration phones to be used for all areas as required for elementary, middle and high schools.

15. It is desired that three-phase equipment shall have three-phase loss protection monitor to automatically shut down the motor upon loss or reversal of any phase and reset automatically after a delay when normal conditions are restored.

16. Networking equipment requires a 120 volt 30 amp circuit installed with a NEMA L5 30p twist lock connector. This shall be located in the network equipment room at the rack.

17. The language below shall be included in the Electrical Division of the specifications as a separate Electrical Section entitled "TESTS – VERIFICATION - GROUNDING"; number to coordinate with the Electrical Division.

TESTS – VERIFICATION – GROUNDING

Part 1 – GENERAL - N/A

Part 2 – PRODUCTS - N/A

Part 3 - EXECUTION

3.1 TESTS

A. System

1. General: After installation of all conductors, and before final acceptance, make required tests to determine proper functioning of all circuits. Furnish all necessary instruments required to make tests and correct any deficiencies found. Prior to energizing, circuits shall be "rung-out" to verify opens, intentional and non-intentional grounds, continuity and detect short circuits by accepted constant "megger".
2. Procedure
 - a) All wires in conduit that are shorted or unintentionally grounded shall be replaced.
 - b) Insulation resistance of all feeder conductors and all conductors AWG #1 and larger shall be tested. This is to include all new conductors and/or all existing conductors that are connected and/or extended. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps and connections are made except connection to source and point of final termination at distribution or utilization equipment. All testing per ANSI/NETA ATS-2009.
 - c) Insulation resistance of conductors that are to operate at 600 volts or less shall be tested by using AVO Biddle (or accepted equal) Megger at not less than 1000 volts dc. Resistance shall be measured from conductor to conduit (ground). Testing methodology shall conform to short-time or spot-reading procedural recommendations of AVO Briddle Instruments for specific megger being used. Acceptable insulation resistance of conductors rated at 600 volts shall not be less than one (1) megohm.
 - d) Conductors that do not satisfy test requirements (c) above shall be removed, replaced and testing repeated on new cable at no additional cost to the Owner. All tests shall be performed by licensed electrician trained in the use of test instruments. Contractor shall furnish all instruments and personnel required for tests shall tabulate readings observed and complete "Conductor Insulation Resistance Test" form (attached) and submit five (5) copies to Engineer for acceptance. Test shall be witnessed by Owners representative and Engineer (if so desired). Final acceptance data is to be submitted in O&M Manual.
 - e) Test reports shall identify each feeder conductor tested, date, time, result of test, weather conditions, range, test voltage and serial number of the megger instrument used. Any conductor or splice that is found defective shall be promptly removed and replaced; additional test shall be performed.
 - f) Observe all safety instructions set by testing equipment manufacturer. Application of voltage testing involves risk of electric shock and sparking.
3. Take readings of voltage and amperage at building main disconnect switch and at main for each panel, at primary and secondary side of each transformer and at the end of the longest branch circuit at each panel. The above readings shall be taken (1) "no load" conditions and (2) "full load" conditions with all equipment using electricity. Tabulate readings, complete Voltage & Amperage Readings - Tabulated Data" form (see Forms section of this manual) and submit five (5) copies to the Engineer for acceptance. Final accepted data is submitted in the O&M Manual.

B. Grounds

1. Test each raceway for raceway continuity.
2. Test each grounding system used in the project.
3. Submit "Ground Test Information" form (see Forms section of this manual) for each and every grounding system in the project including but not limited to: each ground rod installation; each water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment); and each building steel ground connection (test building steel to ground and test building steel to building service equipment).
4. Grounding resistance shall be as called for in "Conductor Insulation Resistance Test" form (see Forms section of this manual).
5. Testing shall be three (3) point method in accordance with IEEE.
6. Provide ground ring encircling each building and connected to each building periodically.

C. Ground Resistance

1. Main Electrical Service (to each building) and Generator Locations
 - a) Grounding resistance measured at each main service electrode system and at each generator electrode system shall not exceed 5 ohms.
2. Other locations
 - a) Resistance to ground of all non-current carrying metal parts shall not exceed 5 ohms measured at motors, panels, busses, cabinets, equipment racks, light poles, transformers and other equipment.
 - b) Lightning Protection system ground locations shall not exceed 5 ohms for the Franklin system measured at ground electrode.
3. Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two (2) or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two (2) or more rods connected together but not connected to the grounding electrode conductor.

D. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor). Depending on soil condition, etc of ground rod locations it has been found that the ground rod lengths required to achieve the specified resistance may range from the minimum specified length to up to 80 feet or more in length.

E. Provide grounding well with cover at each rod location. Install grounding well top flush with finished grade.

F. Verify that final backfill and compaction has been completed before driving rod electrodes.

G. Install ground rods not less than 1 foot below grade level and not less than 2 feet from structure foundation.

18. The language below shall be included in the Electrical Division of the specifications as a separate Electrical Section entitled "REGULATORY REQUIREMENTS"; number to coordinate with the Electrical Division.

REGULATORY REQUIREMENTS**Part 3 - EXECUTION****3.1 Regulatory Requirements**

- A. Conform to all applicable requirements of the following codes, standards, guidelines, etc. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any codes or laws.
 1. Standards and Miscellaneous Codes / Regulations (comply with latest edition or notice available unless otherwise adopted by Authority having Jurisdiction)
 - a) Americans with Disabilities Act (ADA)
 - b) American National Standards Institute (ANSI)
 - c) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - d) American Society of Mechanical Engineers (ASME)
 - e) American Society for Testing and Materials (ASTM)
 - f) Concrete Reinforcing Steel Institute (CRSI)
 - g) Department of Community Affairs (DCA)
 - h) Electronics Industries Association / Telecommunications Industry Association (EIA/TIA)
 - i) Institute of Electrical and Electronics Engineers (IEEE)

- j) Illumination Engineering Society (IES)
 - k) Local Power Company Requirements (LPCR)
 - l) Lightning Protection Institute (LPI)
 - m) Local Telephone Company Requirements (LTCR)
 - n) National Energy Conservation Policy Act (NECPA)
 - o) National Electrical Safety Code (NESC)
 - p) National Electrical Manufacturers' Association (NEMA)
 - q) National Fire Protection Association (NFPA) Codes and Standards as adopted by Authority having Jurisdiction including the National Electrical Code (NEC)
 - r) The Occupational Safety and Health Act (OSHA)
 - s) Sheet Metal and Air Conditioning Contractors (SMACNA)
 - t) Underwriter's Laboratories Inc. (UL)
 - u) Applicable Florida Statutes and Referenced Codes / Standards
 - v) All Federal, State, Local Codes, Laws and Ordinances as applicable
 - w) Florida Building Code 2007 Edition
2. Local School Board Requirements
- a) School Board of Volusia County Florida
 - 1) Guidelines for the Design and Construction of Educational Facilities for Volusia County Schools (current edition).
 - 2) Volusia County Schools Television System Standards
 - 3) Volusia County Schools Security System Standards

SECURITY / INTRUSION DETECTION

1. The criteria below apply to new construction, renovations and redevelopment projects. Electrical Engineer shall coordinate work with VCS Facilities Communications Department and Construction Project Manager.
2. Elementary schools– provide motion detectors in first floor perimeter rooms with doors or windows, all entrances and all hallways, administration, media center, cafeteria and computer labs. Isolate buildings by zone.
3. Middle and High Schools – provide motion detection in areas of circulation and access with particular attention to identified spaces: gymnasium, labs, administration, media center, cafeteria and computer labs.
4. On any new security installation or new construction, sufficient capacity shall be provided in the security system control panel that more spaces can be added over the life of the campus.
5. Provide peepholes and doorbell in kitchen / food service exterior rear doors with adequate exterior lighting. Doorbell shall be audible in the Kitchen Manager's Office.
6. Contractors working on an existing school site shall have a plan established to address security emergencies, which may occur. This should include lock-downs of the campus, fire alarms, vandalizing and severe weather.
7. The contractor, subcontractors and all personnel shall abide by the School Board of Volusia County Florida security procedures while on site.
8. See Article 9, this section, for wiring and conduit requirements.
9. G. E. equipment shall not be specified.

PRODUCTS / PRODUCT NOTES

1. SECURITY SYSTEM CONTROL PANEL

- A. The security system contractor shall furnish and install equipment specifically designed and programmed as a complete operating security system base on a Notifier NFS-640 system, no substitutions.
- B. Each device shall annunciate individually and distinctly at the control panel. System shall have up to 32 zones of annunciation to the RTU.
- C. Unit shall be complete with enunciator driver board (32 contacts) which shall interface to the radio transmitter described below.
- D. Unit shall be provided with a minimum 5 amp power supply with backup battery and charging circuit.
- E. Hand set and speaker shall be in a common area (office or section of the office)
- F. Security panel shall have clearly identified spares for portables areas and future buildings.
- G. Each building shall have 2 clearly identified spare zones for home runs.
- H. Security panel shall have a 20 Amp 120v AC dedicated circuit.
- I. Every zone from the security panel to the radio unit (including grounds) shall be clearly identified.
- J. All security panels and sub panels shall have terminal blocks not phone or scotch blocks
- K. All sub panels shall be grounded
- L. All sub panels shall have battery backup
- M. All sub panels shall have terminal blocks, not phone blocks

2. RADIO TRANSMITTER

- A. Contractor shall provide and install two way radio system which communicates with like units by way of coded FM signals
- B. Radio unit shall be Motorola ACE3600 Remote Terminal Unit
- C. Unit shall be capable of monitoring and control of discrete or analog functions and shall be interfaced to the security system control panel.
- D. Unit shall include a 115 volt power supply with a 5 ampere-hour backup lead-acid battery. The power supply shall provide for 7amp/15 volt load battery charger, AC power failure detection, low battery detection, battery disconnect mechanism and a 30 second time-out timer during power outage.
- E. Radio unit may be located next to security panel, in a mechanical room or another systems room; they do not have to be in the Main Office.
- F. All radio units shall be grounded
- G. All radios shall have a polyphaser
- H. All radio units shall be tested for SWR reading, antenna power output and radio specs. Coordinate testing with Facilities Communications Department.

3. MOTION DETECTORS

- A. Provide motion detectors where shown on plans.
- B. Detectors shall be dual microwave / PIR type, a combination of microwave and passive infrared technologies, Duel Tech DT-7450c or approved equal.
- C. Detectors shall have Fresnel lens and multi-segmented PIR mirror. Additional lens shall be provided to block outer PIR zones for narrow application.
- D. Detector shall have automatic temperature compensation.
- E. An addressable interface module shall be provided at each detector to interface with the security system data loop.
- F. Every building shall have its own internally located power supply unit to provide power for motion detectors
- G. Motion detectors shall be mounted 7'6" AFF or as specified for that motion detector.
- H. Long range motion detectors shall face hallways, or areas designated for protection as to achieve maximum coverage.
- I. All motion detectors that are in high risk areas (gym, locker rooms, etc) shall be protected by cage.
- J. Door contacts, if required, shall be Form "C" contacts

K. Window contacts, if required, shall be Form "C" contacts

4. SECURITY CAMERA SYSTEM / DVR

A. Security cameras are to be installed in new facilities in the allocations outlined below; coordinate locations with the Facilities Communications Department.

- 1) Elementary Schools: 0
- 2) Middle Schools: 24
- 3) High Schools: 32
- 4) School Way Café: 8 – provide in kitchen; exact areas to be determined by Facilities Communication Department

B. DVR shall be IC Realtime or approved equal; software shall be compatible.

C. Cameras shall be Digital Watchdog or approved equal.

D. Provide conduit between all buildings terminating in main office; coordinate location with the Facilities Communications Department.

5. ANTENNA

A. Antenna shall be no more than 100 feet from radio unit

B. Antenna feed line shall be LMR400 (Belden), no substitutes.

C. All antennas shall meet wind loading requirements as required by code.

D. All conduit for antenna pipe shall be grounded

6. WIRING

A. Prefer all wiring to be in conduit

B. If wiring is free wired, shall be properly supported. A/E shall provide details of above ceiling wiring supported plans.

C. All wiring shall be marked and labeled

D. If copper wiring is used from building to building it shall have surge protectors at each end.

E. Provide CAT 6 cable from radio unit to external hand set. Provide 2 conductor 18 gauge stranded wire for speaker system.

F. All wiring to motion detectors shall be at least 18 gauge stranded copper.

G. Every building shall have its own clearly identified home run.

H. All wiring from building to building at long distances shall be 14 gauge or larger depending on distance

7. TESTING

A. All systems installed shall be tested for compliance with VCS standards by contractor and the VCS Facilities Communications Department; coordinate with the Construction Project Manager.

**CLOSED CIRCUIT TELEVISION SYSTEMS, K-12
TECHNICAL SPECIFICATIONS**

1. Pre-Construction Design Process

A. Prior to system design, an initial meeting will take place between the Facilities Communications supervisor, the architect, and the engineer. At this meeting the Facilities Communications supervisor will be provided with information regarding the scope of the project.

B. Following the initial meeting, the Facilities Communications supervisor will provide the architect and engineer with up-to-date system information, conduit routing, specifications, Owner provided equipment options and drawings as needed for the project.

C. The preliminary design shall be submitted to the Facilities Communications supervisor for acceptance. This design will include:

- 1) Cable routing and footage for each run.

- 2) Type of cable to be used on all runs.
 - 3) Conduit layouts and riser diagrams.
 - 4) Input and output levels of all devices.
 - 5) Manufacturer's specifications for all contracted equipment.
 - 6) Architect's Closed Circuit Television Specifications.
 - D. The Facilities Communications supervisor will review the preliminary design, and return the approved/corrected version to the architect or engineer.
 - E. If corrections are necessary, the Facilities Communications supervisor will repeat the review process above. When the design is approved, the architect may submit the specifications to the School Board.
 - F. All equipment submittals shall be sent to the Facilities Communications supervisor for review and approval prior to construction. All changes to these specifications shall be included with the submittals.
2. The technical specifications below shall be considered base minimum for all projects, architect/engineer may modify to reflect actual project but any modifications shall be coordinated with the Owner.

Section 16780

School Closed Circuit Television Systems, K-12

Part 1 - General

1.01 Summary

- A. School Closed Circuit Television systems shall be included in construction of instructional areas, and in accordance with the current issue of Technical Specifications – Closed Circuit Television Systems, K-12.
 1. Television reception shall be provided in all instructional areas, in administrative, and conference areas as requested.
 2. All headends shall be located in the work core of the school media center.
 3. When construction includes a new or renovated media center, a new CCTV headend will be included.

1.02 Section includes

- A. These specifications call for the furnishing of all equipment, materials and services necessary to provide a complete and operating television distribution system for a school of the School Board of Volusia County. Omission of minor items in these specifications does not relieve the contractor of any responsibility for providing a complete and operable system. Work shall be done in a professional manner in compliance with all Federal, State, and local laws, codes and regulations, VCS-project manuals and drawings, and these specifications.
 1. Electronic equipment shall be specified "Professional Grade" from "Blonder Tongue Laboratories, Inc."
 2. Each system shall be designed to perform in the following manner:
 - a. Be capable of transmitting RF modulated signals from the headend on selected CATV channels (1.6).
 - b. Deliver a minimum of +5 dBmV and a maximum of +12 dBmV signal level on CATV Channels (55-550 MHz) to each receiving outlet from the school headend.
 - c. Be designed to pass sub-band return frequencies (5-30 MHz).
 - d. Provide local origination needs on a per project basis (1.04.B).
 - e. Meet all detailed requirements of contract system drawings and schematics.
 3. These specifications shall become part of the Project Manual, Contract or Purchase Order.
 4. Information contained within these specifications is as accurate as possible; however it is the contractor's responsibility to verify all performance.

1.03 Technical Specifications

- A. Technical Specifications – Closed Circuit Television Systems, K-12, specify requirements for design and installation of a full or partial television distribution system. Each system shall be capable of delivering a signal on all channels of +5 dB to +12 dB @ 75 ohms to all receiving outlets.
 - 1. Design guidelines:
 - a. Low Output Modulators (40 dB).
 - b. (Rack mount) channel combiner.
 - c. (Rack mount) distribution amplifier.
 - d. Amplifier inputs (headend or field distribution) will be attenuated, and/or equalized to provide 15 dB on all channels.
 - e. Maximum signal slope allowed will be 7 dB.
 - f. Amplifiers will operate at 44 dB @ 550 MHz (Ch. 78), 40 dB @ 212 MHz (Ch. 13), and 37 dB @ 55MHz (Ch. 2).
 - g. No more than one field amplifier is allowed on any one trunkline.
 - h. All CCTV distribution runs from building to building will be made with .500 cable or larger.

1.04 Inspection, Testing and Documentation

- A. Upon completion of the system in each school, and prior to the inspection and approval of the system, the contractor shall send a complete set of "as-built drawings" to the Owner. The design schematic shall include, but not be limited to:
 - 1. Cable routing and lengths.
 - 2. Cable size and cable transition information.
 - 3. All active and passive components and their locations.
 - 4. Amplifier input and output levels.
 - 5. Tap values and levels at each CCTV outlet.
 - 6. Manufacturer's schematics and service information.
 - 7. The contractor may use the sample as-built form to record the classroom receiving outlet tap values and signal levels.
- B. The site shall be cleaned prior to the CCTV System Test. All CCTV terminal cabinets, headend counters, drawers, shelves, and surface mounted raceways shall be cleaned, dusted, and free of all debris and contamination.
- C. The contractor/installer shall execute a CCTV system test in the presence of the Facilities Communications supervisor, or designee. The contractor shall furnish equipment necessary for the Proof of Performance. Required test equipment:
 - 1. 1 each DVD player.
 - 2. 1 each portable color receiver/monitor.
 - 3. 1 each calibrated signal level meter.
 - 4. DVD player with color bars and tone or color bar generator.
 - 5. Required cables and adapters.
- D. A one-year warranty of equipment, cable and installation is required. The warranty period begins after the Facilities Communications supervisor has completed the Systems Test inspection, and has documented that the system is substantially complete. This transmittal shall be sent to the Owner.
- E. Deviations from the current issue of Technical Specifications – Closed Circuit Television Systems, K-12, without prior approval from the Facilities Communications supervisor shall not be accepted.

1.05 CCTV Headend Channel Assignments

A. Elementary Schools

Channel T9-4	field origination modulator
Channel 5	TV production modulator
Channel 8	ITV signal processor
Channel 10	headend modulator tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators
Channel 12	headend modulator tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators
Channel 13	headend modulator & 550 MHz test tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators

B. Middle Schools

Channel T9-4	field origination modulator
Channel 5	TV production modulator
Channel 10	headend modulator tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators
Channel 11	headend modulator tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators
Channel 12	headend modulator tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators
Channel 13	headend modulator & 550 MHz test tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators

C. High Schools

Channel T9-4	field origination modulator
Channel 5	TV production modulator
Channel 7	headend modulator tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators
Channel 10	headend modulator tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators
Channel 11	headend modulator tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators
Channel 12	headend modulator tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators
Channel 13	headend modulator & 550 MHz test tuners must have digital and analog inputs (DVD players or tuner boxes) for the input of the modulators

PART 2 - Products

2.01. Amplifiers, Modulators and Processors

NOTE: Since amplifier and modulator models are constantly being revised, the list below represents a design ideal for estimating purposes only. Equipment submittals are considered critical to the success of the project, therefore the Facilities Communications supervisor shall be the sole authority on acceptable CCTV and CATV components.

A. Headend Distribution Amplifier – Used to amplify headend modulators and processors.

Specifications:

Hybrid technology: power doubling

Frequency range: 50-550 MHz

Gain: 33 dB (full gain, 0 slope)

Output level (max.): +44

Gain control range: 15

Slope control range: 10
Composite triple beat: >60 dB (at rated output)
Mounting: rack mount

Blonder-Tongue, RMDA 550-30P, or approved equal.

- B. Broadband Distribution Amplifier #1 (30 dB) – Used as a CATV amplifier or as a CCTV amplifier in a Television Terminal Cabinet (TVTC).

Specifications:

Hybrid technology: power doubling
Frequency range: 5 to 30 & 45-550 MHz
Gain: 32 dB (full gain, 0 slope)
Output level (max.): +44
Gain control range: 10
Slope control range: 10
Composite triple beat: >58 dB (at rated output)
Mounting: surface

Blonder-Tongue, BIDA 55A-30P, or approved equal.

- C. Broadband Distribution Amplifier #2 (43 dB) – Used as a CATV amplifier, or as a CCTV amplifier in a TVTC.

Specifications:

Hybrid technology: power doubling
Frequency range: 5-30 & 47-750 MHz
Gain: 50 dB (full gain, 0 slope)
Noise figure: 7.0
Output level (max.): +44
Gain control range: 10
Slope control range: 10
Composite triple beat: >58 dB (at rated output)
Mounting: surface
Dimensions (WxHxD): approximately 7.14 x 11.5 x 2.6

Blonder-Tongue, BIDA 75A-43P, or approved equal.

- D. Frequency Agile Modulator #1 – Used at the headend to modulate the output of a TV tuner and to test the system to 550 MHz.

The unit shall provide an audio and video modulated carrier on any channel in the 50 to 550 MHz range, and have a SAW filter on the output. FCC Docket 21006 aeronautical frequency offset requirements will be met (+/- 5 KHz video carrier accuracy.) The RF output shall be 40 dB, or greater. Output channels shall be field selectable via front panel controls. The video input connector shall be a BNC. (Rack mount).

Blonder-Tongue, AM-40-550 w/Option 02, or approved equal.

- E. Frequency Agile Modulator #2 – Used in the field to modulate A/V sources into a sub-band channel, and deliver the signal to the headend for processing.

The unit shall provide an audio and video modulated carrier on any channel in the 7 to 450 MHz range, and have a filter on the output. FCC Docket 21006 aeronautical

frequency offset requirements shall be met (+/- 5 KHz video carrier accuracy.) The RF output will be 40 dB or greater. Output channels shall be field selectable via front panel controls. The sub-band output shall be 7 to 50MHz. The video input connector shall be a RCA connector. (Rack mount).

Blonder-Tongue, AM-40-450 with w/Option 04, or equal.

- F. Audio-Video Modulator – Used at the headend to modulate the output of a TV tuner.

The unit shall provide an audio and video modulated carrier on a pre-selected sub-band channel, or CATV band up to 404 MHz, and have a SAW filter on the output. FCC Docket 21006 aeronautical frequency offset requirements will be met (+/- 5 KHz video carrier accuracy.) The RF output will be 40 dB or greater. The channel output will be fixed. (Rack mount).

Blonder-Tongue, MAVM Channelized Series, or approved equal.

- G. Frequency Agile CATV Processor – Used at the headend to select and process the Instructional Television Cable TV, or off-air signal, for CCTV distribution.

The unit shall process CATV signals up to 550 MHz, and have a minimum output level of 40 dB. Channels will be selectable via front panel controls. (Rack mount).

Blonder Tongue, AP-40-550, or approved equal.

- H. Frequency Agile Sub-band Processor – Used at the headend in a sub-band return system to convert the sub-band signal from the field to a CCTV channel.

The unit shall have an input range of -18 to +30 dB, and a minimum output level of 40 dB. Channels will be selectable via front panel controls. (Rack mount).

Blonder Tongue, AP-60-550 w/Option 17, or approved equal.

- I. Headend Combiner – Used at the headend to combine the outputs of multiple modulators and processors.

Minimum isolation requirements between adjacent ports -32 dB, or between any ports -42 dB. (Rack mount).

Blonder Tongue, OC Series, or approved equal.

- J. VHF/Sub-channel Diplexer (2) – Used at the headend, and in the field to separate, or combine the 5 to 30 MHz (sub-band) with the 50 to 1000 MHz (CATV). Impedance: 75 ohms. Return Loss: 14 dB.

Blonder-Tongue, DSV #4375, or approved equal.

- K. Audio-Video Distribution Amplifier – Used at the headend to distribute A/V for videotape duplication.

This unit shall have one input and six outputs. The input shall be looping.

Technical Necessities, MDA-6, or approved equal.

2.02. Drop Passive Devices

- A. Splitter/Combiners – Splitters/combiners shall have a zinc die cast housing and provide better than 100 dB EMI isolation. The bandwidth shall be 5-600 MHz. The “F” ports shall be 1/2” machined. The input and output ports shall be vertical. Surface mount.
- 1) (2-way, 3-way, 4-way, 8-way):
Toner, horizontal XGVS-* Series;
Regal, horizontal Red Label Series;
or, approved equal.
- B. Directional Couplers – Directional couplers will have 1, 2 or 4 tap ports and shall have zinc alloy housing and provide better than 90 dB EMI isolation. The bandwidth shall be 5-600 MHz. The “F” ports shall be 1/2” machined. Surface mount.
- 1) DCs (assorted values)
Regal, RDCT6-* Series;
Blonder-Tongue, CRT Series;
or, approved equal.
- C. CCTV Receiving Outlets
- 1) Permanent classrooms (looping distribution) – Receiving outlets for permanent classrooms shall be single output, enclosed directional coupler, with -80 dB EMI radiation or better. The outlet shall be flush mounted with “F” type connectors on tap input and output ports. The bandwidth shall be 5-900 MHz.

Blonder-Tongue, M-3889, or approved equal.
 - 2) Permanent classrooms (DC-trunk/drop distribution) – Receiving outlets for permanent classrooms shall be single outlet flush. The outlet shall be a “through” type with no isolation.

Blonder-Tongue, TF-GF-FT w/75 ohm terminator, or approved equal.
 - 3) Portable classrooms – Receiving outlets for portable classrooms shall be single outlet flush mounted. It shall be a “through” type with no isolation.

Blonder-Tongue, TF-GF-FT w/75 ohm terminator, or approved equal.
- D. Jumpers – The contractor/installer shall provide pre-made jumper cables for each of the following:
- 1) Classroom receiving outlet (permanent and portable) –
Three RG6 cable assemblies shall be provided for each outlet. One cable shall be installed from the CCTV outlet to the channel tuner. The last cable assembly shall be signed over to a school administrator associated with the project. The cable assembly will have the following characteristics:

Cable type: RG6
Length: 8 feet
Connector: “F” (2 ea.)
Adapter (2 ea.): Screw-on “F” to push-on “F”.

PART 3 - Execution**3.01 Installation, Locations and Workmanship**

- A. The contractor and/or sub-contractor shall install a complete CCTV system in accordance with the VCS approved project manuals and drawings, and these specifications. All materials used in the CCTV system shall be new, and the proper materials for the job.
- B. Electrical grounding, bonding and surge suppression shall be provided and installed in accordance with VCS, Division 16 specifications.
- C. Equipment rack wiring shall utilize a wire management system for neat, well organized wire installation.

3.02 Conduit Installation – General

- A. Exposed interior and exterior cable runs shall be in conduit, excluding equipment harnesses which are to be tie-wrapped.
- B. In new construction, renovations and additions, the trunk/feeder cable(s) shall be in conduit. The trunk routing will be determined by the Facilities Communications supervisor and given to the architect. All conduits from building to building will be 3" in diameter.
- C. Refer to the Electrical Section of the VCS-Project Manual for information regarding the use of Wiremold products, rigid conduit, PVC and EMT.
- D. All conduits, including spares, shall be labeled to indicate the exact location of the other end as follows: "TO BUILDING #, ROOM #."
- E. All conduits shall terminate in a box, cabinet or pedestal.
- F. Spare and future conduits shall appear on the as-built drawings.
- G. All conduits for future cable runs shall contain a nylon pull line, and shall be capped at both ends.
- H. In new construction, a 3" conduit for the CATV drop shall be installed from the media center headend TVEC, to a site determined by the local Cable Company Construction Coordinator.

This conduit shall have a minimum of 24" sweeps and 500 lb. pulling line installed for cable company use.

A stake and flag shall mark the end of the conduit. The stake shall be marked "CATV" followed by the depth of the conduit.

If the total length of the conduit is greater than 1,200', an intermediate above ground pull box shall be established in an electrical room along the conduit path. An electrical duplex outlet shall be provided along with appropriate grounding and bonding for the cable. The box shall be a minimum of 24" x 36" x 8" (WHD), and the base shall be 12" AFF.

- I. In new construction, 1" conduits shall be installed from the media center headend TVEC to the Intercom Room, Telephone Room and main Computer Room.
- J. In new construction and renovations, One, 3" conduit shall be installed for a future satellite interconnect. The conduit shall begin at the TVEC and shall terminate in an area which will allow the antenna to have a clear view of the west/southwest. The termination point will be selected by the Facilities Communications supervisor.
- K. Portable area(s) shall be connected to the CCTV system by one, 2" conduit. This conduit shall begin at the TVTC nearest the portable site(s), and shall terminate at the designated portable systems terminal area. The conduit will be labeled, "CCTV TO PORTABLES." The conduit

shall stub-up 6" above grade, and placed inside of an enclosure. A nylon pulling line shall be installed.

3.03 CCTV Cable Installation – General

- A. All runs of cable shall be continuous lengths except for interfacing with equipment items listed in Part - 2 of these specifications. **DO NOT SPLICE CABLES.**
 - 1) Grounding blocks shall be used for cable type changes only, and shall be noted on the as-built drawings.
- B. Cable runs from building to building will be .500 cable. All other cables shall be type RG6 or RG11. The type and specification dependent on application.
- C. All trunk runs shall use flooded cable, and shall be in conduit.
- D. All exposed cable shall be in conduit, excluding equipment harnesses, which shall be tie-wrapped.
- E. All cable not in conduit shall be supported in cable trays, wiring duct, or by bridle rings. Free cable shall not go unsupported more than 4 feet.
- F. All buildings under construction shall incorporate a Television terminal Cabinet (TVTC) to house amplifiers and passives. All TVTCs shall be 18" x 24" x 6" (WHD). All TVTCs shall have an electrical duplex outlet.
- G. A service loop is required on all cables entering and exiting a TVTC. Store cables neatly around the perimeter of the cabinet.
- H. The female threads of all "F" connectors shall be treated with a light coating of silicone lubricant before the male portion is attached. The outside connector and cable shall be free of silicone. Silicone is not permitted to contact the center conductor or dielectric.

3.04 CCTV Cable Installation – Expansion and Renovations

- A. New trunklines to additional buildings shall home-run to the headend, or nearest TVTC.
- B. When new trunklines are added, the signal levels to the existing system shall not change more than 1.0 dB.
- C. Before the architect designs a CCTV expansion, the Facilities Communications supervisor shall be notified that the headend or building signals need to be verified. The Facilities Communications supervisor will document the signal level readings and transmit the results to the architect.
 - 1) Connections to the existing CCTV system shall be made at the headend or TVTC by means of a directional coupler-tap. The tap shall have less than 1dB thru loss.
 - 2) When the connection is made at the headend, the directional coupler-tap shall be installed at the output of the main distribution amplifier, or the modulator/combiner.
 - 3) When the connection is made at an existing TVTC, the directional coupler-tap shall be installed at the output of the distribution amplifier, or spliced into trunk/feeder cable if there is no amplifier.

3.05 CCTV Cable Installation – Portables

- A. In new construction, the CCTV signal shall be extended to the portable system terminal site from the nearest building TVTC. At the building TVTC, a DC shall be tapped into the CCTV trunkline. An amplifier shall be connected to the tap port of the DC to serve the portables. An RG11 flooded cable shall be connected to the amplifier and shall terminate at the portable system site area.

3.06 Headend Cable and Wire Installation

- A. The audio, video and RF lines to and from electronics and passives shall be cut to length. The cables shall be neatly organized and tied with black plastic ties.
- B. All solder points shall be completely defluxed.
- C. The audio, video and RF lines shall be marked with their equipment/connector identifiers (label or tag).
- D. Self-laminating vinyl or polyester wire markers shall be used for headend equipment labeling. Video and RF markers shall have a 1" x 3/4" white background with a clear wrap. Audio markers shall have a 1/2" x 1/2" white background with a clear wrap.
- E. Plastic ties are not permitted inside of raceways.

3.07 CCTV Equipment Location

- A. All headend equipment shall be mounted as shown on the diagrams attached and/or in the project drawings.
- B. All unused ports shall be terminated.
- C. The Television Entrance Cabinet (TVEC) entrance box shall be a minimum of 24" x 36" x 8" (WHD), and positioned to allow semi-rigid cable to be pulled through the box. The TVEC base shall be 12" AFF.
- D. All TVTC and origination cabinets shall be capable of mounting and easily accessing amplifiers, passives and electrical outlets. All cabinets shall have lockable, full-front doors. The cabinet dimensions shall be a minimum of 18" x 24" x 6" (WHD).
- E. All exterior splitters, taps, grounding blocks and line extenders not mounted in headend equipment racks are to be mounted in weatherproof enclosures.

3.08 CCTV Receiving Outlets

- A. In new construction and renovations of instructional areas when TV wall mounts are used, receiving outlets shall be installed 80" AFF no more than 16" from an AC outlet, which is also 80" AFF. The outlets shall be on or adjacent to the front wall of all classrooms and other instructional areas, on the right, or left side of the chalkboard/tackboard.
- B. In new construction and renovations of instructional areas when TV wall mounts are not used, receiving outlets shall be installed to match the existing outlet height, and be no more than 16" from an AC outlet. The outlets shall be on or adjacent to the front wall of all classrooms and other instructional areas, on the right or left side of the chalkboard.
- C. Receiving outlets in administrative areas shall be installed 16" AFF and no more than 16" from an AC outlet and 36" from a computer outlet.
- D. Cafetorium, gymnasium, and auditorium distribution system designs may vary for elementary, middle and high schools. Specific design information for these areas will be given to the architect and engineer by the Facilities Communications supervisor following the initial meeting.

3.09 Origination Outlets

- A. Two types of origination systems are used in Volusia County Schools – home-run and sub-band return.
- B. Home-run origination points shall be used in renovations of facilities that have an existing home-run origination system. Origination outlet locations shall be determined by the Facilities Communications supervisor and provided to the architect and engineer following the initial meeting.
- C. Cafetorium, gymnasium, auditorium and classroom origination system designs vary for elementary, middle and high schools. Specific design information will be given to the architect and engineer by the Facilities Communications supervisor following the initial meeting.
- D. When home-run origination points are used, the origination cabinet shall be flush mounted 16" AFF. The cabinet shall be 12 x 18 x 6 (WHD), with a full-front, hinged, key lockable door.
- E. Sub-band return origination systems shall be used in new construction and renovations here sub-band systems are existing.

3.10 Electrical Outlets

- A. Electrical outlets shall be installed inside of all TVTCs and origination cabinets. Electrical power shall be provided to meet equipment requirements.
- B. Electrical outlets shall be installed within 16" of the CCTV outlet.
- C. Electrical outlets for the headend racks shall be in flexible conduit originating from the headend TVEC.

3.11 Special Outlets

- A. In new construction of media centers, a CATV receiving outlet shall be installed from the headend to the students' multimedia workstation. The outlet shall be floor mounted, and labeled "CATV SERVICE."

3.12 CATV Signal

- A. In new construction of media centers, it is the Contractor's responsibility to meet with the local Cable Company Construction Coordinator to verify the location of the 3" CATV conduit. At the meeting, the Contractor shall communicate the following CATV signal requirements to the Construction Coordinator – MINIMUM +6 dB to 750 MHz, FLAT.
- B. In renovation or additions of media centers, the Contractor shall contact the Cable Company Construction Coordinator to verify placement of a new CATV conduit and cable. Extension of the existing CATV cable drop is not permitted.

3.13 CCTV Headend – Expansion or renovation of existing.

- A. Expansion and renovation specifications for headends will be compiled on a job specific basis. These specifications may be obtained through the office of the Facilities Communications supervisor.

3.14 TELEVISION PRODUCTION STUDIO AND CLASSROOM – High Schools

- A. Architect, Owner and Curriculum Specialist shall develop studio square footage and design
- B. Completion and approval of preliminary design of studio and adjacent classroom.
 - 1) Heating and air conditioning: TV studio shall have separate heating and cooling controls.
 - 2) Acoustical treatments for walls, ceiling and floor in the studio to be determined by A/E.

- 3) Studio lighting plan shall be provided by the A/E and implemented by the electrical contractor. The contractor will be responsible for lighting, studio lighting system, grid, fixtures, studio curtain and rigging. Any changes in the plan must be approved by Facilities.
- 4) Special safety equipment in the studio shall be provided by the contractor.
- 5) TVP classroom shall be adjacent to the studio.

C. Special equipment and furniture for the studio and classroom shall be Owner provided.

3.15 VIDEO PRODUCTION AREA – Elementary and Middle Schools

- A. Architect, Owner and Curriculum Specialist shall develop production area square footage and design
- B. Completion and approval of preliminary design of video production area.
 - 1) Heating and air conditioning: Video production area shall have separate heating and cooling controls.
 - 2) Lighting plan shall be provided by the electrical contractor after consultation with the Facilities designee. Specialty lighting fixture shall be Owner provided. Any changes in the plan must be approved by the Facilities designee.
 - 3) Curtains and track in the video production area shall be Owner provided.
- C. Special equipment and furniture for the video production area shall be Owner provided.

3.16 CAFETORIUM

- A. Architect, Owner and Curriculum Specialist shall develop production area square footage and design.
- B. Completion and approval of preliminary design with a theatrical A/E.
- C. Acoustical treatment for walls, ceiling and floor in the facility to be determined by A/E.
- D. A lighting plan shall be provided by the A/E and implemented by the electrical contractor. The contractor will be responsible for lighting, lighting system, grid, fixtures, studio curtain and rigging. Also special needs considerations as well as emergency lighting. Any changes in the plan must be approved by the Owner.
- E. Special safety equipment shall be provided by the contractor. Example: fire curtain stair lights ramp emergency lighting.
- F. Special equipment and furniture shall be Owner provided.
- G. A sound system capable of meeting the needs of the uses of the facility. Cluster versus surround systems as per needs basis.

3.17 FINE ARTS FACILITY

- A. Architect, Owner and Curriculum Specialist shall develop production area square footage and design.
- B. Meeting with A/E to determine the following criteria:
 - 1) Acoustic design of building with consideration for minimal large flat surfaces that would need acoustic treatment. The roof specification to minimize rain or outside noise influence.
 - 2) Lighting needs that will vary on the stage size and seating capacity. Consideration to rental use from outside sources should be considered.
 - 3) Lighting equipment should be approved by the Owner.

- 4) Special needs requirements are to be approved in the design stage.
 - 5) Emergency lighting with consideration to stairs and isle lighting.
 - 6) Audio delivery system can be cluster system or surround sound. The sound booth is to be exposed to the hall sound, not enclosed as is the control booth. They are separate in their use.
 - 7) Rigging and stage curtains that will be required. This includes a screen for a media delivery system.
- C. Completion and approval of preliminary design of Fine Arts Facility.
- D. The acoustic properties of the materials used should be under the recommendation of the A/E.
- E. Audio needs: generally speaking a 32-channel audio board is a good start for the audio system. The microphone jacks need to be shown on the plans as well as a spare conduit for growth. It has also been suggested that a minimum of 4 wireless microphones with belt packs be installed. A UHF system is required for this application. Hard wired head set communication should also be provided for stage production crew.
- F. Lighting needs: this will vary as to the stage size and distance to the first lighting bar. The lighting board and delivery system (dimmer rack) must be approved by Volusia County Schools, Facilities Services. The size of the console will support at least a 48/96 channel. The number of ellipsoid will vary but about 46 fixtures with the degree specified by the lighting contractor. The fresnel type of lighting about 25 with a good mix of 6" and 8". The lighting that is required for the cyclorama or backdrop screen needs to have at least 3 quad packs. To light the backdrop with various colors. The addition of side lighting needs to be factored in which will require lighting outlets on the house walls as per design. Pole lighting is to be included. All stage lighting should be on electric winches for safer operation. Training and warranty to be provided to approved persons. Electronic equipment should be purchased within the year that it is to be installed (if not you get 3-year old equipment at the installation time). A minimum of a 2-year service contract is required. A supply of 10% of the light bulbs installed for spare stock is recommended.
- G. Special needs requirement needs are to be reviewed by Facilities Communications Department to see if equipment meets our standards. Example seating, stage access, emergency escape route.
- H. Rigging and stage layout is to be approved by Facilities Communications Department. If a pit cover is to be installed it must meet building code requirements.
- I. Media delivery system: the system will provide for projection to the stage screen from the rear of the theatre but have that option to work from the front of the stage (for presentations with speaker in front) or be controlled by the person in the control booth. Television outlets and video outlets will be installed according to design placement. An open conduit (2") to the inside wall of the orchestra pit is requested. A monitoring system to the back stage area should be included in the design.

OVERHEAD PROJECTOR

1. CABLE REQUIREMENTS

- A. SVHS Type Cable
- 1) Number of Coax: 2
 - 2) AWG: 30
 - 3) Stranding: 7x38
 - 4) Conductor Material: TC - Tinned Copper
 - 5) Insulation Material: FHDPE - Foam High Density Polyethylene
 - 6) Overall Diameter: 0.255 Inch

- 7) Inner Shield Material: TC - Tinned Copper
- 8) Inner Jacket Material: PVC - Polyvinyl Chloride
- 9) Outer Jacket Material: PVC - Polyvinyl Chloride
- 10) Plenum (Y/N): N
- 11) Nom. Characteristic Impedance: 75+/-50
- 12) The cable should be a low loss cable for running longer lengths. It should have capacitance of 55pf/m and attenuation not more than .06 dB/m @ 10 MHz.

B. VGA Type Cable

- 1) UL listed, CMP rated cable jacket
- 2) Quantity: 3
- 3) Center Conductor: 26 awg stranded (7/34) tinned copper
- 4) Shield: 100% tinned copper wrap with aluminum foil wrap
- 5) Impedance: 75 ohm
- 6) Resistance: 41 ohm/1000 feet
- 7) Capacitance per foot: 17
- 8) Attenuation: (100 MHz: 5.9dB/100'); (400 MHz: 12.9dB/100'); (1000MHz: 21.5dB/100')
- 9) Timed Delay: 1.2 nS/ft
- 10) Insulation: foamed fluorinated ethylene propylene
- 11) Velocity of Propagation: 83%
- 12) Color Code: red, green, blue
- 13) Diameter: .107" +/- .005"
- 14) Or similar wire. No hoods installed due to space in conduit issue.

C. Audio Cable with Male RCA Connectors

- 1) 41 strands per conductor
- 2) 99.9% high-purity copper
- 3) Color-coded conductors for easy identification
- 4) Flame retardant white PVC jacket
- 5) UL listed CL2 rated for in-wall installation (or similar wire)

2. PROJECTOR MOUNTING PLATE

- A. See detail in the Attachments section of this manual.

3. STANDARD PROJECTION SYSTEM LAYOUT

- A. See Attachments section of this manual.

VOICE / DATA**1. HORIZONTAL DISTRIBUTION**

- A. Horizontal distribution of voice and data shall be via 4 pair Category 6 unshielded twisted pair cabling. Cables shall originate at horizontal patch panels located in the respective IDF and terminate at jacks installed at workstation locations. The system shall be a generic system in which any particular horizontal port/cable can be used for either voice or data. System shall be wired utilizing 568B wire configuration. Cables shall be routed above accessible ceilings on J-Hooks spaced 48 to 60 inches on center. Cables above inaccessible ceilings shall be routed in conduit.

2. COMMUNICATION OUTLET PLACEMENTS**A. General Classrooms**

- 1) Provide two (2) communication outlets each with four ports (two type 4P outlets) for support of student computers (total of eight CAT6 wired connections for students).

- 2) One (1) communications outlet with four ports (one type 4P outlet) for teacher's computer and VOIP telephone handset (total of four CAT6 wired connections for teacher). Locate this outlet near the teacher's desk.
- 3) Provide one (1) single gang outlet box with blank plate and one inch (1") conduit to ceiling space adjacent to teacher's communications outlet for routing of future cabling of voice and video enhancements.
- 4) Provide one (1) single gang outlet box with blank plate and one inch (1") conduit to ceiling space adjacent to television outlet for routing of future cabling of voice and video enhancements.
- 5) Provide one (1) communications outlet with two (2) ports (type 2P outlet) for wireless access point. Locate outlet for wireless access point in ceiling as close to center of room as possible. A power outlet is not required for the wireless access unit.
- 6) If the ceiling is above twelve (12) feet from the floor, place type 2P outlet for the wireless on the wall at eight (8) to ten (10) feet off the floor and within ten (10) to twelve (12) feet from the door opening to the room. Place outlet in an open area of wall as not to be obstructed by other equipment or furniture.

B. Computer Labs

- 1) Four (4) ports of connectivity for every three (3) student computers.
- 2) Provide one (1) communications outlet with four ports (one type 4P outlet) for teacher's computer, network printer and VOIP telephone handset. Locate this outlet near the sound enhancement unit.
- 3) Provide one (1) single gang outlet box with blank plate and one inch (1") conduit to ceiling space adjacent to teacher's communications outlet for routing of future cabling from teacher's computer to ceiling mounted projection unit.
- 4) Provide one (1) communication outlet with two (2) ports (type 2P outlet) for overhead projection device and wireless connectivity. Coordinate placement of this outlet with optimal set back distance of anticipated projection unit. Provide power outlet on ceiling for projection unit adjacent to projection unit.
- 5) If the ceiling is above twelve (12) feet from the floor, place type 2P outlet for the wireless on the wall at eight (8) to ten (10) feet off the floor and within ten (10) to twelve (12) feet from the door opening to the room. Place outlet in an open area of wall as not to be obstructed by other equipment or furniture.

C. Standard Single Person Office

- 1) Provide two (2) communications outlets with two (2) ports (two type 2P outlets) for occupant's computer and VOIP telephone handset (total of four CAT6 wired connections).

D. Group Offices and Work Areas

- 1) Provide two (2) ports of connectivity per person or no less than 4 ports per room. Ports may be provided as type 2P outlets or 4P outlets as indicated by room arrangement. This shall include but not be limited to the following areas: Teacher's Lounges, Conference Rooms, and Work Rooms. In Teacher's Lounges, Conference Rooms, Work Rooms and Group Offices provide one (1) communications outlet with two (2) ports (type 2P outlet) for wireless access point. Locate outlet for wireless access point in ceiling as close to center of room as possible.
- 2) If the ceiling is above twelve (12) feet from the floor, place type 2P outlet for the wireless on the wall at eight (8) to ten (10) feet off the floor and within ten (10) to twelve (12) feet from the door opening to the room. Place outlet in an open area of wall as not to be obstructed by other equipment or furniture.

E. Main Office Front Desk Area

- 1) Provide one (1) communications outlet with two (2) ports (type 2P outlet) for wireless access point. Locate outlet for wireless access point in ceiling as close to the center of the room as possible.

F. Custodial and Maintenance Office

- 1) Provide two (2) communications outlets with two (2) ports (two type 2P outlets) for occupant's computer and VOIP telephone handset (total of four CAT6 wired connections).
 - 2) Provide one (1) communications outlet with two (2) ports (type 2P outlet) for wireless access point. Locate outlet for wireless access point in ceiling as close to the center of the room as possible.
 - 3) If the ceiling is above twelve (12) feet from the floor, place type 2P outlet for the wireless on the wall at eight (8) to ten (10) feet off the floor and within ten (10) to twelve (12) feet from the door opening to the room. Place outlet in an open area of wall as not to be obstructed by other equipment or furniture.
- G. Media Centers (or any room with ceiling above 12'0")
- 1) Four (4) ports of connectivity for every three (3) computers.
 - 2) Two (2) communications outlets each with four (4) ports (two type 4P outlet) at circulation desk for computer, network printer and VOIP telephone handset(s).
 - 3) At each presentation area provide one (1) communications outlet with two (2) ports (type 2P outlet) for overhead projection device and wireless connectivity. Coordinate placement of this outlet with optimal set back distance of anticipated projection unit. Provide power outlet on ceiling for projection unit adjacent to projection unit.
 - 4) Place up to eight (8) communication outlets each with two (2) ports (one type 2P outlet) for a total of sixteen (16) CAT6 wired connections for wireless.
 - 5) If the ceiling is twelve (12) feet or lower, place two (2) each 2P outlet in the ceiling spaced evenly within five feet (5') of the north, south, east and west wall of the media center. If ceiling is above twelve (12) feet, place two (2) each 2P outlet on the north, south, east and west at eight (8) to ten (10) feet off the floor. Whether mounted in ceiling or on each wall the two (2) 2P outlets should be placed as evenly along the north, south, east and west wall as possible. If there are large support columns in the room consider putting at least one (1) or two (2) of the 2P outlets on opposite sides the column, if appropriate.
- H. Multipurpose / Cafeteria
- 1) Place one (1) communications outlet with two (2) ports (type 2P outlet) close to each point of sale (POS) computers.
 - 2) Place one (1) communications outlet with two (2) ports (type 2P outlet) in kitchen area for time clock network system. For exact location of point of sale computers and time clocks please contact the School Way Café Department.
 - 3) Place one (1) communications outlet with four (4) ports (type 4P outlet) in the cafeteria manager's office.
 - 4) If the room has a stage, place a minimum of one type 2P outlet on both side walls of the stage behind curtain.
 - 5) Place eight (8) communication outlets each with two (2) ports (one type 2P outlet) for a total of sixteen (16) CAT6 wired connections for wireless.
 - 6) If the ceiling is twelve feet (12') or lower, place two (2) each 2P outlet in the ceiling within five feet (5') of the north, south, east and west wall of the media center. If ceiling is above twelve feet (12'), place each 2P outlet on the north, south, east and west at eight (8) to ten (10) feet off the floor. Whether mounted in ceiling or on each wall the two (2) 2P outlets should be placed as evenly along the north, south, east and west wall as possible. If there are large support columns in the room consider putting at least one (1) or two (2) of the 2P outlets on opposite sides the column, if appropriate.
- I. Auditorium
- 1) In the stage area, place a minimum of one (1) type 2P outlet on both side walls of the stage behind curtain.
 - 2) Place eight (8) communication outlets each with two (2) ports (one type 2P outlet) for a total of sixteen (16) CAT6 wired connections for wireless. Place two (2) each 2P outlets spaced evenly on the north, south, east and west at eight (8) to ten (10) feet off the floor. The two (2) - 2P outlets should be placed as evenly along the north, south, east and west wall as possible.

J. Gym

- 1) Place eight (8) communication outlets each with two (2) ports (one type 2P outlet) for a total of sixteen (16) CAT6 wired connections for wireless. Place two (2) each 2P outlets spaced evenly on the north, south, east and west at eight (8) to ten (10) feet off the floor. The two (2) - 2P outlets should be placed as evenly along the north, south, east and west wall as possible.

K. Communication Outlet General Requirements

- 1) Communication outlets shall utilize angled faceplates in four (4) port (single gang) and eight (8) port (double gang) styles. Plates and jacks shall be white.
- 2) Sufficient power shall be provided within twelve inches (12") (6 inches preferred) of each communications outlet. Each communications outlet shall have a one-inch (1") conduit stubbed into an accessible location in the ceiling cavity.

L. Horizontal Connectivity

- 1) System shall be specified as a complete EIA/TIA Category 6 Premise Distribution System (PDS) with a minimum 15-year warranty for the entire system. The basis of design is the Krone Category 6 TrueNet Structured Cabling System with Systems by Hubbell and Avaya as approved substitutions. Specifications shall limit products to these three manufacturers as VCS does not have warehouse space available to maintain additional inventories of spare parts that would be required to support installations of other manufacturer's products.

Horizontal Connectivity Products		
Description	Material	Warehouse Number
Horizontal Cable 4pr Cat 6 Outdoor – non plenum	ADC	01B526
Horizontal Cable 4pr Cat 6 Indoor Plenum	ADC	01B527
Single Gang 2 port plate	ADCP 6644-1-15202	00B093
Single Gang 4 port plate	ADCP 92-142	00B094
Double Gang 4 port plate	ADC	00A201
Double Gang 8 port plate	ADC / Krone 6830-1-800-01	
6 port plate	Krone 6644-2-201-02	00B115
Single Jack RJ45	Krone 6830-1-830-02	
24 Port Horizontal Patch Panel 1 RU High Density Cat 6	Krone 6653-1-679-24	

Note: part numbers above are frequently subject to change by manufacturers; they must be confirmed and updated for each project.

3. BACKBONE DISTRIBUTION

A. Fiber Optic

- 1) From MDF provide one (1) 12-24 Fiber 62.5 um multimode fiber optic cable to each IDF (50 um multimode fiber may be used for new construction of entire school only. VCS may wish to consider using 50 um fiber fir runs over 720 feet). Fiber optic cables that run underground shall be loose tube get filled type. Fiber optic patch panels shall have ST type connectors. Fiber optic products shall be limited to products manufactured by Krone, Corning Cable Systems, and Avaya. VCS does not have warehouse space available to maintain additional inventories of spare parts of that would be required to support installations of other manufacturer's products. *Note: increased utilization of fiber by other trades, i.e. HVAC etc., may facilitate adding more fiber between MDF and IDFs.*

B. Copper

- 1) From MDF provide one 25 pair Category 3 copper cable to each IDF (Intermediate Distribution Frame) locations, on the school campus. This pair count is sufficient for almost all locations as VCS utilizes VOIP (Voice Over IP) for the majority of their telephones. Copper cable that runs underground shall be gel filled PE89 type cables. Provide multi-pair protectors Avaya 489A (188 style 110 in/110 out) fully populated with 4C1S protector modules at each end of any cable running between buildings.
- 2) From the building entrance terminal in each IDF, provide one 25 pair category 3 cable to each 24-port RJ45 voice patch installed in the rack. Terminate each pair on pins 4 and 5 of all 24RJ45 ports existing in the voice patch panel, leaving pair 25 unused.
- 3) Provide one 25 pair Category 3 copper cable from Telephone company demarcation point to MDF if the telephone company's demarcation point is located outside of the MDF location.
- 4) A minimum of one (1) wall should be covered with rigidly fixed (3/4 trade size) A-C plywood preferably void free, 8 ft. high, capable of supporting attached equipment. Plywood should be fire rated and covered with two coats of fire retardant paint. More "wood wall" area may be needed for other types of equipment. An approved power source ground must be provided at the telecommunications backboard location. Electrician to run a #6 AWG insulated solid copper ground wire from the main electrical distribution panel power ground conductor.

C. Backbone Pathway

- 1) Four (4) 2-inch (2") conduits with long sweep ells shall be provided from MDF to each IDF for routing of Premise Distribution System Site Backbone Cabling. One (1) 2-inch (2") conduit shall contain fiber optic cable, one (1) 2-inch (2") conduit shall contain Cat 3 copper cable and the other two (2) 2-inch (2") conduits shall be empty spares with pull strings for future use.

D. Telephone Entrance Pathway

- 1) On new facilities or where a new campus telco demarc is established at an existing facility a minimum of two (2) 4-inch (4") conduit should be provided from the property line to the telco demarc point. An additional 4-inch (4") conduit to the demarc shall be run from the property line, however this line should be at a different ingress point. The location will be determined by Technology Services during the preliminary site review meetings.
- 2) The 4-inch (4") conduits should contain at least three (3) inner ducts per conduit. MaxCell fabric inner duct or equivalent is acceptable inner duct for the conduits.
- 3) A 200 lb. test pull wire should be placed in all telecommunication entrance conduits for proofing and pulling purpose. Also a stake should be placed at the end of the conduit to facilitate locating the end of the entrance conduit at the property line.

4. EQUIPMENT ROOMS

A. MDF Main Distribution Frame

- 1) Secure dedicated room with its own cooling system. The access door shall be a minimum of 36-inches (36") wide and 80-inches (80") high and shall be fitted with a lock. Exterior access to the MDF is preferable. The size of this should be a minimum of 10'x20', with final dimensions determined by the amount of equipment and rack space needed. This space will also accommodate a workspace for a networking manager. Floors, walls and ceiling shall be treated to eliminate dust. Floor should be treated with sealant to reduce dust build up. Finishes on wall and ceiling shall be light in color to enhance room lighting.
- 2) Freestanding 19-inch (19") equipment rack(s) with sufficient space for network electronics. For network electronics allow a minimum of two rack units per 24CO ports plus an additional 12 rack units.
- 3) In addition to the above racks a separate 4-post rack must be provided for mounting servers and other like devices. A minimum of forty-two inches (42") of clearance around all four sides of data rack assemblies; i.e. multiple racks are connected into one rack assembly in MDF and IDF's location at the sides. Provide a 30 amp 208 volt outlet for the UPS that will power the main VOIP equipment (receptacle type for UPS would be NEMA L6-30R located behind the rack and no more than six feet (6') from center rack), as well as a minimum of two (2)

dedicated 20A, 120V AC duplex electrical outlets, each a separate circuit. All the above outlets MUST be fed from the generator at facilities that have a generator. The Vender shall provide and install at least 1-6 outlet surge protected 1U rack mounted power strip with fifteen foot (15') cord, UL1449/330 rated per rack installed (use Wiremold part #R8BZ-15 or equivalent). There should be additional duplex outlets every six feet around perimeter of the room.

B. IDF Intermediate Distribution Frame

- 1) Secure dedicated room with its own cooling system. In existing facilities where a dedicated secure room is not possible the rack shall be installed in a freestanding locking enclosure.
- 2) Freestanding 19-inch (19") equipment rack(s) with sufficient space for network electronics. For network electronics allow a minimum of two rack units per 24CO ports plus six (6) additional rack units.
- 3) Provide 2-20 amp 120-volt outlets for the UPS that will power the VOIP switches. These outlets should be fed from the generator at facilities that have a generator. If IDF is servicing the main office of the school then generator power is a MUST at facilities that have a generator. The Vender shall provide and install at least 1-6 outlet surge protected 1U rack mounted power strip w/15' cord, UL1449/330 rated per rack installed (use Wiremold part #R8BZ-15 or equivalent).

5. PATCH CORDS

- A. Patch cords will be provided by Owner.

6. LABELING

- A. All ports, cables, terminations, etc shall be labeled. Communications outlets shall be labeled using the following scheme:
- 1) &&-@@@-**- (A-H)
 - 2) && = Building Number
 - 3) @@@ = Room Number
 - 4) ** = Outlet Number
 - 5) (A-H) = Port Identifier
- B. Outlets shall be numbered around the room clockwise with the outlet to the right of the primary entry door as number 01. The port in the upper left corner of a faceplate shall be port A.

7. EXTRA MATERIALS

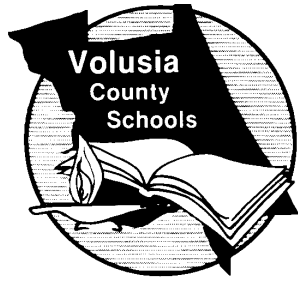
- A. Include requirement for the following maintenance materials to be turned over to owner.
- 1) Provide 20% spare modular jack inserts.
 - 2) Provide 20% spare dust covers of each type.
 - 3) Provide 20% spare faceplates of each type.
 - 4) Provide 20% spare patch panels of each type.
 - 5) Provide 20% spare termination blocks of each type.
 - 6) Provide 10% spare surge suppression modules of each type.

8. TESTING AND QUALITY ASSURANCE

A. Fiber Optic

- 1) Each fiber in every backbone interbuilding and intrabuilding cable run shall undergo an Optical Time Domain Reflectometer (OTDR) test. Test Results to include a record of:
 - a) Wavelength
 - b) Fiber type
 - c) dB Loss
 - d) Continuity

- e) Attenuation specification
 - f) Bandwidth specification
 - g) Fiber and cable number
 - h) Measurement direction
 - i) Test equipment model and serial numbers
 - j) Date
 - k) Reference setup
 - l) Operator (crew members)
 - m) Cable length
 - 2) All fibers shall be tested at both 850 nm and 1300 nm.
 - 3) Test equipment shall have a current certificate of calibration from the manufacturer's authorized service center. A copy of the certificate shall be included in the closeout documents.
 - 4) All OTDR test results shall be included in the closeout documents in both hard copy (three copies) and software (three copies of complete file on CD) versions.
- B. Copper UTP Cable Testing
- 1) Every wire and connector pin for each horizontal cable run from an IDF, CC or MDF to a CO shall be tested per TIA standards for Category 6 out to a minimum of 350 MHZ. Testing shall include:
 - a) Continuity
 - b) Resistance
 - c) Correct pin-pair orientation (Wire Map)
 - d) Near end crosstalk (NEXT value)
 - e) PSNEXT
 - f) Far end crosstalk (FEXT value)
 - g) PSFEXT
 - h) ELFEXT
 - i) PSELFEXT
 - j) dB loss (attenuation)
 - k) Delay Skew
 - l) Return Loss (RL)
 - m) Attenuation to Crosstalk Ratio (ACR)
 - n) PSACR
 - o) Cable length
 - 2) Every wire run between IDF's, CC's, CP's and/or CER's shall be tested for continuity. Selected circuits shall be tested to demonstrate Level III/Category 3 transmission capability.
 - 3) Testing of copper cable shall be accomplished using a Fluke DSP Series Cat 6 Certifiable Digital Cable Analyzer or accepted equivalent. Test equipment shall have a current certificate of calibration from the manufacturer's authorized service center. A copy of the certificate shall be included in the closeout documents.
 - 4) All UTP test results shall be included in the closeout documents in both hard copy (three copies) and software (three copies of complete file on CD) versions.



ADDITIONAL REQUIREMENTS

FACILITIES SERVICES

CUSTODIAL ROOM REQUIREMENTS

1. CUSTODIAL CLOSETS

- A. The door shall always open outward to provide usable space within the room.
- B. The floor sink should be located in a corner tight to walls with mop hangers affixed over the floor sink, if possible. Provide 4'-0" pill hose on faucet.
- C. Two (2) shelves at least four (4) feet long.
- D. 110-V electrical outlet with ground fault protection. This is needed because the autoscrubbers operate on two (2) twelve volt (12-V) batteries, total 24 volts (24-V), which need to be charged each evening.
- E. The closets need to be vented because the batteries are being charged and omitting gas
- F. The minimum size of the closet: sixty (60) square feet.
- G. Do not provide hot water heaters in custodial closets.

2. HEAD CUSTODIAN / RECEIVING

- A. Recommended size: one thousand four hundred (1400) square feet.
- B. Emergency eyewash station and shower where cleaning chemicals are mixed.
- C. Ceiling to floor shelving at least twelve (12) feet long.
- D. Four (4) electrical outlets with ground fault protection spaced around room.
- E. Phone / computer outlet for a work station desk.

3. FMT AREA WITHIN CUSTODIAN / RECEIVING BUILDING

- A. Phone / computer outlet for a work stations desk.
- B. Separate FMT area from rest of room with a chain link fence. Floor to ceiling with one (1) thirty-six inch (36") wide gate / door. Gate / door to have lever handle door knob / lock.
- C. One (1) electrical outlet (separate circuit not required).

VCT FLOOR FINISH PROCEDURE

1. EQUIPMENT / CHEMICALS REQUIRED

- A. Neutral-based pH cleaner
- B. High speed twenty inch (20") roto with block
- C. Nineteen inch (19") green shower scrub disk
- D. Heavy duty vacuum cleaner
- E. Wet vacuum cleaner
- F. Mop bucket with wringer
- G. Wet mop handle and wet mops
- H. Floor finish applicator
- I. Premium grade floor finish with not less than twenty five percent (25%) hard particles (VCSB contracted product)
- J. Wet floor signs
- K. MSDS sheets for both the cleaner and floor finish
- L. Appropriate PPE for both chemicals

2. PROCEDURE

- A. Use a heavy duty vacuum cleaner to remove construction debris and dust
- B. Using a mop, and mop bucket and wringer, liberally apply neutral-based cleaner to a ten foot by ten foot (10'x10') area
- C. Use a twenty inch (20") roto with a green shower scrub disk agitating the solution
- D. After agitating the ten foot by ten foot (10'x10') area, use the wet vac or mop to remove solution
- E. Wet mop the area with clear water until it appears clear, wet vacuum or mop dry
- F. Allow to thoroughly dry before applying floor finish
- G. Apply finish at recommended square feet/gallon

3. MINIMUM NUMBER OF COATS OF FLOOR FINISH BY AREA

- A. Classrooms – five (5) coats
 - B. Office and clinic – five (5) coats
 - C. Cafeteria – seven (7) coats
 - D. Corridors / hallways – seven (7) coats
4. Contractor shall finish the VCT as part of the contract unless approved and coordinated with the Owner.
5. Owner will furnish the floor finish. Contractor to return all empty, partially used and full floor finish containers to Owner.

SCHOOL KITCHEN REQUIREMENTS

1. SOLID SURFACE FLOOR

- A. Quarry tile, nonslip.

2. HOSE REELS

- A. Minimum of two (2) with hoses long enough to clean kitchen, can wash and serving areas, mixing valve and hot and cold water (consider females using hoses without the upper body strength of males so more reels may be necessary – consider pressure washer)

3. WALK-IN COOLER

- A. Molded plastic shelving with lifetime warranty (e.g.: Metro Max)
- B. Locate near delivery door
- C. Eight feet (8') to nine feet (9') ceiling preferred
- D. Review size requirement
- E. Fluorescent lighting
- F. Consider at rear

4. WALK-IN FREEZER

- A. Molded plastic shelving with lifetime warranty and 60/40 ratio freezer to cooler (e.g.: Metro Max)
- B. Locate near delivery door
- C. Eight feet (8') to nine feet (9') ceiling preferred
- D. Review size requirement
- E. Fluorescent lighting
- F. Consider at rear

5. SECURE PAPER STORAGE AREA

- A. Dunnage racks (future dish room)
- B. Molded plastic shelving with lifetime warranty (e.g.: Metro Max)

6. SECURE STOCKROOM

- A. High density shelving, dunnage racks and track rolling rack
- B. Molded plastic shelving with lifetime warranty (e.g.: Metro Max)

7. SECURE LAUNDRY ROOM

- A. Washing machine and dryer, laundry tub, shelving and locking chemical cabinet

8. SERVING LINES

- A. Electrical outlets - prefer overhead power
- B. All serving lines and snack bars that are apart from main serving lines to have overhead power cords with twist-lock release for hotbox
- C. Roll-through coolers and heated cabinets behind the serving lines with glass fronts when built-in.
- D. POS cash register at every serving line with both power and CAT-6 communication lines through ceiling, each communication line home run to closest IDF room.
- E. Elementary schools: two (2) serving lines
- F. Middle schools: four (4) main serving lines, snack bar in "dish room" paper storage area, two (2) snack lines in dining room
- G. High schools: eight (8) main serving lines (6 non-traditional lines, 2 walk-up lines), two (2) to three (3) snack bar lines on opposite side of dining room that opens both into the cafeteria and to the

School Kitchen Requirements

outside of the building (outside opening to have overhang to protect from the elements) and roll down security gate to close off serving area from dining room

9. SIGNAGE

- A. All schools shall have one standard electrical outlet in dining room, centered above serving line area, for School Way Café sign
- B. Middle schools: one additional standard outlet per serving line, on dining room wall centered on each serving line for School Way Café signage
- C. High schools: one additional standard outlet located per line, in fascia, centered on each serving line or snack bar for School Way Café signage
- D. Menu Board (secondary schools)
 - 1) Double-paneled menu boards to hang from ceiling above and slightly to the rear of each serving line
 - 2) Electric outlet to be ceiling mounted and centered at each line
 - 3) Each snack bar to have single-panel menu board located in same manner

10. CAN WASH AREA

- A. Provide hose reel and shelf, recessed floor sink with spray head and wall controls for interior installations.

11. Employee restroom and lounge area with built-in lockers and table and chairs

- A. Prefer two (2) toilet rooms off lounge – one (1) female and one (1) male

12. HOOD SYSTEM

- A. Floor drains running the entire length of the hood on each side
- B. Water filter (Never Scale type) on water line coming to equipment under hood
- C. Prefer self cleaning hoods as appropriate

13. Pot filler located in proximity to mixers at proper height

14. Kitchen and Snack Bar Doorways

- A. Air curtains to prevent insect intrusion at kitchen delivery door
- B. Air curtains at dining room doors if open directly to exterior.

15. SINKS

- A. All schools: one (1) 2-compartment sink and one (1) 4-compartment sink with drying rack
- B. Secondary schools: one (1) additional 3-compartment power sink with drying rack
- C. Hand washing sinks in kitchen and serving areas: two (2) minimum in elementary schools, four (4) minimum in secondary schools
- D. Remote snack bars to have additional hand washing sink
- E. Locate hand washing sink near serving line
- F. Provide paper towel dispenser at sinks
- G. Provide one garbage disposal

16. KITCHEN BACKDOOR

- A. Oversized or double door, solid, with peephole, doorbell, exterior light and air curtain.

School Kitchen Requirements

17. MANAGER'S OFFICE

- A. Window(s) viewing kitchen area
- B. Multiple access electric outlets located at intervals around perimeter of room
- C. All schools: automated money counting machine

18. WORK TABLES

- A. Stainless steel with stainless steel under-shelves, legs and bullet feet or casters
- B. One cooks table with pot and pan rack
- C. One baker's table located near mixer
- D. One receiving table (work table)
- E. Additional work tables

19. REACH-IN COOLERS & FREEZERS

- A. Glass fronts / doors when built-in

20. Replace kettles with skillets

- A. Ensure proper drainage

SCHOOL FUNDED SHED INSTALLATION

1. SELECTING SHED LOCATION

- A. Sixty feet (60') from any structure. VCS Project Manager and school will decide. (Shed may be closer than sixty feet (60') if constructed of non-combustible materials.)
- B. Level location. VCS Project Manager and school will decide.
- C. High and dry location. VCS Project Manager and school will decide.
- D. Accessibility for delivery of portable shed. VCS Project Manager and school will decide.

2. PROJECT DRAWINGS AND SPECIFICATIONS

- A. Site plan showing location of portable shed; to scale, show dimension from existing buildings as provided by Owner.
- B. Plan with dimensions, design and wind load of portable shed. Shed company will provide.
- C. Anchor plan and details. Shed company will provide.
- D. Note on plan or letter that states these buildings meet the wind requirements of the Florida Building Code and the ASCE standard ASCE 7. Shed company will provide.
- E. All drawings / letters shall be signed and sealed by a Florida Registered Engineer; shed company will provide.

3. OBTAINING BUILDING PERMIT

- A. Complete "Building Permit Application" blue form number "2A, 2B, and 2C". School will complete with the assistance of the VCS Project Manager.
- B. Two (2) sets of complete project drawings signed and sealed by Registered Florida Engineer. Shed company will provide.
- C. For sheds over 250 sq. ft., company / persons installing sheds and tie downs will need a copy of state contractor's license, and liability and Workman's Compensation Insurance to receive permit.
- D. Send Building Permit Application and two (2) sets of project drawings to VCS Project Manager. School will send. VCS Project Manager will turn in application and drawings to Building Department.
- E. After plan review the VCS Project Manager, school and the shed company will receive notice of corrections needed or if all information submitted is satisfactory a building permit will be issued.
- F. No delivery or installation of a shed shall be done prior to the issuing of a building permit.

WIND SPEED

TABLE 1604.5 (VCS MODIFIED)
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

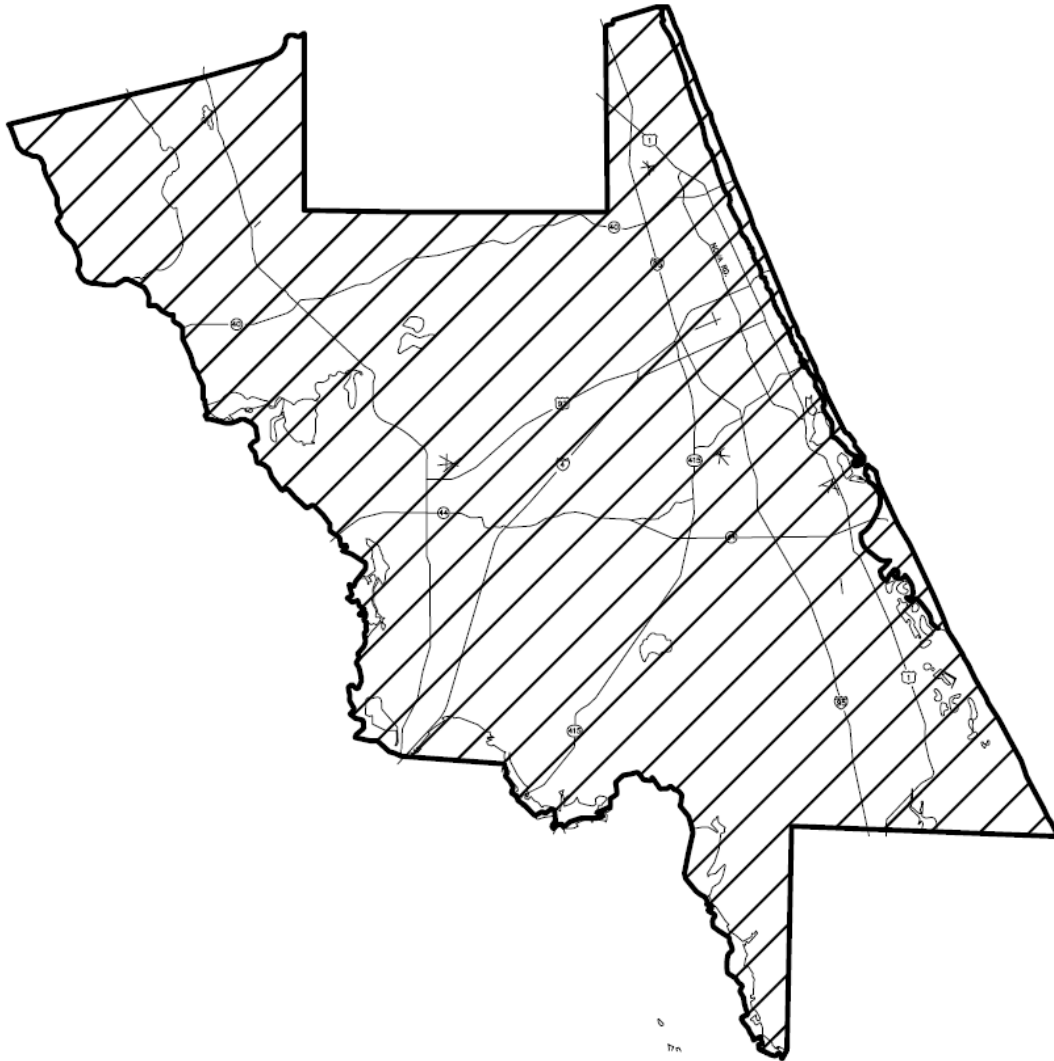
RISK CATEGORY

- I. Not applicable to VCS facilities or structures
- II. Not applicable to VCS facilities or structures
- III. Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to:
 - All Volusia County Schools facilities and structures.
 - Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than three hundred (300).
 - Buildings and other structures containing elementary school, secondary school or day care facilities with an occupant load greater than two hundred fifty (250).
 - Buildings and other structures containing adult education facilities, such as colleges and university, with an occupant load greater than five hundred (500).
 - Group I-2 occupancies with an occupant load of fifty (50) or more resident patients but not having surgery or emergency treatment facilities.
 - Group I-3 occupancies.
 - Any other occupancy with an occupant load greater than five thousand (5,000) ^a.
 - Power-generating stations, water treatment facilities for potable water, waste water treatment facilities and other public utility facilities not included in Risk Category IV.
 - Buildings and other structure not included in Risk Category IV containing sufficient quantities of toxic or explosive substances to be dangerous to the public if released.
- IV. Buildings and other structure designated as essential facilities, including but not limited to:
 - All Volusia County Schools facilities and structures.
 - Group I-2 occupancies having surgery or emergency treatment facilities.
 - Fire, rescue, ambulance and police stations and emergency vehicle garages.
 - Designed earthquake, hurricane or other emergency shelters.
 - Designated emergency preparedness, communications and operations centers and other facilities required for emergency response.
 - Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.
 - Structures containing highly toxic materials as defined by Section 307 where the quantity of the material exceeds the maximum allowable quantities of Table 307.1(2).
 - Aviation control towers, air traffic control centers and emergency aircraft hangars.
 - Building and other structures having critical national defense functions.
 - Water storage facilities and pump structures required to maintain water pressure for fire suppression.

^a For purposes of occupant load calculation, occupancies required by Table 1004.1.2, Florida Building Code, to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

WIND SPEED

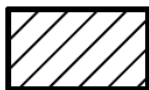
Florida Building Code wind speed maps and tables have been modified for Volusia County School District property.



Volusia County

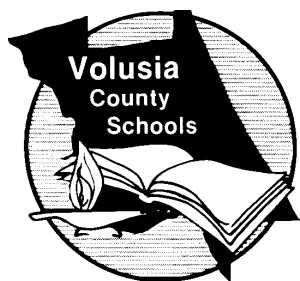
Figure 1609B (VCS modified)

VCS Ultimate Design Wind Speed, Vult



155 MPH AND WINDBORNE
DEBRIS PROTECTION
THROUGHOUT THE COUNTY AT
ALL VCS FACILITIES

Fifth Edition (2014) Florida Building Code - Building



FORMS

FACILITIES SERVICES



DESIGN GUIDELINES CONFORMANCE STATEMENT

SCHOOL BOARD OF VOLUSIA COUNTY FLORIDA

This document shall be signed by the Architect / Engineer of record and provided with the construction document submittal to the Owner.

School / Facility Name: _____

Project Name: _____

VCS Project No.: _____ A/E Project No.: _____

VCS Project Manager: _____

I do hereby certify that I am the Architect / Engineer of record for the above indicated project and I have reviewed the School Board of Volusia County Florida design guidelines and have incorporated the requirements of those guidelines into the construction documents unless indicated otherwise below.

Guideline Section		I have complied:		
		Yes	No	Exception
Introduction				
General Information / Design Elements				
Division 0	Bidding Requirements, Contract Forms, Conditions of the Contract			
Division 1	General Requirements			
Division 2	Site-work			
Division 3	Concrete			
Division 4	Masonry			
Division 5	Metals			
Division 6	Wood & Plastics			
Division 7	Thermal & Moisture Protection			
Division 8	Doors & Windows			
Division 9	Finishes			
Division 10	Specialties			
Division 11	Equipment			
Division 12	Furnishings			
Division 13	Not Used			
Division 14	Elevators			
Division 15	Mechanical			
	Conformance Statement			
Division 16	Electrical			
	Closed Circuit Television			
	Overhead Projector Cable Specifications			
	Voice / Data			

Additional Requirements		I have complied:		
		Yes	No	Exception
Custodial Room Requirements				
VCT Floor Finish Procedure				
School Kitchen Requirements				
School Funded Shed Installation				
Volusia County Wind Speed				

**DESIGN GUIDELINES
CONFORMANCE STATEMENT**

	I have complied:		
Forms	Yes	No	Exception
Design Guidelines Conformance Statement			
Division 15 Conformance Statement			
Voltage & Amperage Readings – Tabulated Data			
Ground Test Information			
Conductor Insulation Resistance Test			
Suggested Changes / Modifications Form			

	I have complied:		
Attachments	Yes	No	Exception
2011 List of Invasive Plant Species			
Typical Surge Protection Device (SPD) Panel Installation			
Standard Projection System Layout			
Bronze Dedication Plaque (example)			
Volusia County Wind Speed Map			
Elementary School Storage “Cubbies” Detail			

Architect / Engineer Name

Signature

Firm Name

Date



DIVISION 15 CONFORMANCE STATEMENT

SCHOOL BOARD OF VOLUSIA COUNTY FLORIDA

This document shall be signed by the engineer of record and provided with the construction document submittal to the Owner.

School / Facility Name: _____

Project Name: _____

VCS Project No.: _____ Eng. Project No.: _____

VCS Project Manager: _____

I do hereby certify that I am the engineer of record for the above-indicated project and I have reviewed the School Board of Volusia County Florida Design Guidelines and have incorporated the requirements of those guidelines into the construction documents unless indicated otherwise below.

Guideline Section		I have complied:			
		N/A	Yes	No	Exception
15010	Basic Mechanical Requirements				
15015	Supplemental Mechanical Conditions				
15020	Special Project Procedures				
15060	Pipes and Pipe Fittings				
15100	Valves				
15120	Piping Specialties				
15140	Supports and Anchors				
15160	Pumps				
15240	Mechanical Sound and Vibration Control				
15250	Mechanical System Insulation				
15301	Fire Protection				
15371	Wet Chemical Extinguishing System				
15400	Plumbing				
15510	Hydronic Piping				
15530	Refrigerant Piping				
15550	Boilers				
15575	Breechings, Chimneys, and Stacks				
15650	Fuel Oil Equipment				
15680	Water Chillers				
15710	Cooling Towers				
15715	Water Treatment				
15781	Split DX Air Conditioning Equipment				
15783	100% O/A Package DX Equipment				
15785	Packaged A/C for Computer Equipment				
15815	Electric Duct Heaters				
15835	Fan Coil Units				
15855	Air Handling Units				
15858	Packaged Indoor Air Conditioner				
15859	Packaged Rooftop Unit				
15870	Power and Gravity Ventilators				
15871	Grease Hood System				

DIVISION 15
CONFORMANCE STATEMENT

Guideline Section		I have complied:			
		N/A	Yes	No	Exception
15885	Air Cleaning				
15890	Ductwork				
15892	HVAC System Cleaning				
15900	HVAC Instrumentation and Controls				
15910	Building Automation System				
15930	Air Terminals				
15936	Air Outlets and Inlets				
15950	Sequence of Operations				
15955	DDC Control System				
15971	Electronic Temperature Controls				
15975	Variable Frequency Drive				
15991	Contractor Test and Balance				
15992	Owner Test and Balance				
15995	System Starting / Commissioning				

Legend:

N/A = This requirement does not apply to this project.

Yes = All requirements in this section have been incorporated into the construction documents.

No = One or more requirements in this section are not incorporated into the construction documents and I have attached a written request for an exception.

Exception = Reference to the attached written exceptions.

Engineer Name

Signature

Firm Name

Date



VOLTAGE & AMPERAGE READINGS TABULATED DATA

SCHOOL BOARD OF VOLUSIA COUNTY FLORIDA

SCHOOL/FACILITY NAME: _____

SWITCHGEAR / PANEL BOARD _____

FULL LOAD AMPERAGE READINGS

DATE: _____

TIME: _____

PHASE A _____

B _____

C _____

N _____

GROUND _____

FULL LOAD VOLTAGE READINGS

DATE: _____

TIME: _____

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

VOLTAGE AT THE END OF THE LONGEST BRANCH _____

TYPE OF LOAD _____

NO LOAD VOLTAGE READINGS

DATE: _____

TIME: _____

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

CONTRACTOR'S REPRESENTATIVE

DATE

ENGINEER'S REPRESENTATIVE

DATE

OWNER'S REPRESENTATIVE

DATE



GROUND TEST INFORMATION

SCHOOL BOARD OF VOLUSIA COUNTY FLORIDA

SCHOOL/FACILITY NAME: _____

GROUND TYPE: _____

TEST BY: _____

DATE OF TEST: _____

GROUND LOCATION: _____

GROUND TYPE: _____
(Rod, Water Pipe, etc.)

PRIOR TO CONNECTION TO SYSTEM

GROUND: _____ (OHMS)

AFTER CONNECTION TO SYSTEM

GROUND: _____ (OHMS)

WEATHER CONDITIONS (Wet/Dry): _____

SOIL CONDITIONS (Wet/Dry): _____

CONTRACTOR'S REPRESENTATIVE

DATE

ENGINEER'S REPRESENTATIVE

DATE

OWNER'S REPRESENTATIVE

DATE



CONDUCTOR INSULATION RESISTANCE TEST

SCHOOL BOARD OF VOLUSIA COUNTY FLORIDA

SCHOOL/FACILITY NAME: _____

CONDUCTOR FROM: _____ TO: _____

SIZE: _____

INSULATION TYPE: _____

INSULATION VOLTAGE RATING: _____

DATE: _____ TIME: _____

WEATHER CONDITIONS: _____

TEST VOLTAGE (DC): _____

RANGE: _____

MEGGER INSTRUMENT / SERIAL NUMBER: _____

TESTING METHODOLOGY: _____

INSULATION RESISTANCE MEASUREMENT
(ACCEPTABLE MEASUREMENT NOT LESS THAN 1 MEGOHM): _____

PHASE A TO GROUND: _____

PHASE B TO GROUND: _____

PHASE C TO GROUND: _____

NEUTRAL TO GROUND: _____

ISOLATED GROUND TO GROUND: _____

CONTRACTOR'S REPRESENTATIVE

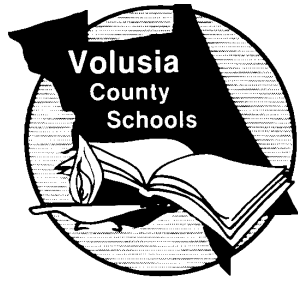
DATE

ENGINEER'S REPRESENTATIVE

DATE

OWNER'S REPRESENTATIVE

DATE



ATTACHMENTS

FACILITIES SERVICES

Florida Exotic Pest Plant Council's 2015 List of Invasive Plant Species

Purpose of the List: *To focus attention on —*

- ▶ the adverse effects of exotic pest plants on Florida's biodiversity and native plant communities,
- ▶ the habitat losses in natural areas from exotic pest plant infestations,
- ▶ the impacts on endangered species via habitat loss and alteration,
- ▶ the need for pest plant management,
- ▶ the socio-economic impacts of these plants (e.g., increased wildfires or flooding in certain areas),
- ▶ changes in the severity of different pest plant infestations over time,
- ▶ providing information to help managers set priorities for research and control programs.

CATEGORY I

Invasive exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. *This definition does not rely on the economic severity or geographic range of the problem, but on the documented ecological damage caused.*

Scientific Name	Common Name	FLEPPC Category	Gov. List	Regional Distribution
<i>Abrus precatorius</i>	rosary pea	I	N	C, S
<i>Acacia auriculiformis</i>	earleaf acacia	I		C, S
<i>Albizia julibrissin</i>	mimosa, silk tree	I		N, C
<i>Albizia lebbek</i>	woman's tongue	I		C, S
<i>Ardisia crenata</i> (<i>A. crenulata</i> misapplied)	coral ardisia	I	N	N, C, S
<i>Ardisia elliptica</i> (<i>A. humilis</i> misapplied)	shoebutton ardisia	I	N	C, S
<i>Asparagus aethiopicus</i> (<i>A. sprengeri</i> ; <i>A. densiflorus</i> misapplied)	asparagus-fern	I		N, C, S
<i>Bauhinia variegata</i>	orchid tree	I		C, S
<i>Bischofia javanica</i>	bishopwood	I		C, S
<i>Calophyllum antillanum</i> (<i>C. calaba</i> misapplied)	Santa Maria, mast wood, Antilles calophyllum	I		S
<i>Casuarina equisetifolia</i>	Australian-pine, beach sheoak	I	P, N	N, C, S
<i>Casuarina glauca</i>	suckering Australian-pine, gray sheoak	I	P, N	C, S
<i>Cinnamomum camphora</i>	camphor tree	I		N, C, S
<i>Colocasia esculenta</i>	wild taro	I		N, C, S
<i>Colubrina asiatica</i>	lather leaf	I	N	S
<i>Cupaniopsis anacardioides</i>	carrotwood	I	N	C, S
<i>Deparia petersenii</i>	Japanese false spleenwort	I		N, C
<i>Dioscorea alata</i>	winged yam	I	N	N, C, S
<i>Dioscorea bulbifera</i>	air-potato	I	N	N, C, S
<i>Dolichandra unguis-cati</i> (<i>=Macfadyena unguis-cati</i>)	cat's claw vine	I		N, C, S
<i>Eichhornia crassipes</i>	water-hyacinth	I	P	N, C, S
<i>Eugenia uniflora</i>	Surinam cherry	I		C, S
<i>Ficus microcarpa</i> (<i>F. nitida</i> and <i>F. retusa</i> var. <i>nitida</i> misapplied) ¹	laurel fig	I		C, S
<i>Hydrilla verticillata</i>	hydrilla	I	P, U	N, C, S
<i>Hygrophila polysperma</i>	green hygro	I	P, U	N, C, S
<i>Hymenachne amplexicaulis</i>	West Indian marsh grass	I		N, C, S
<i>Imperata cylindrica</i> (<i>I. brasiliensis</i> misapplied)	cogon grass	I	N, U	N, C, S
<i>Ipomoea aquatica</i>	water-spinach	I	P, U	C
<i>Jasminum dichotomum</i>	Gold Coast jasmine	I		C, S
<i>Jasminum fluminense</i>	Brazilian jasmine	I		C, S
<i>Lantana camara</i> (<i>= L. strigocamara</i>)	lantana, shrub verbena	I		N, C, S
<i>Ligustrum lucidum</i>	glossy privet	I		N, C
<i>Ligustrum sinense</i>	Chinese privet, hedge privet	I	N ²	N, C, S
<i>Lonicera japonica</i>	Japanese honeysuckle	I		N, C, S
<i>Ludwigia hexapetala</i>	Uruguay waterprimrose	I		N, C
<i>Ludwigia peruviana</i>	Peruvian primrosewillow	I		N, C, S
<i>Lumnitzera racemosa</i>	kriipa; white-flowered mangrove; black mangrove	I		S
<i>Luziola subintegra</i>	Tropical American water grass	I		S
<i>Lygodium japonicum</i>	Japanese climbing fern	I	N	N, C, S

¹Does not include *Ficus microcarpa* subsp. *fuyuensis*, which is sold as "Green Island Ficus"

²Chinese privet is a FLDACS Noxious Weed except for the cultivar 'Variegatum'

FLEPPC List Definitions:

Exotic – a species introduced to Florida, purposefully or accidentally, from a natural range outside of Florida.

Native – a species whose natural range includes Florida.

Naturalized exotic – an exotic that sustains itself outside cultivation (it is still exotic; it has not "become" native).

Invasive exotic – an exotic that not only has naturalized, but is expanding on its own in Florida native plant communities.

Abbreviations:

Government List (Gov. List):

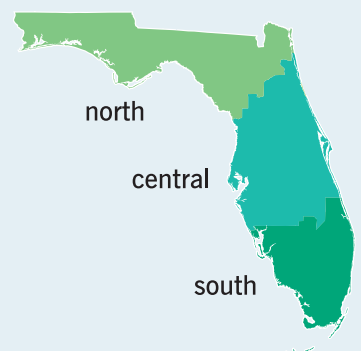
P = Prohibited aquatic plant by the Florida Department of Agriculture and Consumer Services

N = Noxious weed listed by Florida Department of Agriculture & Consumer Services

U = Noxious weed listed by U.S. Department of Agriculture.

Regional Distribution:

N = north, C = central, S = south, referring to each species' current distribution in general regions of Florida (not its potential range in the state). Please refer to the map below.



Changes to the 2015 List:

New Category I Listings:

Sporobolus jacquemontii
(West Indian dropseed)

This weedy grass, a native of the West Indies and tropical America, was introduced into Florida in the early 1900s. In the 1980s-1990s, it was becoming noticeable, especially in pastures where it crowds out forage grasses. It is not palatable for cattle and is very difficult to control. In recent years, this weed has been advancing into natural areas such as palmetto prairies and open flatwoods. West Indian dropseed is a close relative of, and very similar in appearance to, smut grass, *Sporobolus indicus*, leading to confusion with identification. The seedheads of both grasses can be affected by a smut fungus that leaves the seeds black and unfertile. Both grasses have spike-like seedheads. West Indian dropseed is taller, usually about 3-4 feet tall, with spreading seedhead branches. Smut grass is usually 1-2 feet tall with a tight cylindrical spike. Both species are very weedy, but West Indian dropseed is the one that has started invading native habitats.

David Hall

Vitex rotundifolia
(Beach vitex)

Beach vitex is a deciduous shrub that can grow to 1.5 m (5'). The nodal rooting system can extend 10m (34') with stems that can extend over 6m (20') from the main taproot. Young stems are green with fleshy tips that become larger in diameter, brown, and woody with age. Vitex has simple aromatic leaves that are sometimes palmately trifoliate. Leaves are 2-6.5 cm long and 1-4.5 cm wide. The flower is purple in color and appears in late spring to early summer. Vitex can be found on dunes, vacant lots, and along public right-of-ways.

Rick O'Connor, Florida Sea Grant/
University of Florida

New Category II Listings:

Crassocephalum crepidioides
(redflower ragleaf)

Crassocephalum crepidioides is a member of the Aster family native to tropical Africa. This erect herb has a soft stem with lobed leaves and red flowers, with high seed production of more than 4000 per plant. Seeds are dispersed by the wind. First found

Scientific Name	Common Name	FLEPPC Category	Gov. List	Regional Distribution
<i>Lygodium microphyllum</i>	Old World climbing fern	I	N, U	C, S
<i>Macfadyena unguis-cati</i> (see <i>Dolichandra unguis-cati</i>)				
<i>Manilkara zapota</i>	sapodilla	I		S
<i>Melaleuca quinquenervia</i>	melaleuca, paper bark	I	P, N, U	C, S
<i>Melinis repens</i> (= <i>Rhynchelytrum repens</i>)	Natal grass	I		N, C, S
<i>Mimosa pigra</i>	catclaw mimosa	I	P, N, U	C, S
<i>Nandina domestica</i>	nandina, heavenly bamboo	I		N, C
<i>Nephrolepis brownii</i> (= <i>N. multiflora</i>)	Asian sword fern	I		C, S
<i>Nephrolepis cordifolia</i>	sword fern	I		N, C, S
<i>Neyraudia reynaudiana</i>	Burma reed, cane grass	I	N	S
<i>Nymphoides cristata</i>	crested floating heart	I	N	C, S
<i>Paederia cruddasiana</i>	sewer vine, onion vine	I	N	S
<i>Paederia foetida</i>	skunk vine	I	N	N, C, S
<i>Panicum repens</i>	torpedo grass	I		N, C, S
<i>Pennisetum purpureum</i>	Napier grass, elephant grass	I		N, C, S
<i>Phymatosorus scolopendria</i>	serpent fern, wart fern	I		S
<i>Pistia stratiotes</i>	water-lettuce	I	P	N, C, S
<i>Psidium cattleianum</i> (= <i>P. littorale</i>)	strawberry guava	I		C, S
<i>Psidium guajava</i>	guava	I		C, S
<i>Pueraria montana</i> var. <i>lobata</i> (= <i>P. lobata</i>)	kudzu	I	N	N, C, S
<i>Rhodomirtus tomentosa</i>	downy rose-myrtle	I	N	C, S
<i>Rhynchelytrum repens</i> (See <i>Melinis repens</i>)				
<i>Ruellia simplex</i> ¹	Mexican petunia	I		N, C, S
<i>Salvinia minima</i>	water spangles	I		N, C, S
<i>Sapium sebiferum</i> (= <i>Triadica sebifera</i>)	popcorn tree, Chinese tallow tree	I	N	N, C, S
<i>Scaevola taccada</i> (= <i>Scaevola sericea</i> , <i>S. frutescens</i>)	scaevola, half-flower, beach naupaka	I	N	C, S
<i>Schefflera actinophylla</i> (= <i>Brassaia actinophylla</i>)	schefflera, Queensland umbrella tree	I		C, S
<i>Schinus terebinthifolius</i>	Brazilian-pepper	I	P, N	N, C, S
<i>Scleria lacustris</i>	Wright's nutrush	I		C, S
<i>Senna pendula</i> var. <i>glabrata</i> (= <i>Cassia coluteoides</i>)	climbing cassia, Christmas cassia, Christmas senna	I		C, S
<i>Solanum tampicense</i> (= <i>S. houstonii</i>)	wetland nightshade, aquatic soda apple	I	N, U	C, S
<i>Solanum viarum</i>	tropical soda apple	I	N, U	N, C, S
<i>Sporobolus jacquemontii</i> * (= <i>S. indicus</i> var. <i>pyramidalis</i>)	West Indian dropseed	I		C, S
<i>Syngonium podophyllum</i>	arrowhead vine	I		N, C, S
<i>Syzygium cumini</i>	jambolan-plum, Java-plum	I		C, S
<i>Tectaria incisa</i>	incised halberd fern	I		S
<i>Thespesia populnea</i>	seaside mahoe	I		C, S
<i>Tradescantia fluminensis</i>	small-leaf spiderwort	I		N, C
<i>Urena lobata</i>	Caesar's weed	I		N, C, S
<i>Urochloa mutica</i> (= <i>Brachiaria mutica</i>)	Para grass	I		C, S
<i>Vitex rotundifolia</i> *	beach vitex	I		N

CATEGORY II

Invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species. *These species may become ranked Category I if ecological damage is demonstrated.*

Scientific Name	Common Name	FLEPPC Category	Gov. List	Regional Distribution
<i>Adenanthera pavonina</i>	red sandalwood	II		S
<i>Agave sisalana</i>	sisal hemp	II		C, S
<i>Aleurites fordii</i> (= <i>Vernicia fordii</i>)	tung oil tree	II		N, C
<i>Alstonia macrophylla</i>	devil tree	II		S
<i>Alternanthera philoxeroides</i>	alligator weed	II	P	N, C, S
<i>Antigonon leptopus</i>	coral vine	II		N, C, S
<i>Ardisia japonica</i>	Japanese ardisia	II		N
<i>Aristolochia littoralis</i>	calico flower	II		N, C, S

¹Many names are applied to this species in Florida because of a complicated taxonomic and nomenclatural history. Plants cultivated in Florida, all representing the same invasive species, have in the past been referred to as *Ruellia brittoniana*, *R. tweediana*, *R. caerulea*, and *R. simplex*.
*Added to the FLEPPC List of Invasive Plant Species in 2015

Scientific Name	Common Name	FLEPPC Category	Gov. List	Regional Distribution
<i>Asystasia gangetica</i>	Ganges primrose	II		C, S
<i>Begonia cucullata</i>	wax begonia	II		N, C, S
<i>Blechnum pyramidatum</i> (see <i>Ruellia blechnum</i>)				
<i>Broussonetia papyrifera</i>	paper mulberry	II		N, C, S
<i>Bruguiera gymnorhiza</i>	large-leaved mangrove	II		S
<i>Callisia fragrans</i>	inch plant, spironema	II		C, S
<i>Casuarina cunninghamiana</i>	river sheoak, Australian-pine	II	P	C, S
<i>Cecropia palmata</i>	trumpet tree	II		S
<i>Cestrum diurnum</i>	day jessamine	II		C, S
<i>Chamaedorea seifrizii</i>	bamboo palm	II		S
<i>Clematis terniflora</i>	Japanese clematis	II		N, C
<i>Cocos nucifera</i>	coconut palm	II		S
<i>Crassocephalum crepidioides</i> *	redflower ragleaf, Okinawa spinach	II		C, S
<i>Cryptostegia madagascariensis</i>	rubber vine	II		C, S
<i>Cyperus involucratus</i> (<i>C. alternifolius</i> misapplied)	umbrella plant	II		C, S
<i>Cyperus prolifer</i>	dwarf papyrus	II		C, S
<i>Dactyloctenium aegyptium</i>	Durban crowfoot grass	II		N, C, S
<i>Dalbergia sissoo</i>	Indian rosewood, sissoo	II		C, S
<i>Elaeagnus pungens</i>	silverthorn, thorny olive	II		N, C
<i>Elaeagnus umbellata</i>	silverberry, autumn olive	II		N
<i>Epipremnum pinnatum</i> cv. Aureum	pothos	II		C, S
<i>Eulophia graminea</i>	Chinese crown orchid	II		S
<i>Ficus altissima</i>	false banyan, council tree	II		S
<i>Flacourtia indica</i>	governor's plum	II		S
<i>Hemarthria altissima</i>	limpo grass	II		C, S
<i>Heteropterys brachiata</i> *	red wing	II		S
<i>Hibiscus tiliaceus</i> (See <i>Talipariti tiliaceum</i>)				
<i>Hyparrhenia rufa</i>	jaragua	II		N, C, S
<i>Ipomoea carnea</i> ssp. <i>fistulosa</i> (= <i>I. fistulosa</i>)	shrub morning-glory	II	P	C, S
<i>Kalanchoe pinnata</i> (= <i>Bryophyllum pinnatum</i>)	life plant	II		C, S
<i>Koeleruteria elegans</i> ssp. <i>formosana</i> (= <i>K. formosana</i> ; <i>K. paniculata</i> misapplied)	flamegold tree	II		C, S
<i>Landoltia punctata</i> (= <i>Spirodela punctata</i>)	spotted duckweed	II		N, C, S
<i>Leucaena leucocephala</i>	lead tree	II	N	N, C, S
<i>Limnophila sessiliflora</i>	Asian marshweed	II	P, U	N, C, S
<i>Livistona chinensis</i>	Chinese fan palm	II		C, S
<i>Macroptilium lathyroides</i>	phasey bean	II		N, C, S
<i>Melaleuca viminalis</i> (= <i>Callistemon viminalis</i>)	bottlebrush, weeping bottlebrush	II		C, S
<i>Melia azedarach</i>	Chinaberry	II		N, C, S
<i>Melinis minutiflora</i>	molasses grass	II		C, S
<i>Merremia tuberosa</i>	wood-rose	II		C, S
<i>Mikania micrantha</i>	mile-a-minute vine	II	N, U	S
<i>Momordica charantia</i>	balsam apple, balsam pear	II		N, C, S
<i>Murraya paniculata</i>	orange-jessamine	II		S
<i>Myriophyllum spicatum</i>	Eurasian water-milfoil	II	P	N, C, S
<i>Panicum maximum</i> (= <i>Urochloa maxima</i> , <i>Megathyrsus maximus</i>)	Guinea grass	II		N, C, S
<i>Passiflora biflora</i>	two-flowered passion vine	II		S
<i>Pennisetum setaceum</i>	green fountain grass	II		S
<i>Phoenix reclinata</i>	Senegal date palm	II		C, S
<i>Phyllostachys aurea</i>	golden bamboo	II		N, C
<i>Pittosporum pentandrum</i>	Philippine pittosporum, Taiwanese cheesewood	II		S
<i>Praxelis clematidea</i> *	praxelis	II		C
<i>Pteris vittata</i>	Chinese brake fern	II		N, C, S
<i>Ptychosperma elegans</i>	solitaire palm	II		S
<i>Rhoeo spathacea</i> (see <i>Tradescantia spathacea</i>)				

*Added to the FLEPPC List of Invasive Plant Species in 2015

FLEPPC 2015 List of Invasive Plant Species

in the US in 1997 in Miami-Dade County, redflower ragleaf was documented in the panhandle in Escambia County in 2012.

Patricia L. Howell

Heteropterys brachiata

(red wing)

Heteropterys brachiata or “redwing” is a liana (woody vine) in the Malpighiaceae family. It is native to Mexico, Central America and South America. Redwing seedlings dominate the understory of hardwood hammocks, and older plants twine up into the canopy where their flowers and fruits are present, but out of reach, in winter months. The fruits of redwing are deep red, wind-dispersed samaras; hence the name “redwing.”

Jennifer Possley, Fairchild Tropical Botanic Garden

Praxelis clematidea

(Praxelis)

Praxelis clematidea is an Aster with lavender colored flowers from South America. Its short life cycle and propensity to be moved by vehicles contribute to its recent invasion in Central Florida. Look for young, light green plants with irregularly toothed leaves that soon flower, and then develop tough stems and bases. Flowers are a series of florets produced in heads, each producing a single, bristle-topped seed that is seated on a conical receptacle. This key character is easy to see because the phyllaries fall to reveal the receptacle when the head is in fruit.

Colette Jacono

Spermacoce verticillata

(scrubby false buttonweed)

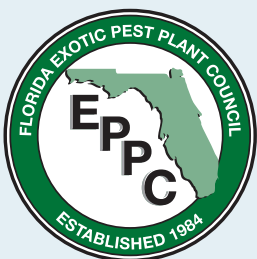
A common weed of disturbed sites for over 80 years, *Spermacoce verticillata* is advancing into natural areas, especially in southern Florida. A member of the coffee family, Rubiaceae, plants are best known for their nearly woody, multiple branched structure, opposite, stalkless leaves often clustered in a whorl; and axillary, cylindrical heads of densely packed flowers. Distinguish this species from our natives by its tubular white flowers that are no longer than 1mm and fruits that are less than 1.5mm long.

Colette Jacono

Use of the FLEPPC List

The FLEPPC List of Invasive Plant Species is not a regulatory list. Only those plants listed as Federal Noxious Weeds, Florida Noxious Weeds, Florida Prohibited Aquatic Plants, or in local ordinances are regulated by law. FLEPPC encourages use of the Invasive Species List for prioritizing and implementing management efforts in natural areas, for educating lay audiences about environmental issues, and for supporting voluntary invasive plant removal programs. For more information on using the FLEPPC List of Invasive Plant Species, see *Proper Uses of FLEPPC Invasive Plant Lists* at www.fleppc.org/list/list.htm

NOTE: Not all exotic plants brought into Florida become pest plants in natural areas. The FLEPPC List of Invasive Plant Species represents only about 11% of more than 1,400 exotic species that have been introduced into Florida and have subsequently established outside of cultivation. Most escaped exotics usually present only minor problems in highly disturbed areas (such as road-sides). And there are other exotics cultivated in Florida that are “well-behaved” — that is, they don’t escape cultivation at all.



www.fleppc.org

Scientific Name	Common Name	FLEPPC Category	Gov. List	Regional Distribution
<i>Richardia grandiflora</i>	large flower Mexican clover	II		N, C, S
<i>Ricinus communis</i>	castor bean	II		N, C, S
<i>Rotala rotundifolia</i>	roundleaf toothcup, dwarf Rotala, redweed	II		S
<i>Ruellia blechum</i> (= <i>Blechum brownei</i>)	green shrimp plant, Browne's blechum	II		N, C, S
<i>Sansevieria hyacinthoides</i>	bowstring hemp	II		C, S
<i>Sesbania punicea</i>	purple sesban, rattlebox	II		N, C, S
<i>Solanum diphyllum</i>	two-leaf nightshade	II		N, C, S
<i>Solanum torvum</i>	susumber, turkey berry	II	N, U	N, C, S
<i>Spermacoce verticillata</i> *	shrubby false buttonweed	II		C, S
<i>Sphagneticola trilobata</i> (= <i>Wedelia trilobata</i>)	wedelia	II		N, C, S
<i>Stachytarpheta cayennensis</i> (= <i>S. urticifolia</i>)	nettle-leaf porterweed	II		S
<i>Syagrus romanzoffiana</i> (= <i>Arecastrum romanzoffianum</i>)	queen palm	II		C, S
<i>Syzygium jambos</i>	Malabar plum, rose-apple	II		N, C, S
<i>Talipariti tiliaceum</i> (= <i>Hibiscus tiliaceus</i>)	mahoe, sea hibiscus	II		C, S
<i>Terminalia catappa</i>	tropical-almond	II		C, S
<i>Terminalia muelleri</i>	Australian-almond	II		C, S
<i>Tradescantia spathacea</i> (= <i>Rhoeo spathacea</i> , <i>Rhoeo discolor</i>)	oyster plant	II		S
<i>Tribulus cistoides</i>	puncture vine, burr-nut	II		N, C, S
<i>Vitex trifolia</i>	simple-leaf chaste tree	II		C, S
<i>Washingtonia robusta</i>	Washington fan palm	II		C, S
<i>Wedelia</i> (see <i>Sphagneticola</i> above)				
<i>Wisteria sinensis</i>	Chinese wisteria	II		N, C
<i>Xanthosoma sagittifolium</i>	malanga, elephant ear	II		N, C, S

Citation example:

FLEPPC. 2015. List of Invasive Plant Species. Florida Exotic Pest Plant Council. <http://www.fleppc.org/list/list.htm>

The 2015 list was prepared by the FLEPPC Plant List Committee:

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The Early Detection and Distribution Mapping System (EDDMapS) holds records of reported sighting of invasive species in Florida. Most records are from local, state, and federal parks and preserves; a few records document infestations in regularly disturbed public lands such as highways or utility rights-of-way. Natural area managers, veteran observers of Florida's natural landscapes, and others submit these records, with many supported further by voucher specimens housed in local or regional herbaria for future reference and verification. New and updated observations can be submitted online at EDDMapS [www.eddmaps.org/florida/]. All reports are verified by an expert. This database, along with other plant data resources such as the University of South Florida's Atlas of Florida Vascular Plants [www.plantatlas.usf.edu], the Florida Natural Areas Inventory database [www.fnai.org], and The Institute for Regional Conservation Floristic Inventory of South Florida database [www.regionalconservation.org], provides important basic supporting information for the FLEPPC List of Invasive Plant Species. Greater success and accuracy in searching for plant information is likely if you search by scientific name rather than common name. Common names often vary in cultivation and across regions.

*Added to the FLEPPC List of Invasive Plant Species in 2015

DIVISION 16

ALUMINUM CANOPY LIGHT FIXTURE INSTALLATION

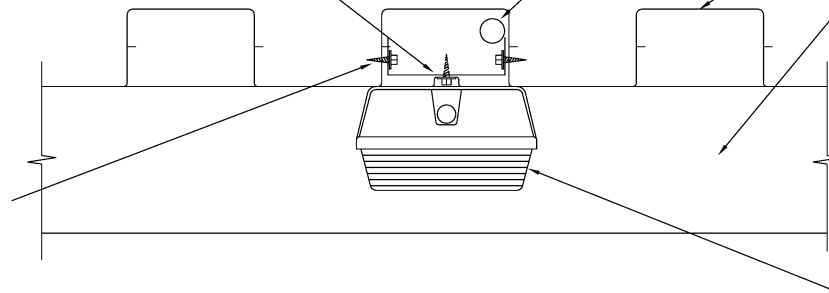
6" Long Extruded Aluminum Channel Brackets to Match Canopy Decking by Canopy Mnfr. for mounting Light Fixtures. (2) per Fixture. Attach to Sides of Decking Flutes as High as possible w/ Self-Tapping Stn. Stl. Neoprene Gasketed Fasteners. Do Not Penetrate Top or Bottom of Deck.

Sched 40 PVC Electrical Conduit, Clips and Fittings @ Canopies. Fasten Clips w/ Self-Tapping Stn. Stl. Neoprene Gasketed Fasteners to Sides of Deck Flutes as High as Possible.

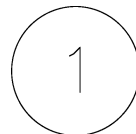
Extruded Alum Decking.

Extruded Aluminum Beam Beyond.

Silicone Sealant @ Outer Deck Side of all Fasteners.



Exterior Industrial Light Fixture w/ Non-Metalic Fiberglass Housing for High-Humidity Exterior Applications. Provide Factory Threaded Hubs @ Each End of Fixture Housing. Attach Only to Alum Canopy Brackets as Shown w/ Staninless Steel Brackets and Hardware by Light Fixture Mnfr.



DETAIL

SCALE: 1 1/2" = 1'-0"

TYPICAL ALUMINUM CANOPY
LIGHT FIXTURE

DIVISION 16

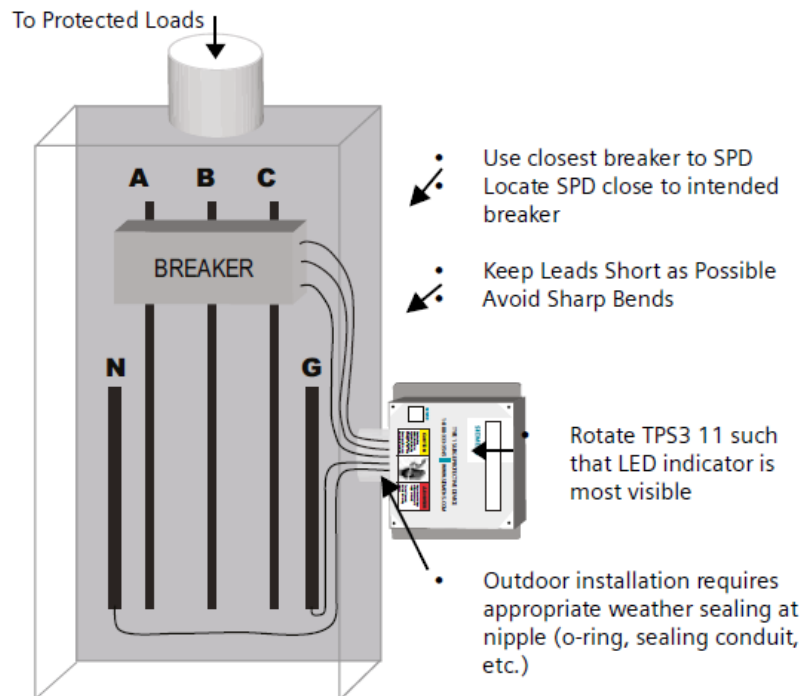
TYPICAL SURGE PROTECTION DEVICE PANEL INSTALLATION

1. Use a voltmeter to check all voltages to ensure correct SPD
2. If unit has Flush Mount option refer to Flush Mount Installation Instructions following
3. If SPD has Dry Contact pre-plan its installation
4. Remove power for panel. Confirm panel is deenergized.
5. Identify breaker location and SPD location
6. Remove an appropriately sized knockout from panel
7. Mount SPD, use appropriate weatherproofing equipment as needed
8. Connect conductors as appropriate – short and straight as possible (Note that Hi-Legs are Phase B)
9. Label or mark conductors as appropriate (neutral: white, ground: green, energized: black, hi-leg: orange)
10. Make sure system is bonded per NEC® and is clear of hazards or faults before energizing (N-G bonding not per NEC® will fail SPDs: #1 cause of SPD failures)
11. Energize and confirm proper operation of indicators and/or options

A sealing O-ring is provided. SPD can be chase-nipple mounted (nut is provided).

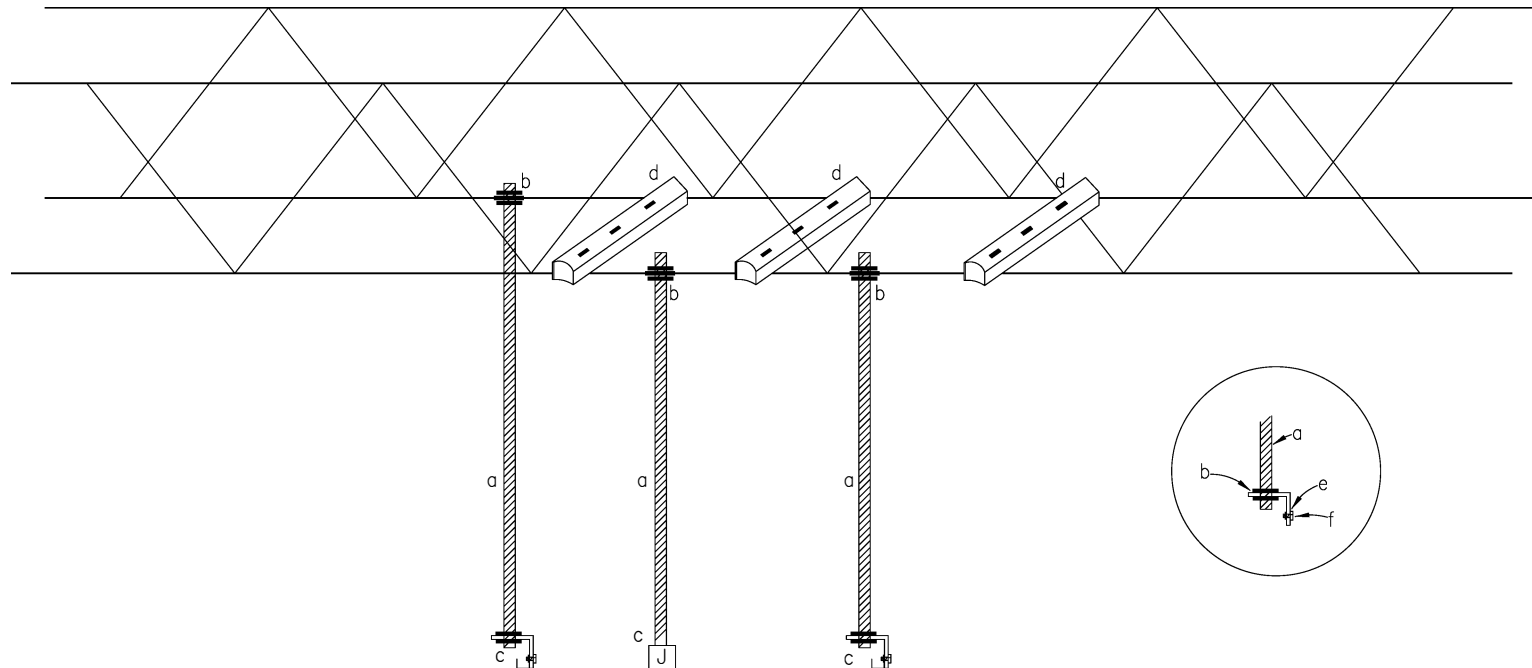
Note that any conduits must be installed correctly.

Figure 5: Typical Panel Installation



DIVISION 16

PROJECTOR MOUNTING PLATE DETAIL



TYPICAL PROJECTOR MOUNTING PLATE DETAIL

N.T.S.

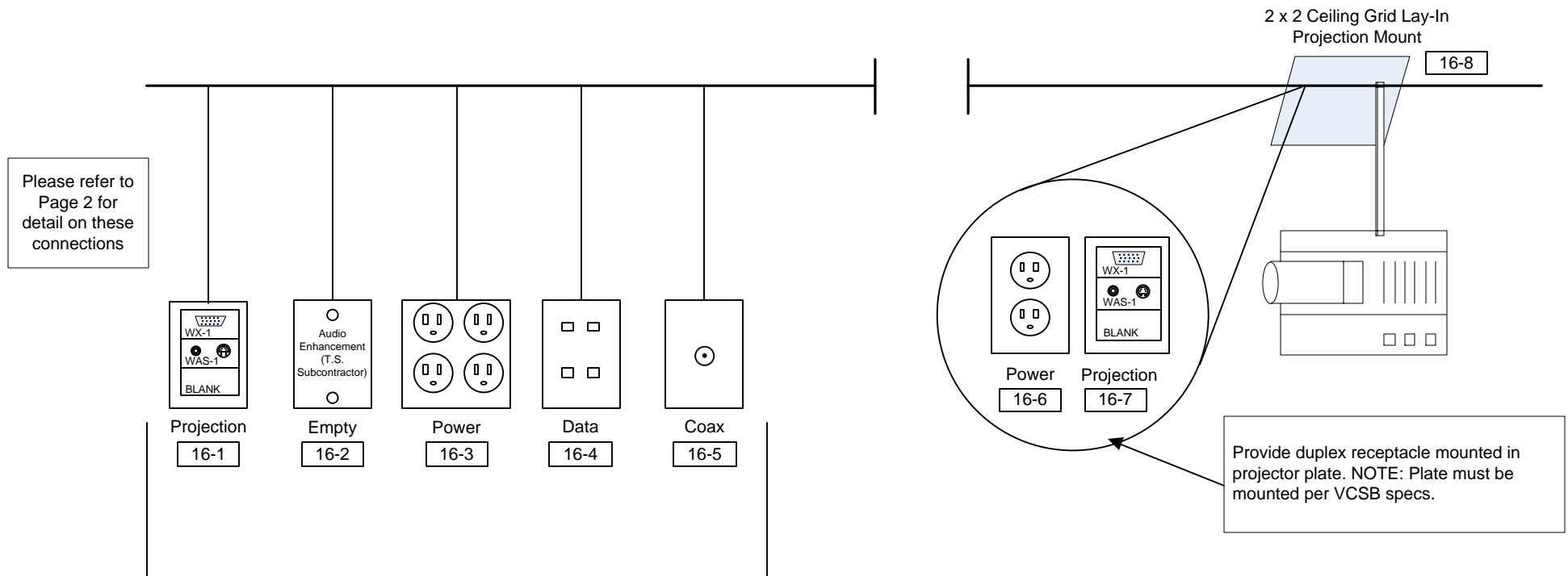
NOTES:

- a. 3/8" ALL THREAD LENGTH AS REQUIRED
- b. (2) 3/8" X 20 NUTS
(2) 1/2" X 20 LOCK WASHERS
(2) 3/8" X 1-1/2" FENDER WASHERS ATTACH TO BUILDING STRUCTURE
- c. PROVIDE (2) LOCK WASHER, FENDER WASHERS AND (2) 3/8" X 20 NUTS FOR J-BOX AND PROJECTOR PLATE ATTACHMENT.
- d. UNISTRUT 1-5/8" LENGTH AS REQUIRED TO SPAN BAR JOIST OPENING. ATTACH WITH SAME AS (b). PROVIDE UNISTRUT TO SPAN DUCT WORK OR OTHER ABOVE CEILING OBSTACLES WHERE REQUIRED.

NOTES (CONT.):

- e. (2) HOLE ANGLE BRACKET
(2) 3/8" HOLES, 1/4" THICK METAL, SIMILAR TO KINDORF B915
- f. 1/4" X 20 X 1-1/4" HEX BOLT WITH
(1) 1/4" X 20 NUT
(2) 1/4" X 1" FENDER WASHER
(1) 1/4" X 20 LOCK WASHER

Technology Services - Standard Projection System Layout



General Notes:

1. Locate at specific location designated by Technology Services contact.
2. All cabling, mounting plates, and outlet plates provided, installed and terminated per VCS specifications. See termination requirements on second page of this document.

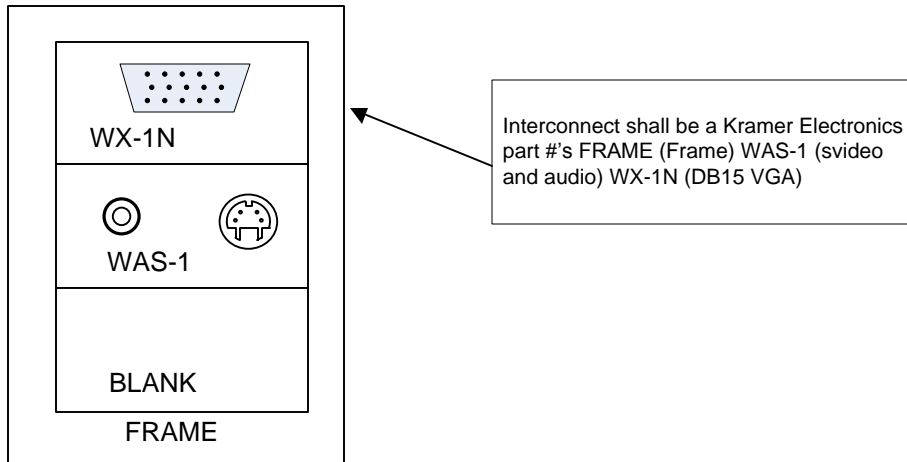
Specific Notes:

- 16-1 Provide (1) West Penn 255CRGB (5 coax RGBHV cable) and (1) West Penn Plenum #252825 (dual minimax 75 ohm SVHS 25 AWG) and (1) West Penn 77292 (audio cable). Provide 4' of slack at 16-7 area and 2' of slack at the top of the conduit 16-1 from the wall. These cables should run and terminated to 16-7 (projector ceiling plate). See page 2 for part numbers and termination specs.
- 16-2 Three pull strings to be installed by electrical contractor in audio enhancement conduit.
- 16-3 Conditioned Power: Provide black quad receptacles and stainless steel cover plate.
- 16-4 Data: Box #52171 ¾, with single gang plaster ring with four CAT 6 or higher UTP cabled to be terminated back to IDF/MDF.
- 16-5 Coax: Box #52171 ¾, with single gang plaster ring with TV Cable to terminate back to CCTV rack and terminated with Type 'F' connector. Stainless steel plate with barrel connector.
- 16-6 Conditioned Power: Provide (1) duplex receptacles and stainless steel cover plate.
- 16-7 See 16-1
- 16-8 Technology Services will provide projector plate. Locate 8-10' from the center of the projector screen.

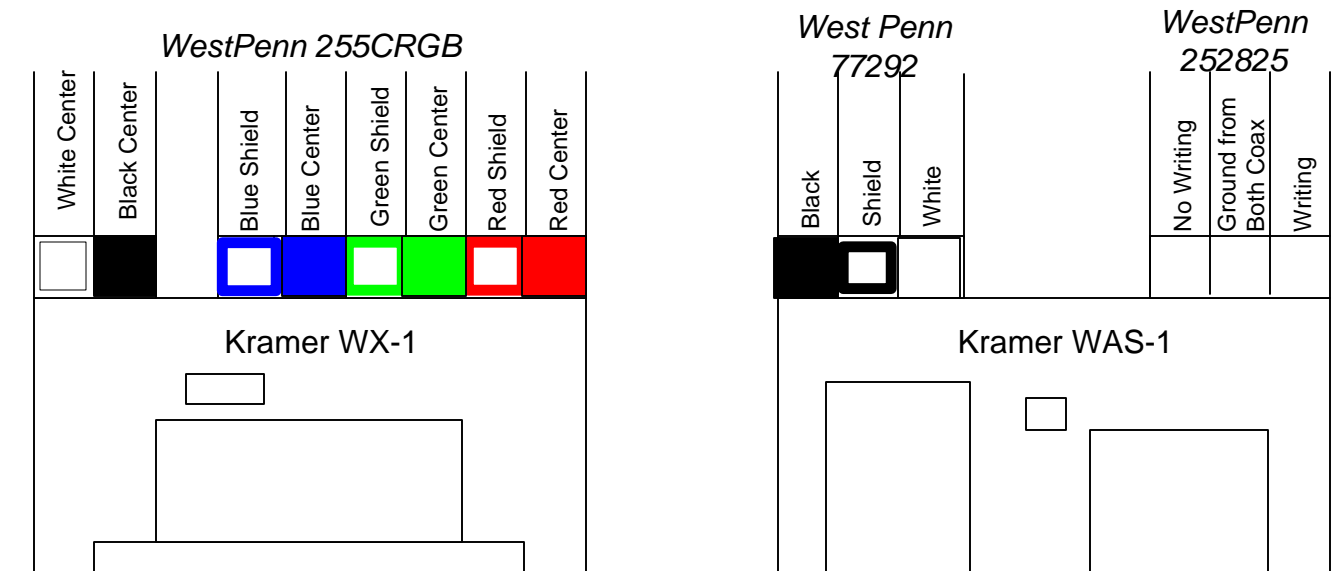


New Construction & Renovation - Projection System Wiring Diagram

Typical Projector Interconnect:

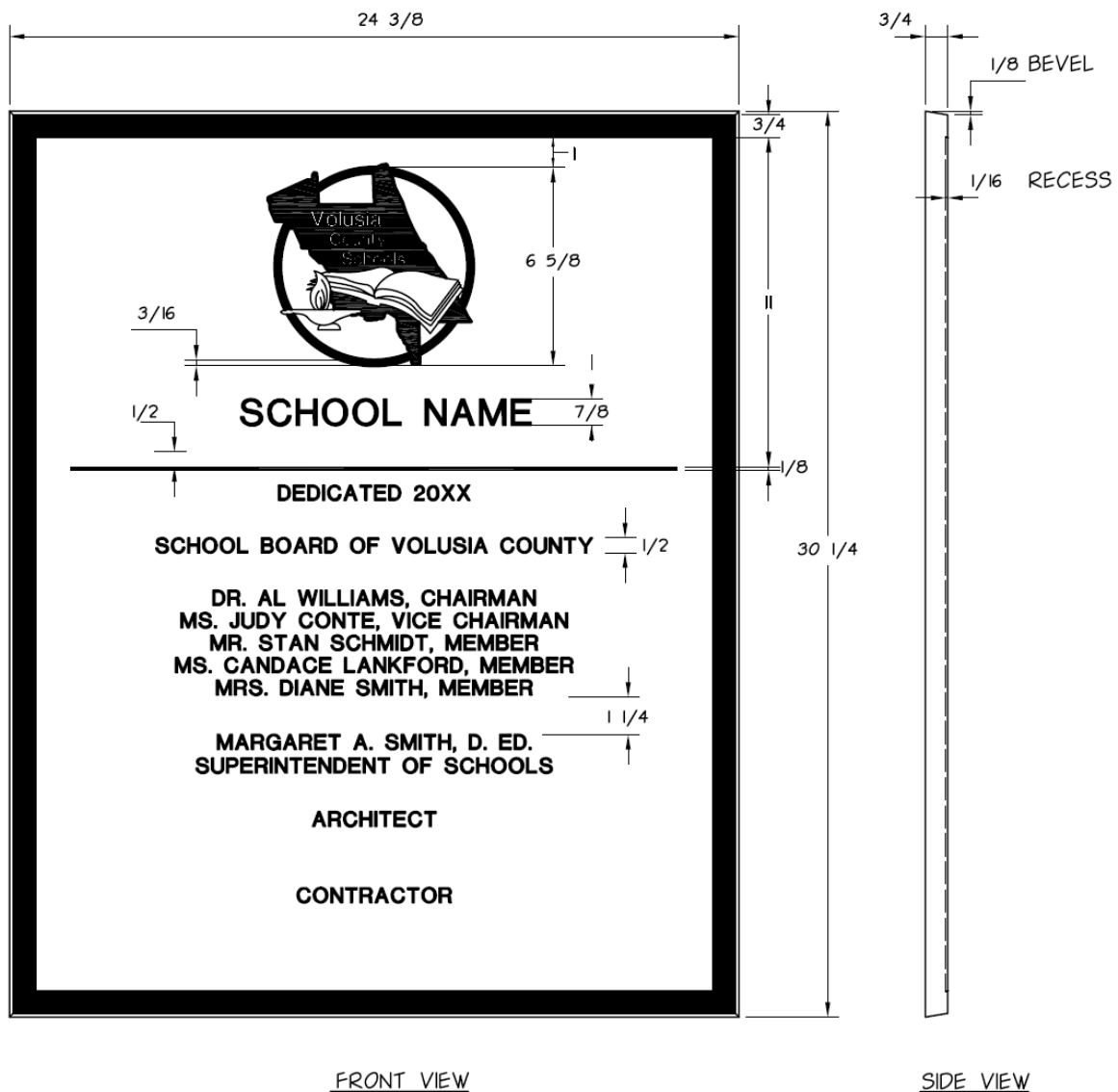


Termination Specifications:



BRONZE DEDICATION PLAQUE

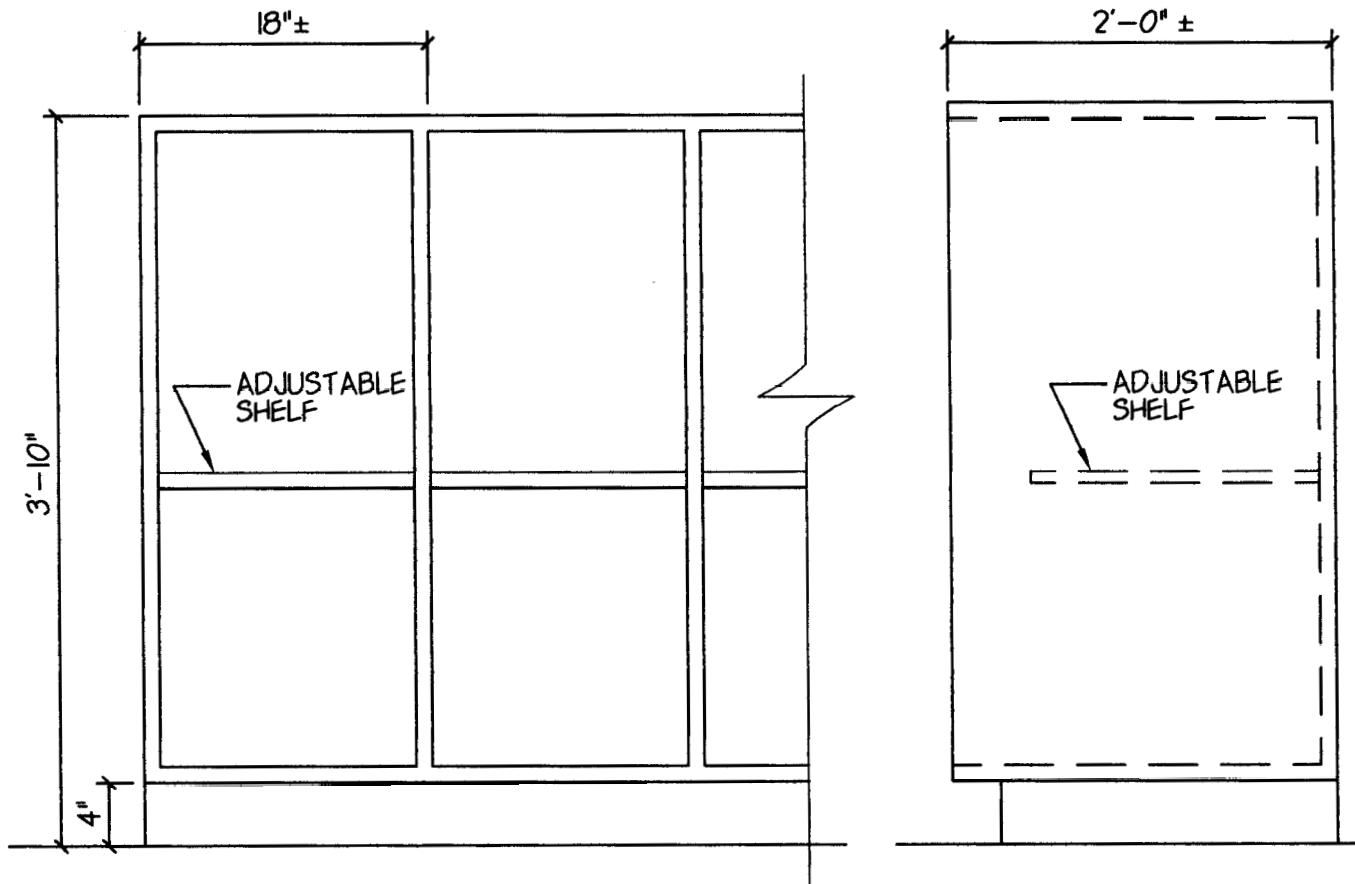
EXAMPLE



Material: Bronze / Aluminum Bronze Plated
Size: 24" W x 30" H
Mount: Flush

Finish: Satin
Color: Black
Background: Standard Pebble
Boarder: Raised

Note: School Board Members shall be listed as they were at the time the project was approved.



ELEMENTARY SCHOOL STORAGE "CUBBIES" DETAIL

SCALE: $1'' = 1'-0''$

10/31/07