DESIGN STANDARDS

for

CONSULTANTS

The School District of Osceola County

prepared by

Facilities Planning & Construction

(Printed 7/30/08)

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INTRODUCTION

The School Board of Osceola County believes that a quality education should lead all students to responsible citizenship, a sound means of earning a living, and a desire to be a life-long learner. Therefore, the Board is committed to the attainment of excellence in all programs and services provided to the students. The Board believes that citizen participation in the decision-making process and in the school system's volunteer programs enhances the quality of educational programs and encourages such participation.

To provide a quality education with all the elements identified above, the facilities to house our educational environment must be designed for the appropriate function with construction quality in mind.

Since the intent of the standards is not to limit the scope and creative judgment of the Architect/Engineer, but to provide guidelines from which to work, only minimum criteria are included herein; therefore, some deviation from the standards is expected, but only with the written approval of the School District of Osceola County, Office of Facilities Planning and Construction. Such approval does not constitute approval by other governmental regulatory agencies inasmuch as the School District does not have the power to grant exceptions that violate other governmental agency standards and codes.

These standards are intended to equal or exceed those enforced by the State Department of Education. Governmental regulations are revised periodically so care should be taken to verify compliance with current applicable governmental standards.

The Design Standards are divided into three (3) sections. The following is a summary outline of the information contained in each section.

Section One - Architectural and Engineering Design Criteria: A summary of design requirements needed during the initial planning and design concepts and suggestions specific to the School District of Osceola County, divided into the following sections.

.... Design Objectives
.... Building and Site Criteria
.... Land Planning and Landscaping Standards
.... Mechanical Design Standards
.... Electrical Design Standards

Section Two - Contract Documents: A summary of standards required in the preparation of working drawings and specifications.

Section Three - Construction Specifications: A summary of detailed construction specification requirements, specific and technical, presented in the Construction Specification Institute (CSI) format of Sections 01000 through 15000.

Questions regarding these standards should be directed to the Director of Facilities Planning and Construction, School District of Osceola County.

PREFACE

The Construction Design Standards are only one document in a set of related documents that make up a total Design Guide for the School District of Osceola County. The following documents should be used as reference during the design of construction for the school district and is included in the PROJECT DESIGN MANUAL.

.... A/E Contract

.... Architect/Engineer General Terms and Conditions

.... Project Manual for the School District of Osceola County construction projects

.... School District of Osceola County approved Educational Specifications for the project.

.... School District of Osceola County Construction Design Standards

SECTION TWO

CONTRACT DOCUMENTS

PART 2.1 - GENERAL

2.1.1 DOCUMENT REQUIREMENTS

A. The Architect/Engineer shall strive to make the 100% submittal complete without having to be returned to him for correction or comment for final processing. The drawings, specifications and cost estimate should be complete and to the point where, if necessary, the project could be advertised immediately without further change. **PROJECT DRAWINGS SHALL BE, TO THE BEST OF THE ARCHITECT/ENGINEER'S KNOWLEDGE, FINAL AND COMPLETE, WITH ALL ELEMENTS THOROUGHLY CHECKED AND COORDINATED**.

PART 2.2 - DRAWINGS

2.2.1 PREPARATION OF DRAWINGS

A. Standard professional drawing practice as contained in the "Architectural Graphic Standards" is acceptable. All available information which will define the scope of the work must be included on the drawings. A complete legend of abbreviations and symbols and, when applicable, complete finish, equipment and fixture schedules shall also be included on the drawings. If necessary, Additive Bid Items may be designated on the drawings as "Additive Bid Item". All elements of the work shall be properly coordinated to insure that there are no conflicts between architectural, structural, mechanical and electrical portions of the work. PARTICULAR EMPHASIS SHALL BE PLACED ON THIS COORDINATION WHEN CERTAIN ELEMENTS OF DESIGN ARE PERFORMED UNDER SUBCONTRACT TO THE ARCHITECT/ENGINEER CONTRACT. Drawings should be so prepared that change orders to construction contracts will not be necessary as a result of errors, omissions, inadequacies, or conflicts with the Specifications. ALL DRAWINGS AND SPECIFICATIONS SHALL BE THOROUGHLY CHECKED BY AN ARCHITECT/ENGINEER EXPERIENCED IN THE PARTICULAR DISCIPLINES INVOLVED.

2.2.2 Drafting Media

A. Unless instructed otherwise, complete sets of project working drawings are required to be produced or as-builts to be produced in CADD. The work shall conform to the AUTO CADD Standards found in Architect/Engineers General Terms and Conditions. (See also PART III ADMINISTRATIVE PROVISIONS, 01700 PROJECT CLOSEOUT.)

2.2.3 Drawings for Remodeling Projects

A. Two drawings of each floor plan are required: One drawing to show existing construction and demolition, the second to show the new construction and existing construction which is to remain. When sheet size permits, the two plans shall be drawn on the same sheet, for easy comparison of the two. This requirement applies to the floor plans for all Divisions of the Work.

2.3.4 Fire Rated Construction

A. All fire rated construction shall be labeled on plans, sections and details. To better interpret the fire rating construction, all plans and sections shall be marked in different patterns to designate different hourly fire ratings.

2.2.5 Arrangement of Drawings

A. Drawings should be arranged in the following order:

1. Index (may be included with plot and vicinity plan cover sheet)
2. Sanitary and Civil (including pump stations and similar facilities)
3. Architectural
4. Structural
5. ***Mechanical (heating, ventilation, plumbing, fire-protection,etc.)***
6. Electrical

2.2.6 Drawing Title Page/Cover Sheet

Refer to Architects/Engineers General Terms and Conditions.

PART 2.3 - SPECIFICATIONS

2.3.1 SPECIFICATION REQUIREMENTS

A. DO NOT USE OUTDATED SPECIFICATIONS PREPARED FOR OTHER PROJECTS OR OBSOLETE GUIDES AND INFORMATION REMAINING from other contracts in the preparation of the Specifications for a new project. CUT AND PASTE SPECIFICATIONS WILL BE REJECTED. MICROSOFT WORD TYPED MANUSCRIPT ONLY WILL BE ACCEPTED ON FINAL SUBMISSIONS, AND WILL REPRESENT ORIGINALS. It is advisable to use this form, as received, as a master for printing of specifications rather than risk the possibility of omissions and errors being made in typing the copy.

2.3.2 General Instructions

A. The project specifications form a part of the contract documents. Project specifications shall be as brief as possible, definite, and free of ambiguities and omissions which might result in controversies and Contractor's claims for additional compensation. For construction projects which involve interruptions of existing building operations or major utility outages, it is the ARCHITECT/ENGINEER's responsibility to discuss the required outages and interruptions with the District Project Manager and establish a construction schedule in the Specifications for these interruptions.

2.3.3 Continuity of School District Operations

A. Throughout the construction period, it is essential that schools, classrooms, etc. be maintained in continuous operation. These include class schedules, special events, routine services activity, etc. Further, vehicular and pedestrian traffic and fire fighting equipment access to all buildings must be maintained without interruption.

It is the responsibility of the Architect/Engineer to include in the contract documents specific requirements for continuity of services. Such requirements may include schedules for certain features of the work, limitations on noise, temporary walkways, provisions for dust-proof partitions, and utilities disruptions. In each case, requirements for maintenance of School District facilities shall be coordinated with the District Project Manager and all special limitations on the Contractor's construction methods shall be included in the drawings and specifications.

2.3.4 Tests

A. Unless the Owner specifically states in the Specifications that certain tests will be made by the School District, all testing will be performed by the contractor or by qualified agents employed by the contractor. To enable the contractor to price out the testing, all tests to be performed must be stated clearly in the Specifications. The text should state what is to be tested, the Standard or Specification under which it is to be tested, which test should be used, the number of units to be tested, how many tests should be made and the frequency at which they should be made. In addition, acceptable limits of tests results shall be stated. Manufacturer's certified tests, when made in accordance with recognized standards or procedures such as those of the ASTM, are acceptable and should be used in lieu of testing an actual unit where possible. Maintenance Department representatives will witness all tests and specifications should specify this requirement.

2.3.5 Inspection

A. When the word "inspection, inspect, "and words of similar meaning are used in the Specifications, the performance is to be accomplished by the Owner's Representative or his qualified agent. The School District will not "inspect" any portion of the work unless the Specification states that the School District is to be the inspector. If the Architect/Engineer, in his professional opinion, feels that the School District should inspect any part of the work, he shall so state the requirement in the Specification in clear and concise manner.

2.3.6 Organization

A. Titles of sections should be brief but should reflect the principal items and/or trades specified in the section.

2.3.7 Format

A. The standard Construction Specifications Institute 16-Division, sectional format shall be used unless otherwise directed by the Office of Facilities Planning and Construction.

B. Indexing shall be bound to contain the legal standard documents listed below. Use colored stock for printing as follows:

WHITE - "Owner" Project Manual (Bidding Conditions and Contractual Conditions)

YELLOW - "Owner" Project Manual (Special Conditions)

WHITE - Architectural (Division 1-14)

BLUE - Mechanical (Division 15), First page shall be index to Division 15.

BUFF - Electrical (Division 16), First page shall be index to Division 16.

Binders - Roll-form plastic/GBC binders are **NOT** acceptable.

2.3.8 Format of Submissions During Design Review Phases

A. The number of copies required for each submission shall be as stipulated in the Architect/Engineer contract. Typically this is six (6) complete sets of documents.

B. Final Specifications shall be single-spaced on 8-1/2" X 11" bond paper, typed on one side of paper only, with 1 1/2" left margin and 1" right margins. At least one Xerox copy of the final Specification manuscript, printed on both sides of the paper, shall be provided.

2.3.9 Project Manual

A. The latest version of the "Project Manual" containing and instructing to bidders, the General Conditions of the Contract for Construction, and the Special Conditions shall be included in each specification and be the basis for further development and completion of drawings and specifications. Contact the District Project Manager for a copy to make sure the most recent document with changes is used.

2.3.10 Coordination of Specifications and Drawing

A. The importance of complete coordination between the drawings and specifications cannot be overstressed. These elements of the contract package **CANNOT** be developed separately and then merged at the last moment. It is necessary for the Architect/Engineer to review the drawings during and after their completion, to assure that everything indicated on the drawings is covered in the specifications and that those methods, materials and procedures required to accomplish the work but which cannot be (or are not) shown on the drawings, are thoroughly and completely described in the specifications. Conversely, those preparing drawings should review the specifications to assure complete coordination. Quite often a simple detail, section, or note on the drawings will make it possible to eliminate substantial descriptive material from the Specifications. All conflicts between the specifications and drawings shall be resolved.

B. Terminology used in Specifications and on the drawings should be the same. If the terminology used in the drawings should vary and revision of the drawings is not practicable, the Specifications must reconcile such differences in a manner similar to the following: "Hollow tile (noted as 'clay tile' and 'terra cotta tile')". The Specification should be cross-checked carefully with the drawings to verify that no conflicts or ambiguities exist and that each reference to drawings in the Specifications "as indicated" is clearly shown on the drawings.

C. PROPRIETARY AND RESTRICTIVE REQUIREMENTS shall not be used when specifying equipment and materials on drawings and in the Specifications. The drawings and specifications shall permit unlimited competition consistent with the type of work. They shall be prepared to utilize standard products and current models of equipment meeting the functional requirements of the facility.

D. The practice of specifying items by naming an acceptable commercial product followed by the words "or equal" will be permitted under the following conditions:

1. There are no state Specifications for the item;

2. The item must be a minor part of the construction project;

3. The item cannot be described adequately because of its technically involved construction or composition.

E. The School District may list specific manufacturers because of life cycle costs justifications or maintenance continuity.

F. If manufacturer's names and trade designations are used, a minimum of three manufacturers shall be included as a part of the required description to assure that the bidding will not be restricted to the particular named manufacturers or suppliers.

2.3.11 Selection of Materials

A. The State and/or "Owner", through its various agencies has, and may, place restrictions on the use of certain materials. It is advisable to INVESTIGATE THOROUGHLY all new materials which have not been proven in the specific type of service involved and whose promotion is based upon unsupported statements and lists of supposedly satisfied users. MATERIALS MUST BE USED IN A MANNER WHICH WILL AFFORD THE MAXIMUM SERVICE AT THE LOWEST COMPARABLE COST. Operation and maintenance costs must be weighed against initial costs to achieve maximum economy. Before deciding upon a specific material for design or specification purposes, the following shall be considered:

Contemplated life of the construction
Climatic and operating conditions

2.3.12 Materials and Equipment

A. Specify by performance specifications or by manufacturers' model numbers. If manufacturers' model numbers are used, name three manufacturers whose products are equal in:

1. Appearance
2. Function
3. Quality
4. Operation
5. Design
6. Service Life

B. State that the drawings and specifications are based on the first product named and that the contractor must make all changes required to accommodate products of other manufacturers. The Architect/Engineer is responsible for insuring that all brands specified are compatible with the basic building design insofar as size, weight, and services are concerned and that brands specified are truly equal in properties listed above.

2.3.13 Computerized Specifications

A. The "Owner" recommends the use of computerized specifications; however, the Architect/Engineer is cautioned that such specifications must be edited to suit the requirements of the project being specified. Computerized specifications must be printed on 8 1/2" x 11" size paper and must be color-coded, both as required by this Standard.

2.3.14 Unacceptable Wordage

A. The following words, phrases, and clauses must be avoided.

1. The note "**by others**." These words must not be used, either on the drawings or in the specifications. In lieu of these words, name the specific contractor or agent.

2. The word "**Owner.**" The State is the owner of a project under construction and remains the owner until completion when the School District becomes the owner. Since the School District becomes the ultimate owner, use the word "**School District**" in Lieu of "**Owner**."

3. The words "**Using Agency**" or "**User**." The District Project Manager acts in behalf of the using agency to see that requirements of the user are satisfied. The Architect/Engineer is responsible only to the "Owner" and District Project Manager, not to the "**using agency**" or "**user"**.

4. The words "**This Contractor shall** " to begin instructions to a contractor. These words are redundant since instructions are directed to one (only) of the prime contractors and it is obvious to which contractor the instructions are directed.

5. The words "**alternate**" or "**substitute**" to indicate an "**option.**" The word "**alternate**" should be used only for alternative work which is specified in the technical sections of the specifications and must be included in the bidders' proposals. The word "**substitute**", or any form of this word, should be used only to indicate materials or methods of construction other than those specified which must be shown on the Substitution Sheet in the Form of Proposal. The word "**option**" should be used to indicate items for which the contractor may make a choice without affecting the contract. Alternates, substitutes, and options are subject to School District approval.

6. The word "**mechanical**" when referring to either the Plumbing Contract or the HVAC Contract, or when referring to either of the contractors doing plumbing or HVAC work. The words "**plumbing**" or "**heating**, **ventilating**, and **air conditionin**g" must be used when making these references; however, the word "**mechanica**l" may be used to indicate combined plumbing and HVAC installations.

2.3.15 Prohibited Construction Practices

A. Attention must be directed to the following prohibitions which contractors must observe. Location of these statements within the specifications, to assure their being read by contractors, is left to the discretion of the Architect/Engineer; however, the statement concerning independent suspension systems must be repeated in all applicable sections of Divisions 9, 15P, 15H, and 16.

1. The use of power-driven anchors shall conform to S.M.A.C.N.A. and N.E.C. recommended practices. Attention to power-driven anchors should be included in every section of the specifications when there is the possibility that power driven anchors would be used to anchor materials specified in that section.

   a. Definition: Power-driven anchors are defined as anchors which are driven into place by any device which produces an impact force by use of a powder charge, compressed air, gas, or any other propellant.

2. The use of ink marking pens on wall surfaces of any kind of materials. Experience has shown that such marks bleed through wall finishes.

3. The penetration of floors and of walls by pipes, ducts, or other penetrations unless openings are appropriately fire stopped by fire doors, or fire dampers, and voids around pipes are sealed with fireproof materials.

4. Suspension systems which are not independently supported. Ceiling grid systems shall not be supported from ductwork, electrical conduit, heating or plumbing lines, and vice versa. Each utility system and the ceiling grid system shall be a separate installation and each shall be independently supported from the building structure. Where interferences occur, provide trapeze type hangers or other suitable supports for each system. Locate hangers and supports where they will not interfere with access to mixing boxes, fire dampers, valves, and other apparatus requiring servicing.

SECTION THREE

DIVISION 1 – GENERAL REQUIREMENTS

01010 – Summary of Work

02100 –

01020 - Allowances

01040 – Project Coordination

01060 – Applicable Codes and Standards

01100 – Alternatives

01200 – Project Meetings

01300 – Submittals

01410 – Testing Laboratory Services

01500 – Construction Facilities and Temporary Controls

01600 – Substitutions: Material and Equipment

01700 – Contract Closeout

01710 – Cleaning

01730 – Operation and Maintenance Data

01740 – Warranties and Bonds

01750 – Spare Parts and Maintenance Materials

SECTION THREE

DIVISION 2 - SITE WORK

02000 - General

Clean fill dirt shall not leave the facility unless approved by Design Project Manager. Surplus soil will be referred to the Office of Facilities Planning and Construction for removal and storage.

02010 - Subsurface Exploration

Architect/Engineer Responsibilities

The Architect/Engineer shall provide plans showing required test boring locations and shall indicate, by letter to the Design Project Manager, any other information required for the testing laboratory. Owner will furnish boring and subsurface investigation.

Preparation of Plans for Borings

In the preparation of plans for boring locations, the Architect/Engineer shall study plans of existing underground utilities and shall locate borings to avoid these utilities. The Design Project Manager will make available maps showing underground installations.

Information to be included in Contract Documents

Boring locations and sections through borings showing all soil conditions shall be shown. Specifications shall contain statements to the effect that information shown is for the Contractor's use, and that the Owner shall in no way be held responsible to the accuracy of the information.

02100 - Clearing

Structure Removal

Include this in DEMOLITION

Clearing the Site

Debris resulting from stripping and demolition operations shall be removed from district property at frequent intervals so as to prevent this material from accumulating on the site.

Grubbing

Removal of trees and shrubs shall include the removal of stumps and roots to the extent that all roots within five feet of an underground structure or utility line or under footings or paved areas are removed. Grubbing in open areas shall include removal of stumps and all roots within three feet of finish grade elevations. Caution should be taken with existing trees and discussed with Design Project Manager.

02120 - Structure Removal

In open areas, foundations of structures shall be removed in accordance to engineering specifications. Where new structures will replace existing structures, indicate extent of foundation removal on the drawings. No existing slabs will remain under fill for new structures. Hazardous material removal shall be coordination with district project managers and conducted prior to structural removal as required by federal, state and local requirements.

Disposal of existing buildings and structures, trees, dismantled equipment, etc., is the responsibility of the Contractor.

02211 - Rough Grading

Slopes shall not be greater than (1) vertical to (6) horizontal in grassed areas. Steeper slopes will be considered in unique circumstances and will be reviewed and approved by Office of Facilities Planning and Construction .

02218 - Landscape Grading (also refer to Appendix M "Landscape Design Guideline")

02222 - Excavating

The term "excavation" includes drilling or subsurface exploratory work as well as trenching and general excavation.

02223 - Backfilling

Backfilling is required at building perimeter and site structures up to subgrade elevation, fill under interior and exterior slabs-on-grade or pavement, and fill under landscaped areas shall be in accordance with structural/civil engineer specifications.

02225 - Trenching

When excavating and backfilling from the mechanical and electrical trades is covered in those portions of the specifications, make certain that the compaction of back-fill is properly specified and meets applicable ANSI/ASTM standards and the requirements of Florida Status and the Trench Safety Act.

02251 - Termite Control

Section 01251 is under the responsibility of the Purchasing Department.

02513 - Asphaltic Concrete Paving

Materials and installation shall comply with requirements of the Florida Department of Transportation and as determined by the civil engineer. Minimum installation shall consist of 1 1/2" plant mixed type S-1 asphaltic concrete surface course over 8" compact base over 12" stabilized soil, unless civil engineers determine otherwise.

02514 - Concrete Paving

Shall be Class A concrete with a minimum compressive strength of 3000 psi in 28 days. All products, materials, and execution shall comply with applicable ANSI and ASTM Standards.

Expansion Joints

Pre-molded type 1/2" thick, full depth of concrete, maximum 30'-0" o.c. and at junctions with vertical surfaces. Expansion joints shall be specified and shown on the drawings.

Control Joints

Shall be saw-cut to squared relief, e.g., 6'-0" side sidewalk, 6'-0" space between. Minimum saw-cut shall be 1/2 to 2/3 of slab thickness to include both inside and outside corners.

Finish

Floated, troweled, and medium broomed.

Utility Cuts

When utilities are required to cross existing paved areas, saw-cutting finished surfaces should be used only as a last resort. The district recommends boring as the standard procedure for crossing streets/roads. Concrete walks shall be cut and replaced from joint to joint, doweled to the remaining slab.

Walks

Concrete sidewalks are required and shall be, at a minimum, (6) feet wide, (4) inches thick with (6 x 6 #10) or Fibermesh reinforcement. All sidewalks subjected to heavy vehicular traffic or crossing shall be a minimum of (6) inches thick.

Walks (used as vehicular drives) shall be a minimum of 6" thick with turned down edges increased to a minimum of 2 additional inches thick and 10'-0" wide, steel reinforced. Secondary sidewalk width should be a minimum of 6 feet, and should match surrounding walk patterns. Care must be taken to prevent slick finishes, and to avoid the possibility of marking or vandalism while the concrete is curing. Expansion joints must be properly designed and indicated on contract drawings. Medium broom finish on all required to protect concrete from defacement by fencing or providing appropriate personnel to maintain and secure the area until the concrete has properly cured.

02515 – FIRE HYDRANTS

A. PERFORMANCE REQUIREMENTS

1. *The travel distance shall not exceed 300 feet from any building to the hydrant or acceptable water source. This distance requirement is measured from the hydrant to the furthest extreme as a fire hose is laid, not as the crow flies.*
2. *Flow rate shall be calculated in accordance with the authority having jurisdiction based on building design and construction characteristics. Hydrants shall be added to the above distance requirements in order to meet the calculated flow rate provided the water utility supplying the campus has sufficient capacity.*
3. *Should the water utility not have sufficient capacity to satisfy the calculated flow rate for an additional hydrant or hydrants, hydrants will not be installed. Once notification from the water utility that the flow rate has been improved to sufficient levels, new hydrants will be added to achieve to required capacity.*

B. MATERIALS, PRODUCTS, EQUIPMENT, MANUFACTURED UNITS

1. *Recommended Products: Products and associated manufacturers listed below are known to have been approved for use within certain Osceola county fire districts. It shall be the responsibility of the design professional to verify with the specific fire district in question to insure the approved type and acceptable manufacturers are specified for use within that particular fire district.*
   a. *Mueller Co. Mod. No. A-423.*
   b. *U.S. Pipe and Foundry Co. Mod. Metropolitan M-94.*
   c. *Clow Valve Mod. Medallion.*
   d. *American Flow Control (Darling) Mod. No. B-84-B.*
   e. *Kennedy Valve Mod. K 81 D.*
   f. *A.V.K. Series 2760.*
   g. *M &H Valve Mod. No. 929 Reliant.*

C. FINISHES

1. *New and existing hydrants, barrel only.*
   a. *1st Coat: S-W Pro-Cryl Acrylic Metal Primer, B66 (5.0-10.0 mils wet, 2-4 mils dry)*
   b. *2nd Coat: S-W DTM Acrylic Gloss Coating, OSHA Osceola.*
   c. *3rd Coat: S-W DTM Acrylic Gloss Coating, OSHA Osceola, (6.5 - 10.0 mils wet, 2.5 - 4.0 mils dry per coat).*
   d. *Before painting the hydrant barrels all rust and contaminants are to be removed from both new and existing hydrants.*

2. *The above colors apply to the hydrant barrel only, the bonnet colors are to be in accordance with NFPA requirements based on the following hydrant gpm flow capabilities, (1) 1500 or greater, Light blue, (2) 1000-1499, Green, (3) 500-999, Osceola, (4) less than 500, Red.*

D. ADMINISTRATIVE CLOSEOUT PROCEDURES

1. Warranty Requirements

a. Manufacture shall provide extended ten (10) year warranty on the fire hydrant.

END OF Division 02515

SECTION 02720 STORM SEWER SYSTEM

PART 1 - GENERAL

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. This section includes storm sewers and structures appurtenant thereto. Excavating, trenching, backfilling and density tests are specified elsewhere. Storm sewer system work includes, but is not limited to, the following:

1. Storm sewer conduits
2. Storm sewer structures required by drawings

B. Refer to applicable DIVISION 2 sections for excavation and backfilling work related to storm sewer systems.

C. Refer to applicable DIVISION 3 sections for concrete work related to storm sewer systems.

1.3 QUALITY ASSURANCE

A. Installer: A firm specializing and experienced in storm sewer work for not less than two years.
B. Code Compliance: Comply with applicable portions of local plumbing codes, the requirements of South Florida Water Management District and the Florida Department of Environmental Protection.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturers technical data and installation instructions for each major component for the storm sewer system materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed storm sewerage piping and products. All drawings must be labeled as "Record Drawings" and be signed and sealed by a Professional Land Surveyor licensed in the State of Florida. Drawings shall include as a minimum: horizontal locations, tied to project coordinate system, of all structures (area drains, catch basins, manholes, headwalls, etc.) and piping, rim elevations of all structures with invert elevations of all pipes entering structures, diameter and material of all piping, and the slope of each pipe segment. Verify all elements of drainage control structures, including rim elevations, elevation of slots, weirs and orifices, and invert elevation of all pipes entering structures. Refer to "EARTHWORK" Section 02200 for record drawing requirements regarding grading, swales, lakes and drainage retention areas.

C. An electronic copy of the Record Drawing shall be provided to the Architect in AutoCADD 2004 format prior to final acceptance of the work.

D. Maintenance Data: Submit maintenance data and parts lists for storm sewer system materials and products. Include this data, shop drawings, product data and record drawings in a maintenance manual to be presented to the Owner at project close-out.

PART 2 - PRODUCTS

2.1 GENERAL

A. Except as otherwise provided, all storm sewer materials shall comply with the applicable sections of the Florida Governmental Utilities Authority Standards which are hereby incorporated into these specifications by reference.

2.2 CONDUIT MATERIALS

A. Provide materials specified below:

1. Polyvinyl Chloride (PVC), ASTM D-3034, SDR 35 pipe and fittings. Joints and fittings shall have elastomeric gasket joints manufactured in accordance with ASTM D-3212 and ASTM D-477.
2. High Density Polyethylene Pipe (HDPE), 3-inch to 10-inch, in accordance with AASHTO M252 and ASTM D-3350, and shall have a smooth interior lining. Joints shall provide a water tight seal using elastomeric gaskets manufactured in accordance with ASTM D-3212 and ASTM F-477.
3. High Density Polyethylene Pipe (HDPE), larger than 10-inch, in accordance with AASHTO M294, Type S, and ASTM D-3350. Joints shall provide a water tight seal using elastomeric gaskets manufactured in accordance with ASTM D-3212 and ASTM F-477.

4. Round Reinforced Concrete Pipe (RCP) in accordance with ASTM C-76. Joints shall be bell and spigot type. The spigot end shall be grooved to accommodate a rubber O-ring gasket to provide a water tight seal conforming to the requirements of ASTM C-443.

2.3 STORM SEWER STRUCTURES

A. Provide materials and perform all work in accordance with Section 425 of the referenced FDOT Standard Specifications.

B. Manhole Joint Seals: Preformed plastic gaskets shall meet all requirements of Federal Spec. SS-S-00210.

C. Manhole Frames and Covers: Traffic-bearing cast iron of size and shape detailed on the drawings. Covers shall have the word "STORM" in 2" raised letters. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects. Plane or grind bearing surfaces to ensure flat, true surfaces. Covers shall be true and seat within ring at all points.

D. Catch Basin Frames and Grates: Use cast iron grates and cast-in angle iron seats on all catch basin structures. Grates in paved areas shall be traffic bearing.

E. Base Rock: Clean 3/4" gravel or crushed rock uniformly graded from coarse to fine conforming to requirements of FDOT specifications, 1996.

F. Concrete: All concrete work shall conform to the requirements of SECTION 03300.

G. Cleanouts: Provide as indicated, pipe extension to grade with brass ferrule and brass countersunk cleanout plug.

1. Provide a 12-inch by 12-inch concrete collar, 6 inches thick around all exterior cleanouts.

2.4 MITERED END SECTIONS

A. Provide materials according to FDOT Standard Index No. 273, with 2.5 inch pipe grates on 6-inch centers.

PART 3 - EXECUTION

3.1 GENERAL

A. General: All construction operations shall adhere to the requirements of the referenced FDOT Standard Specifications.

B. Conform to manufacturer's recommendations on the installation of RCP, PVC, and HDPE storm sewers.

C. Pipe Distribution: Distribute material on the job no faster than it can be used to good advantage. Unload pipe which cannot be physically lifted by workers from the trucks, by a forklift, or other approved means. Do not drop pipe of any size from the bed of the truck to the ground.

D. Pipe Preparation and Handling: Inspect all pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are being used. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

E. Use proper implements, tools, and facilities for the safe and proper protection of the work. Lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. Remove all damaged pipe from the job site. Do not drop or dump pipe into trenches under any circumstances.

3.2 LINE AND GRADE

A. General: All sewer lines between structures shall be absolutely straight and true. No curvature shall be tolerated. Do not deviate from line or grade more than 1/2" for line and 1/4" for grade, provided that such variation does not result in a level or reverse sloping invert.

1. Establish line and grade for pipe by the use of lasers or by transferring the cut from offset stakes to batter boards set in the trench at maximum intervals of 25 feet. Maintain a minimum of three sets of batter boards with string line ahead of the pipe laying at all times.

B. Laying and Jointing Pipe: Pipe laying shall proceed upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined and the inside of the joint immediately before joining the pipe. Make assembly of the joint in accordance with the recommendations of the manufacturer of the type of joint used. Provide all special tools and appliances required for the jointing assembly.

1. After the joint has been made, check pipe for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints. Apply sufficient pressure in making the joint to assure that the joint is "home" as defined in the standard installation instructions provided by the pipe manufacturer. To assure proper pipe alignment and joint makeup, place sufficient pipe zone material to secure the pipe from movement before the next joint is installed.
2. When pipe is laid within a movable trench shield, take necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead.
3. Take the necessary precautions required to prevent excavated or other foreign material from getting into the pipe during the laying operation. At all times, when laying operations are not in progress, at the close of the day's work, or whenever the workers are absent from the job, close and block the open end of the last laid section of pipe to prevent entry of foreign material or creep of the joints.
4. Plug or close off pipes which are stubbed off for structure construction or for construction by others, with temporary plugs.
5. Take all precautions necessary to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.
6. Where non-reinforced pipe is connected to manholes or concrete structures, take connection so that the standard pipe joint is located not more than 3 feet from the outside edge of the structure.
7. When cutting and/or machining the pipe is necessary, use only tools and methods recommended by the pipe manufacturer.

3.3 UNDERGROUND STRUCTURES

A. Rock Base: Prior to setting pre-cast concrete base section, remove water from the excavation. Place a minimum of 6" of rock base and thoroughly compact with a mechanical vibrating or power tamper.

B. Structure Joint Seals: Carefully inspect pre-cast structure sections to be joined. Sections with chips or cracks in the tongue shall not be used. Joint seals shall be installed in strict conformance with the manufacturer's recommendations. Only pipe primer furnished by the joint seal manufacturer will be approved.

C. Pre-cast Concrete Structures: Place pre-cast concrete sections as shown on the drawings. Set top elevation of catch basins as indicated on the drawings. Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set manhole tops 3 inches above finish surface, unless otherwise indicated.

1. Install frames and covers on top of manholes to positively prevent all infiltration of surface or groundwater into manholes.
2. Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring as shown in the Manhole Details on the drawings.
3. Provide rubber joint gasket complying with ASTM C-443.

4. Apply bituminous mastic coating at joints of sections.

D. Manhole Invert: Construct manhole inverts in conformance with details shown on the drawings and to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections which tend to obstruct flow. Trowel all mortar surfaces smooth.

3.4 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed. Place backfill and compact in accordance with provisions of SECTION 02200 - EARTHWORK.

3.5 CLEANING AND TESTING

A. Prior to final acceptance, the storm sewer system shall be thoroughly cleaned and visually inspected in the presence of the Engineer or his designated representative.

B. Following visual inspection, leakage testing may be required at the discretion of the Engineer and/or local authorities.

C. Acceptable methods of testing shall be water exfiltration in accordance with the local authority requirements.

1. The permissible leakage rate shall be a maximum of 50 gallons per inch of pipe diameter per mile of pipe in a 24 hour period for PVC and HDPE pipe. The permissible leakage rate for RCP shall be a maximum of 200 gallons per inch of pipe diameter per mile of pipe in a 24 hour period.

D. The Contractor shall furnish all necessary tools, supplies, labor and equipment for testing.

E. Visual inspection and testing shall be performed on the same day. Notify the Engineer one week in advance.

F. Contractor shall provide a sealed, certified survey of the as-built layout of the storm system including structure locations, inverts, pipe sizes, locations and inverts and detailed information on the storm water management pond areas.

END OF SECTION 02720

SECTION 02730 SANITARY SEWAGE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCOPE:

A. This section includes sanitary sewers and structures appurtenant thereto. Excavating, trenching, backfilling, and density tests are specified elsewhere. Sewage collection system work includes, but is not limited to, the following:

Sanitary sewer conduits
Manholes, frames, and covers

B. For sanitary sewer related construction on the project site, refer to the Florida Governmental Utilities Authority standards, if more stringent than herein specified.

C. Refer to Division 2 Sections for excavation and backfilling work related to sewer collection systems.

D. Refer to Division 3 Sections for concrete work related to sewer collection systems.

1.3 QUALITY ASSURANCE:

A. Installer: A firm specializing and experienced in sewer work for not less than two years.

B. Code Compliance: Comply with applicable portions of a local plumbing codes, the Florida Governmental Utilities Authority standards and the Florida Department of Environmental Protection.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturers technical data and installation instructions for each major component for the sewage collection system materials and products.

B. Record Drawings: At project close-out, submit drawings labeled as “Record Drawings” indicating all installed sewage collection system piping, manholes and products, signed and sealed by a Registered Land Surveyor (State of Florida) containing the following:

1. Location of each manhole. Location of each sewer service at connection. Invert elevations of building services at tie-in. Rim elevations, bottom elevations and invert elevation of all pipes entering manholes. Slope of each segment (mains & services). Length and location of all plugged stub outs. Type of materials used. All horizontal locations required on record drawings shall be located according to the project coordinate.

C. Maintenance Data: Submit maintenance data and parts lists for sewage collection system materials and products. Include this data, shop drawings, product data and record drawings in a maintenance manual to be presented to the Owner at project close-out.

PART 2 - PRODUCTS

2.1 CONDUIT MATERIALS:

A. General: Furnish ells, tees, reducing tees, wyes, couplings, increasersr superior physical and chemical properties as acceptable to the Architect/Engineer.

B. Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe and Fittings: ASTM D-3034, Type PSM , SDR35.
Color: green.

C. PVC Pipe Joints: Joints for PVC sewer pipe shall be rubber gasketed type complying in all respects to the physical requirements of ASTM D-3212 and ASTM F-477. Lubricant for jointing as approved by the pipe manufacturer shall be used for connecting PVC pipes.

2.2 CONCRETE MANHOLES:

A. Precast manhole sections shall be minimum 5" thick and 48" in diameter, conforming to ASTM C-478. Cones shall have same wall thickness and reinforcement as manhole section. Top and bottom of all sections shall be parallel. Joints shall be tongue-and-groove or Keylock type. Joints shall be formed using an approved joint sealer.

1. Prior to the delivery of any size of precast section on the job site, yard tests will be conducted at the point of manufacture. The precast sections to be tested will be selected at random from the stockpiled material which is to be supplied for the job. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C-14.

B. Coating System: All sanitary sewer manholes shall be provided with an interior and exterior coal tar epoxy coating. After the concrete has cured for 28 days, minimum, the precast units shall be coated by the manufacturer. The units shall be touched up in the field by the Contractor, if damaged. Interior and exterior surfaces of the manholes shall be coated in accordance with System A, B, or C below.

1. SYSTEM A (TNEMEC)

Surface Preparation: SP-C2.

Finish: 2 coats of Tnemec 413 Tneme-Tar at 8.3-mil dry thickness, 11.4 wet (140 SFPG) per coat. Thin first coat 10 percent. Apply second coat within 96 hours.

Total Thickness (dry): 16.6-mil.

2. SYSTEM B (PORTER)

Surface Preparation: SP-C2.

Primer:

Finish: 2 coats of Porter 7013 Tarset C-200 Coal Tar Epoxy Black at 6.0-mil dry thickness (200 SFPG) per coat.

Total Thickness (dry): 16-mil.

3. SYSTEM C (KOPPERS)

Surface Preparation: SP-C2.

Finish: 2 coats of Koppers Bitumastic 300M Water Epoxy at 8.0-mil dry thickness (200 SFPG) per coat.

Total Thickness (dry): 16-mil.

C. Sewer Main Connection to Manholes: Manholes shall be provided with manufacturer installed rubber boots with stainless steel clamps for connection of gravity lines.

D. Manhole Joint Seals: Preformed plastic gaskets shall meet all requirements of Federal Spec. SS-S-00210.

E. Manhole Frames and Covers: Traffic-bearing cast iron of size and shape detailed on the drawings. **Covers shall have the word "sewer" in 2" raised letters**. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects. Plane or grind bearing surfaces to ensure flat, true surfaces. Covers shall be true and seat within ring at all points.

F. Base Rock: Clean 3/4" gravel or crushed rock uniformly graded from coarse to fine conforming to requirements of FDOT specifications, 1996.

G. Concrete: All concrete work shall conform to the requirements of SECTION 03300 - CONCRETE WORK.

H. **Cleanouts: Provide as indicated, pipe extension to grade with brass ferrule and brass countersunk cleanout plug.**

1. **Provide a 12-inch by 12-inch concrete collar, 6 inches thick around all exterior cleanouts**

2.3 LOCATION AND IDENTIFICATION:

A. General: All PVC pipe 4 inches and larger shall have a #10 GA copper trace wire located directly above the line and terminate on a metal device accessible from the surface without excavation. In addition, metallic marker tape marked "SANITARY SEWER BELOW" shall be located no less than 1 foot directly above the gravity or force main. Owner's representative shall field verify the tape and locator wire installations prior to backfilling the trench.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUIT:

A. General: All PVC sewer shall be installed in accordance with Uni-Bell, UNI-B-5.

B. Pipe Distribution: Distribute material on the job no faster than it can be used to good advantage. Unload pipe that cannot be physically lifted by workers from the trucks, by a forklift, or other approved means. Do not drop pipe of any size from the bed of the truck to the ground.

C. Pipe Preparation and Handling: Inspect all pipe and fittings prior to lowering into the trench to ensure no cracked, broken, or otherwise defective materials are being used. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

D. Use proper implements, tools, and facilities for the safe and proper protection of the work. Lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. Remove all damaged pipe from the job site. Do not drop or dump pipe into trenches under any circumstances.

3.2 LINE AND GRADE:

A. Gravity Sewer Pipe: All sewer lines between manholes shall be absolutely straight and true. No curvature shall be tolerated. Do not deviate from line or grade, as established by the Engineer, more than 1/2" for line and 1/4" for grade, provided that such variation does not result in a level or reverse sloping invert.

1. Establish line and grade for pipe by the use of lasers or by transferring the cut from offset stakes to batter boards set in the trench at maximum intervals of 25 feet. Maintain a minimum of three sets of batter boards with string line ahead of the pipe laying at all times.

B. Laying and Jointing Pipe: Pipe laying shall proceed upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined, the inside of the joint, and the rubber ring immediately before joining the pipe. Make assembly of the joint in accordance with the recommendations of the manufacturer of the type of joint used. Provide all special tools and appliances required for the jointing assembly.

1. After the joint has been made, check pipe for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints. Apply sufficient pressure in making the joint to assure that the joint is "home" as defined in the standard installation instructions provided by the pipe manufacturer. To assure proper pipe alignment and joint makeup, place sufficient pipe zone material to secure the pipe from movement before the next joint.
2. When pipe is laid within a movable trench shield, take necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead.
3. Take the necessary precautions required to prevent excavated or other foreign material from getting into the pipe during the laying operation. At all times, when laying operations are not in progress, at the close of the day's work, or whenever the workers are absent from the job, close and block the open end of the last laid section of pipe to prevent entry of foreign material or creep of the gasketed joints.
4. Plug or close off pipes that are stubbed off for manhole construction or for construction by others, with temporary plugs.
5. Take all precautions necessary to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.

6. Where non-reinforced pipe is connected to manholes or concrete structures, make connection so that the standard pipe joint is located not more than 3 feet from the outside edge of the structure.
7. When cutting and/or machining the pipe is necessary, use only tools and methods recommended by the pipe manufacturer.

3.3 UNDERGROUND STRUCTURES:

A. Rock Base: Prior to setting precast concrete base section, remove water from the excavation. Place a minimum of 6" of rock base and thoroughly compact with a mechanical vibrating or power tamper.

B. Manhole Joint Seals: Carefully inspect precast manhole sections to be joined. Sections with chips or cracks in the tongue shall not be used. Joint seals shall be installed in strict conformance with the manufacturer's recommendations.

C. Precast Concrete Manholes: Place precast concrete sections as shown on the drawings. Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops 3 inches above finish surface, unless otherwise indicated.

1. Install frames and covers on top of manholes to positively prevent all infiltration of surface or groundwater into manholes.
2. Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring as shown in the Manhole Details on the drawings.
3. Provide rubber joint gasket complying with ASTM C-443.
4. Apply bituminous mastic coating at joints of sections.

D. Manhole Invert: Construct manhole inverts in conformance with details shown on the drawings and to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections which tend to obstruct flow. Where a full section of pipe is laid through a manhole, break out the top section and cover exposed edge of pipe completely with mortar. Trowel all mortar surfaces smooth.

3.4 BACKFILLING:

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.

1. Place backfill and compact in accordance with provisions of Section 02200 - EARTHWORK.
2. During backfill operations over pipelines, install the continuous trace wire directly above the pipe at a depth of 6-inches below finish grade

3.5 CLEANING AND TESTING OF GRAVITY SEWERS:

A. Prior to final acceptance, the sewer collection system shall be thoroughly cleaned and visually inspected in the presence of the Engineer and local authorities. Visual inspection shall include closed circuit television inspection.

1. Closed circuit television inspection shall be in conformance with Section V, "Recommended Specifications for Sewer Collection System Rehabilitation" published by the National Association of Sewer Service Companies.

B. Following visual inspection, leakage testing shall be performed on all sewer lines with a maximum allowable exfiltration of 200 gallons per day / per inch of diameter of pipe / per mile of pipeline, with a minimum of 2 feet of internal pressure head. The testing procedures shall be in accordance with ASTM F-1417 for PVC piping.

C. Acceptable methods of testing shall be low- pressure air exfiltration or water exfiltration in accordance with the local authority requirements. The Contractor shall furnish all necessary tools, supplies, labor and equipment for testing.

1. Low pressure air exfiltration tests shall be performed in accordance with Uni-Bell, UNI-B-6.
2. Water exfiltration tests shall be in accordance with Uni-Bell, UNI-B-5.

D. Visual inspection and testing shall be performed on the same day. Notify Engineer one week in advance.

E. Deflection Testing: Testing is required no sooner than 30 days after the final backfilling activities are completed on all sections of PVC piping. No section of pipe shall deflect more than 5% using a rigid ball or mandrel for the testing with a diameter not less than 95% of the base inside diameter of the pipe. Testing shall not be performed using mechanical pulling.

F. Contractor shall provide a sealed, certified survey of the as-built conditions including locations, pipe sizing and invert data for the entire sanitary system.

3.6 PLACING SYSTEM INTO SERVICE:

A. General: The sewage collection system shall not be placed into service until all required testing has been completed, approved by the Engineer, and a “Clearance for Use” certification (if required) has been issued by the Florida Department of Environmental Protection.

END OF SECTION 02730

02811 - Landscape Irrigation

All landscaped areas shall be irrigated. The irrigation system shall be designed so as to eliminate water spray on pedestrian walkways and buildings.
For sprinkler heads, design around and specify Rain Bird products or approved equal.

Irrigation

All landscaped areas shall be adequately irrigated based on the following criteria:

An automatic sprinkler irrigation system shall be provided for all landscaped areas. All sprinkler lines shall be self-draining.

The irrigation system shall be designed and operated to prevent or minimize runoff of irrigation water onto roadways, driveways, walks, etc.

02821 – Fences and Gates

PART 1 - GENERAL

1.3 DEFINITION

A. A fence is defined as a physical or visual barrier between areas. It can be constructed of various materials to perform the function it is designed to do. A physical and visual fence is described in this standard in fences A thru K and can be regimental or architectural. This type of fencing is used to separate areas that have different functions and for security.

B. A fence or barrier can be made with landscape materials such as ground cover, bushes, trees and earthen berms. This type of fencing will be used in low security areas and for an aesthetic accent to the facility.

C. It is the intent of Osceola County Public Schools to have an "open street" concept at each campus. We also realize that some situations may call for additional security in the form of fencing.

1.2 **APPLICATION**

A. This Standard designates the areas that receive fencing, gates and accessories; the heights of the fencing and the materials used at each location.

B. Fencing and Site requirements for fencing shall comply with Florida Building Code, (latest addition), Chapter 423 (9) (a).

1.3 **FENCES A-J**

A. Galvanized steel chain-link fence

B. PVC-coated, steel chain-link fabric ASTM F 668 (for kindergarten play area).

C. Galvanized steel framework

1. Gates: ASTM F 654-91
2. Posts: ASTM F 1083-93

D. Polymer –coated steel framework

E. Installation: ASTM F 567

F. Fence Fittings: ASTM 626-96a

1.4 FENCE K

A. Panels are 9 gage galvanized steel wire

B. Finish is powder vinyl coated in accordance with ASTM F 668-95

1.5 SUBMITTALS, GENERAL INSTRUCTIONS, PRODUCT DATA, SHOP DRAWINGS, SAMPLES, CERTIFICATES

A. Supply product data, details, dimensions and finishes for the following:

1. **Fence and gateposts, rails and fittings**
2. **Chain-link fabric, reinforcement and attachments**
3. **Gates and hardware**
4. **Privacy slats**
5. **Tension wire**
6. **Concrete footings**
7. **Fabric**

B. Shop Drawings: Show locations of fence, gates, posts, rails, tension wires, attachments, heights and finish.

1.6 QUALITY ASSURANCE

A. Installer Qualifications

1. **An experienced installer who has successfully completed chain-link fences and gate projects.**

B. Contractor Qualifications

1. **The Contractor shall be licensed in Osceola County, Florida to install the work described in this section.**

C. Preconstruction Surveys/Conferences

1. **Contractor shall verify information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures and verify field dimensions before work begins.**

D. Preparation/Field Verification

1. **Contractor shall secure information on locations of underground conduits and utility locations before work begins.**
2. **Do not interrupt utilities serving facilities occupied by the Owner. Repair of interrupted underground conduits and utilities shall be the responsibility of the Contractor.**

E. Samples

1. **Supply samples for approval for each item listed in paragraph 1.4 Submittals.**

1.7 SAFETY PROCEEDURES

A. Construction, dealing with School Safety, of fencing shall be done as follows:

1. **During hours when school is not occupied by students or in areas that are marked and barricaded as construction areas.**

2. **Do not interrupt campus operation with fence construction.**

B. Construction shall comply with OSHA Standards on safety during construction.

1.8 BUILDING PERMIT

A. A permit for the installation of the fence is necessary and the responsibility of the contractor.

PART 2 - <u>PRODUCT/ SYSTEM</u>

2.1 COMPONENTS: MATERIALS, SIZES, FINISHES

A. Fabric, posts, gates & accessories.

2.2 MANUFACTURERS : Chain Link Types A-J

A. Allied Tube and Conduit Corporation

B. Anchor Fence, Inc.

C. Armorlink Corporation

D. Merchant Metals

2.3 MANUFACTURER : Architectural Fence Type K

A. Omega Fence Systems

2.4 TYPE A Chain-Link Fence

A. The location of this fence is around the perimeter of a school facility.

1. **Fence height: 6'-0" above grade.**
2. **Mesh and wire size: 2-inch mesh, .148-1nch diameter, hot dipped galvanized after weaving with the top and bottom selvage knuckled. Provide mesh fabricated in one-piece width (height).**
3. **Tie wire: Top and bottom tension wire No. 9 gage galvanized steel wire for attachment to line posts.**
4. **Stretcher bars: 3/16" x ¾" hot dipped galvanized steel. One stretcher bar for each gate and end post & two bars for each corner and pull post.**
5. **Top rail: *No. 9 gage galvanized steel tie wire.***
6. **Posts: Round, with outside dimension & minimum wall thickness according to C.L.F.M.I. 1997.**
7. **Gate or gates: Site specific.**
   a. **Hardware**
      1) **Hinges: Hot dipped galvanized offset to allow access each direction.**
      2) **Latches: Hot dipped galvanized readily lockable with padlock.**
8. **Footing: Concrete**

2.5 TYPE B Chain-Link Fence

A. This fence encloses the Kindergarten play area.

1. **Fence height: 4'-0" above grade.**
2. **Mesh and wire size: 2-inch mesh, .148 diameters, steel wire with top and bottom selvage knuckled. Provide mesh fabricated in one-piece width (height).**
3. **Color Coating: 10 mil. PVC plastic resin finish.**

4. **Top rail: Round, 1-5/8" outside dimension, galvanized steel**
5. **Posts: Round, with outside dimension & minimum wall thickness according to C.L.F.M.I. 1997, with top caps.**
6. **Gate: 5'-0" wide, double swing. Gate shall swing out.**
    a. **Hardware:**
        1) **Hinges: Hot dipped galvanized to allow access in each direction.**
        2) **Latches: Hot dipped galvanized readily lockable with padlock.**
7. **Footing: Concrete**

2.7 TYPE C Chain-Link Fence

A. This fence is used for equipment enclosures and bicycle rack enclosures.

1. **Fence height: 6'-0" above grade.**
2. **Mesh and wire size: 2-inch mesh, .148 diameter, hot dipped galvanized after weaving with top and bottom selvage knuckled. Provide mesh fabricated in one-piece width (height).**
3. **Top rail: Round, 1-5/8" outside dimension, galvanized steel.**
4. **Stretcher bars: 3/16" x ¾" hot dipped galvanized steel. One stretcher bar for each gate and end post & two bars for each corner and pull post.**
5. **Posts: Round, with outside dimension & minimum wall thickness according to C.L.F.M.I. 1997, with top caps.**
6. **Gate: Bicycle rack: One gate 5'-0" double leaf, one gate 3'-0". All gates shall swing out. Gates shall be at opposite ends of enclosure.**
7. **Gate: Equipment enclosure: Gate shall be sized for equipment repair and removal. Minimum size 4'-0" single leaf. For gates 5'-0" and larger use double leaf. All gates shall swing out 180 degrees.**
    a. **Hardware:**
        1) **Hinges: Hot dipped galvanized to allow outward swing.**
        2) **Latches: Hot dipped galvanized readily lockable with padlock.**
8. **Footing: Concrete**

2.7 TYPE D Chain-Link Fence

A. The location of this fence is around the perimeter of water retention areas, drainage ditches and canals that are deeper than I'-0" and retain water for longer than 24 hours. Water retention areas with slopes of 5:1 and less and that do not retain water for longer than 24 hours do not require fencing.

1. **Fence height: 6'-0" above grade.**
    a. **Fencing shall allow a 20'-0" maintenance berm around the perimeter of water retention area.**
2. **Mesh and wire size: 2-Inch mesh, .148 diameter, hot dipped galvanized after weaving with top and bottom selvage knuckled. Provide mesh fabricated in one-piece width (height).**
3. **Tie wire: Top tie wire No. 9 gage galvanized steel wire for attachment to line posts.**
4. **Stretcher bars: 3/16"x3/4" hot dipped galvanized steel. One stretcher bar for each gate and end post & two bars for each corner and pull post.**

5. **Posts: Round, with outside dimension & minimum wall thickness according to C.L.F.M.I. 1997, with top caps.**
6. **Gate: Pair of 6'-0" out swing gates that open 180 degrees.**
    a. **Hardware:**
        1) **Hinges: Hot dipped galvanized to allow outward swing.**
        2) **Latches: Hot dipped galvanized readily lockable with padlock.**
7. **Footing: Concrete**

2.8 TYPE E Chain-Link Fence

A. The location of this fence is around the perimeter of tennis courts and basketball courts. Plan is in DGM 02881.

1. **Fence height: 10'-0" above court surface.**
2. **Mesh and wire size: 2-inch mesh, .148 diameters, hot dipped galvanized after weaving with top and bottom selvage knuckled. Provide mesh fabricated in one-piece width (height).**
3. **Top rail: Round, 1-5/8" outside dimension, galvanized steel.**
4. **Stretcher bars: 3/16"x3/4" hot dipped galvanized steel. One stretcher bar for each gate and end post & two bars for each corner and pull post.**
5. **Posts: Round, with outside dimension & minimum wall thickness according to C.L.F.M.I. 1997, with top caps.**
6. **Gates: Provide two gates at opposite corners of each court. The size of each gate shall be 4"-0" wide x 7'-0" high. Gates shall swing outward 180 degrees.**
    a. **Hardware:**
        1) **Hinges: Hot dipped galvanized to allow outward swing.**
        2) **Latches: Hot dipped galvanized readily lockable with padlock.**
7. **Wind Block: Provide reinforced woven fabric to act as a wind block on all fencing. The wind block is 6'-0" and centered in the 10'-0" high fence.**
    a. **Note: No wind block is required for basketball court.**
8. **Footing: Concrete**

2.9 TYPE F Chain-link Structure

A. The location of this structure (backstop) is on Elementary School and Middle School softball fields. Plan is in DGM 02881.

1. **Backstop height: 16' above grade (16' vertical section w/ 4' over-hang).**
    a. **Note: Additional height and overhang may be necessary for protection of public safety of adjoining sites from foul ball trajectories.**
2. **Mesh and wire size: Lower 8'-0" height shall be 2-inch mesh, No. 6 gage wire. Top 8'-0" height shall be 2-inch mesh, No. 9 gage wire. Both gages shall be hot dipped galvanized after weaving with top & bottom selvage knuckled.**
3. **Top, bottom & center rails: Round, 1-5/8" outside dimension, galvanized steel.**
4. **Posts: Round, 3" outside dimension, galvanized steel.**
5. **Footing: Concrete**

2.10 TYPE G Chain-Link Structure

A. The location of this structure (backstop) is on High School softball fields. Plan view is in DGM 02881.

1. **Backstop height: 24' above grade.**
2. **Fence from backstop to dugout is 18' above grade.**
3. **Outfield fence from dugout to dugout is 6' above grade.**
    a. **Note: Additional height and overhang may be necessary for protection of public safety of adjoining sites from foul ball trajectories.**
4. **Mesh and wire size: Lower 12'-0" height shall be 2-inch mesh, No. 6 gage wire. Top 12'-0" height shall be 2-inch mesh, No. 9 gage wire. Both gages shall be hot dipped galvanized after weaving with top & bottom selvage knuckled. Provide mesh fabricated in one-piece width (height) for each 10' section.**
5. **Top, bottom & center (three thus) rails: Round, 1-5/8" outside dimension, galvanized steel.**
6. **Posts: Round, 4" outside dimension, galvanized steel.**
7. **Footing: Concrete**

2.11 TYPE H Chain-Link Structure

A. The location of this structure (backstop) is on High School baseball fields. Plan view is in DGM 02881.

1. **Backstop height: 28''-0" above grade.**
2. **Fence from backstop to dugout is 18' above grade.**
3. **Outfield fence from backstop to backstop is 6' above grade.**
    a. **Note: Additional height and overhang may be necessary for protection of public safety of adjoining sites from foul ball trajectories.**
4. **Mesh and wire size: Lower 12'-0" height shall be 2-inch mesh, No. 6 gage wire. Top 16'-0" height shall be 2-inch mesh, No. 9 gage wire. Both gages shall be hot dipped galvanized after weaving with top and bottom selvage knuckled. Provide mesh fabricated in one- piece width (height) for each 12' section.**
5. **Top, bottom & center (three thus) rails.**
6. **Posts: Size determined for wind load using the Florida Building Code Latest Edition.**
7. **Footing: Concrete**

2.12 TYPE J Chain-Link Structure

A. The location of this structure is behind the Discus circle.

1. **Backstop height: 12"-0".**
2. **Configuration: Forming a "U" shape around the discus circle in five equal sections of approximately 12'-0" each. See Section 02881, Playground Equipment and Structures for dimensioned plan. Plan view is in DGM 02881.**
3. **Top, bottom & center rails.**
4. **Posts: Size determined for wind load.**
5. **Footing: Concrete**

2.13 TYPE K Architectural Fence

A. The fence shall be used at campus entrances and in areas of aesthetic visual concentration.

1. **Fence height: 5'-0" and 6'-0" above grade.**
2. **Posts shall be 2" x 2" hot dipped galvanized.**
3. **Gate posts shall be 4" x 4" hot dipped galvanized.**
4. **Coating: All surfaces shall be coated with polyester.**
5. **Footing: Concrete**

PART 3 - QUALITY ASSURANCE DURING EXECUTION

3.1 PROPER SEQUENCE AND SCHEDULING

A. Do not begin installation before final grading is completed.

3.2 INSTALLATION PROCEDURES/ADJUSTMENT PROCEDURES

A. Installation of chain-link fencing shall comply with ASTM 567.

B. Installation instructions and procedures of Architectural fencing shall be by fencing Manufacturer. Spikes in the fabric shall be down.

3.3 SAFETY REQUIREMENTS FOR INSTALLATION

A. Fencing shall be installed in accordance with OSHA Standards.

3.4 PROTECTION DURING CONSTRUCTION

A. Care and protection of the construction site shall be made by the contractor to assure that there is no access by students, teachers or visitors at the facility.

END OF 02821

02842 - Bike Racks

Bike racks shall be of a design in accordance to Section 423 of the 2004 Florida Building Code. The School Districts preference is The Ribbon Rack by Brandir.

02938 - Sodding

Refer to ASPA (American Sod Producers Association) - Guideline Specifications to Sodding.

02950 - Trees, Plants, and Ground Cover-As per SREF

Warranty

Provide a warranty on work of this section for a minimum of one year including one continuous growing season. Commence warranty on date identified in the Certificate of Substantial Completion

SECTION THREE
DIVISION 3 - CONCRETE

03000 - General

03001 - Concrete

Due to quality control and structural integrety after the job is completed, all material, products and execution shall conform to ACI 301 and applicable ANSI/ASTM Standards test.

03200 - Concrete Reinforcement

Reinforcing bar supports frequently are exposed to the weather on soffits and other surfaces, and corrode. Plastic supports are required. Particular care should be exercised in preparation of specifications and during inspection to insure proper coverage of reinforcement.

Admixtures

In general, admixtures are not desired. For concrete placed in hot weather, a retardant may be helpful, and for water reduction some admixtures are satisfactory but unless the Architect/Engineer can clearly justify this opinion, the Owner would prefer no admixtures.

Acid Cleaning

No use of acid wash for cleaning of concrete on the building interior is permitted.

Cold Weather Concreting

Should ambient temperature be 32º or less no concreting shall be permitted. Additional all cold weather concreting shall be done in accordance with ACI 604.

Pipe Shafts

All pipe penetrations through concrete slabs must be sealed.

Aluminum Piping, Conduit or Fittings

The use of these items embedded in concrete is not acceptable; unless adequately protected.

Exposed Vertical Concrete Wall Finishes

Design standards should specify the use of “plyform” on all forms work for exposed vertical surfaces.

Exposed FLAT Concrete Work

All large expanse flat concrete surfaces other than typical sidewalks can be colored to reduce glare coming from the reflection of the sun. Coloring and mixing shall be accordance with A/E specifications.

Snap-Tie-Cone-Hole

When snap-ties are used the Architect/Engineer shall coordinate with the District Project Manager to determine the project standard to be used.

Sidewalks and Ramps

Concrete for these items should be poured "checker-board." This method will ensure straight expansion-joint-filler appearance. Control joints shall be a minimum of one-fourth of the slabs thickness.

Stairs

Poured in place concrete stairs or structural step stairs with pan filled treads are recommended. The design of all stairs shall be in accordance with the current requirements of the Section 423 of the Florida Building Code and applicable codes.

All exterior ramps, stairs, landings and walks shall have an integral non-slip finish. Stairs treads shall have cast in place of nosing.

03511 - Soil-Cement Base Course

Scope of Work

The work specified in this section consists of furnishing all labor, transportation, tools, material and equipment, unless otherwise specified, to construct a compacted base course composed of a combination of soil, Portland Cement and water, and all items called for or that can be reasonably inferred from the drawings, including grading, pulverizing, placing cement, adding material, mixing, compacting and testing as required for a complete job.

Method of Payment

Work under this section will not be paid for as a separate item unless a specific unit price basis is included in the Bid Form.

Products

Portland Cement DOT

Spec, Section 921, “Portland Cement.”

Water DOT

Spec, Section 923, “Water for Concrete.”

Material

Use local or hauled-in clean sand or sand and clay.

Concrete DOT

Spec, Paragraphs 345-2, 345-3, 345-4, 345-6, 345-9, 345-10, 345-11, 345-12 and 345-13, except that the word “Department” shall be taken as “Owner”. All concrete for base repair will be Class 1 concrete, minimum 28-day compressive strength of 2,500 psi.

Curing Material

Cut-back asphalt, Grade RC-70, DOT Spec, Section 916-2.

Execution

Composition and Proportioning

A. Prepare a design mix by an independent testing laboratory and submit to the Engineer for review.

B. Do not process the base until all tests of the soil to be used have been completed and exact proportion of cement required for the particular soil has been determined according to “Expanded Short-Cut Test Methods for Determining cement Factors for Sandy Soils,” Highway Research Bulletin 61, 1952, and/or, when applicable, methods of “Wetting and Drying Test of Compacted Soil-Cement mixtures, “STM D559 (AASHTO T-135).

C. The quantity of water required will be the amount necessary for optimum moisture content in the compacted mixture. This quantity will vary with the nature of the soil and shall have been determined according to “Methods of Test for Moisture-Density Relation of Soil-Cement, “ STM D558 (AASHTO T-134).

Preparation of Soil Aggregate

Remove unsuitable material and add suitable material as necessary prior to the application of cement. Pulverize the soil to be treated for sufficient width and depth to give the compacted cross section shown on the plans. Pulverizing shall continue until 80 percent of the soil, by dry weight, exclusive of gravel, shell or stone larger than 3/4 inch, will pass a No. 4 sieve. Manipulate the pulverized soil until the moisture in the soil does not exceed the percentage of the optimum moisture specified for the soil-cement mixture.

Application of Cement

Shape the soil to the approximate cross section shown on the plans, and spread the designated quantity of cement uniformly over the surface in one operation.

Mixed-In-Place Method

Immediately after the cement has been distributed, mix it with the loose soil with a machine that will produce the proper homogeneous mixture. shape the mixture to the approximate lines and grades sown on the plans.

Central Plan Mixed Method (Optional)

A. Mix the soil, cement and water in a pugmill either of the batch or continuous-flow type. Equip the plan with feeding and metering devices which will add the soil, cement and water into the mixer in the specified quantities. Mix soil and cement sufficiently to prevent cement balls from forming when water is added, and continue until a uniform and intimate mixture of soil, cement and water is obtained.

B. Hand the mixture to the roadway in trucks equipped with protective covers. Place the mixture on the moistened subgrade in a uniform layer by an approved spreader and in such quantity that the completed base will conform to the required grade and cross section. Do not permit dumping of the mixture in piles or windows upon the subgrade.

Compacting and Finishing

A. Compact the base to a density of 95 percent of the maximum density as determined by AASHTO T-134 to the line, grade and thickness shown in the plans.

B. After the mixture is compacted, reshape the surface of the base to the required lines, grades and cross section, and then lightly scarify to loosen imprints left by the compacting or shaping equipment until a uniform, even surface mulch of approximately 1 inch in thickness is obtained. Then thoroughly roll and compact the surface.

C. Complete all of the above mixing, compacting and finishing within six (6) hours.

Construction Joints

A. At the end of each day's construction, form a straight transverse joint by cutting back into the completed work to form a true vertical face. This joint shall be located such as to exclude all that part of the base at the end of the run which does not have full depth, is not thoroughly compacted, not properly proportioned, or not properly mixed.

B. Build soil-cement for large, wide areas in a series of parallel lanes of convenient length and width meeting the approval of the Engineer. Form straight longitudinal joints at the edge of each day's construction by cutting back into the completed work to form a true vertical face free of loose or shattered material.

Weather Limitations

During seasons of probability of freezing temperature, do not apply cement unless the temperature is at least 40 degrees F in the shade and rising.

Surface Requirements (Scalping or Hard-Planning)

After compacting and finishing have been completed, and not later than the beginning of the next calendar day after the construction of any section of base, test the surface with a template cut to the required crown and/or with a 10-foot straight-edge lade parallel to the centerline. Correct all irregularities greater than 1/4-inch. Additional wetting before, during and after this final shaping operation shall be required to keep the base continuously most until the cure coat is applied.

Protection and Curing

Within not more than three daylight house after the hard-planning operations have been completed, the base shall be covered and protected against rapid drying by curing.

Opening to Traffic

Completed sections may be opened to all traffic after seven days.

Maintenance

Maintain the base to a true and satisfactory surface until the wearing surface is constructed. Should any repairs or patching be necessary, they shall extend to the full depth of the base and shall be made in a manner than will assure restoration of a uniform base course conforming to the requirements of these specifications. In lieu of repairing with soil-cement, Class 1 concrete may be used.

Testing

Monitor the construction procedure with the same independent testing laboratory that prepared the approved design mix and perform the following test during placement:

Determine cement content, moisture content, "in-place" density and thickness (maximum spacing of test holes 300 feet). The testing laboratory shall notify the Contractor immediately of any deviation from the design mix.

Perform a laboratory density test and prepare two 4-inch-diameter by 4.6-inch-high compression test cylinders for each 300 feet of roadway. Moist cure by 7 days and test for compressive strength. Minimum acceptance standards are as follows:

Thickness: Average in 1000 feet - 1/4 inch variation
Maximum variation in one hole - 1/2 inch

Compressive 300 psi in 7 days (molded laboratory specimens)
Strength: 350 psi in 14 days 430 psi in 28 days

Send two copies of all field and laboratory test results to the Engineer within 10 days of completion of said tests. Include the cost of mix design and testing in the unit price bid for the soil-cement base.

03510 - Subgrade Stabilization

General

Related Documents

A. Drawings and general provisions of Contract, apply to work of this Section.

Description of Work

A. Stabilize the designated portions of the pavement subgrade in both cut and fill sections to provide a firm and unyielding subgrade to the uniformity, density, bearing value, lines, grades and thicknesses herein specified or shown in the Drawings. The work includes mixing, compacting and grading for a complete job.

Materials

Local Materials: High bearing-soils or sand clay material. The materials passing the #40 mesh sieve shall have a liquid limit not greater than 30, and plasticity index not greater then 10. Blending materials to meet these requirements will not be permitted unless authorized by the Engineer. When so permitted, the blended material shall be tested and approved before spreading.

Limerock/Limerock Overburden: The percentage of carbonates of Calcium and magnesium shall be at least 70, and plasticity index shall not exceed 10. The gradation shall be such that 97% be weight of the material will pass a 1" sieve.

Crushed Shell: Mollusk shell, but not steamed shell (i.e., oysters, mussels, clams, cemented coquina, etc.). Gradation shall be such that at least 97% by weight of the total material passes a 1" sieve, and at least 50% by weight is retained on the #4 sieve. Not more than 20% by weight of the total material shall pass (by washing) the #200 sieve.

Execution

Required Florida Bearing Value (FBV): Unless otherwise specified, the subgrade shall have a minimum Florida Bearing Value of 70. Where local material does not conform to the required FBV, stabilize by uniformly mixing with satisfactory local or hauled in material to depth shown in the Drawings. Perform bearing valve determination per FDOT standard specifications for Road and Bridge Construction, section 160.8.1.

Compaction: Compact the stabilized subgrade in both cuts and fills to a minimum density of 98% of maximum (AASHTO T-180) density. The subgrade shall be shaped to within 1/4 inch of the grades shown in the Drawings.

Maintenance: After the subgrade has been prepared as specified, Contractor shall maintain it free from nuts, depressions and all damage resulting from hauling or handling of any materials, equipment, tools, etc. All work which may become necessary in order to recompact the subgrade shall be at contractor's expense.

Testing: Provide density and bearing value tests at intervals not to exceed 250 feet for roadways or 10,000 square feet for parking areas.

03512 - Limerock

General

Related Documents

A. Drawings and general provisions of Contract, apply to work of this Section.

Description of Work

A. Construct limerock base course on the prepared subgrade as specified herein and in conformance with the lines and grades shown in the Drawings.

Materials

Limerock: FDOT 200-2

Execution

Spreading: Uniformly spread limerock by mechanical rock spreader, equipped with a device which strikes off uniformly to laying thickness, and is capable of even distribution. Where a mechanical spreader is not practical such as crossovers, intersections and ramp areas; roadway widths of 20 fee or less; and main roadway areas when forms are used, spreading may be done by bulldozers or blade graders. Remove and replace all segregated areas of fine or course rock with properly graded rock.

Transportation: Transport limerock to the point of use over rock previously placed, and dump on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will not be permitted.

Courses: Construct bases of specified compacted thickness greater than 5 inches in two courses. The thickness of the first course shall be approximately one-half the total thickness of the finished base, or enough additional to bear the weight of the construction equipment without disturbing the subgrade.

Compacting and Finishing: Clean the lower course (where applicable) of foreign material, blade the surface to a cross-section approximately parallel to the finished base. The lower course shall be tested for density prior to spreading the upper course. After the upper course has been spread, scarify and shape the surface to produce the required grade and cross-section after compaction, free of scabs and laminations.

Moisture Content: Material not having the proper moisture content to insure the required density, shall be wetted or dried as required. Mix-in added water uniformly by disking to the full depth of the course. Wetting and drying operations require manipulation, as a unit, of the entire width and depth of the course which is to be compacted.

Density Requirements: After attaining proper moisture conditions, compact to a density of not less than 98 percent of maximum (AASHTO T-180) density.

Correction of Defects - If, at any time, the subgrade material should become mixed with the base course material, the Contractor shall, without additional compensation, dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean base material, which shall be shaped and compacted as cited herein. Cracks or checks appearing in the base, either before or after priming, which would impair the structural efficiency of the base, shall be removed by rescarifying, reshaping, adding base material, recompacting and repriming without additional compensation.

Priming and Maintaining: Apply the prime coat only when the base meets the specified density requirements, and the moisture content in the top half of the base does not exceed 90 percent of the optimum moisture of the base material. At the time of priming, the base shall be firm, unyielding and in such condition that no undue distortion will occur.

Surface Requirement: Irregularities greater than 1/4 inch, when checked with a template cut to the required crown and with a 15-foot straightedge laid parallel to the center of the roadway, shall be corrected by scarifying and removing or adding rock as required an recompacting the entire area as specified.

Thickness Requirement: Where the base is deficient by ore than 1/2 inch, it shall be reworked to the area extent specified by the testing laboratory and to a depth of at least 3 inches by scarifying and adding more base material, so that after proper compaction the thickness will conform to the Drawings.

Testing Density: Provide three density determinations on each day's final compaction operation on each course. Blading to grade where required shall be completed prior to density testing.

A. Surface: Check the finish surface of the base course with a template cut to the required crown and with a 15-foot straight edge lad parallel to the center of the roadway.

Thickness: Provide test holes at intervals not to exceed 250 feet for roadways or 10,000 square feet for parking areas.

03513 - Asphalt Concrete Paving

General
Related Documents

A. Drawings and general provisions of Contract apply to work of this Section.

Description of Work

A. Extent of asphalt concrete paving work is shown on drawings.

B. Prepared base is specified in "Section 270 of FDOT Standard Specifications for Road and Bridge Construction, latest edition.

C. Prepared subgrade is specified in "EARTHWORK" Section.

Submittals

A. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

Quality Assurance

A. Codes and Standards: Comply with State highway or transportation department standard specifications, latest edition, and with local governing regulations if more stringent than herein specified.

Products

Materials

General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

A. Type S Asphaltic Concrete: FDOT, 331-2, 3, 4, 5.

B. Type III Cement Asphaltic Concrete: FDOT, 333-2, 2, 3, 4 and 5.

C. Asphalt Cement: FDOT, 916-1.

D. Prime Coat: Cut-back asphalt grade RC-70 or RC-250 per FDOT 916-2; emulsified asphalt grade SS-1 or SS1H, per FDOT 916-4, diluted in equal proportions with water, or other types and grades of bituminous material.

E. Tack Coat: Emulsified asphalt; RS-2, SS-1, or SS-1H (diluted in equal proportions with water) per FDOT 916-4. Cut-back asphalt RL-70, or asphalt cement, penetration grade 85-100.

F. Lane Marking Paint: Chlorinated rubber-alkyd type, AASHTO M 248 (FSTT-P-115), Type III or per FDOT 971-12.2.

G. Thermoplastic Traffic Stripes and Markings: Per FDOT standard specifications for Road and Bridge Construction, Section 711.

H. Wheel Stops: Precast of 3,500 psi air-entrained concrete, approximately 6 inches high, and 6 feet 0 inches long with chamfered corners and drainage slots on underside.

Asphalt-Aggregate Mixture and Preparations

A. FDOT 330-5, and FDOT 330-6

Execution

Weather Limitations

A. Mixture shall not be spread when the air temperature is not greater than 40ª F, in the shade (away from artificial heat), or there is evidence of a frozen base, or when the wind is blowing to such an extent that proper an adequate compaction cannot be maintained or when sand, dust, etc., are being deposited on the surface being paved.

Any mixture caught in transit by a sudden rain may be laid only at Contractor's risk. Should such mixture prove unsatisfactory, it shall be removed and replaced at Contractor's expense. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.

Preparation of Asphalt Cement

A. Heat the asphalt cement in advance of the mixing operations, to within a range of 230º F to 310º F. Maintain the heating operations constant within these limits. Wide temperature fluctuations during the day will not be permitted.

Preparation of Aggregate

FDOT 330-5

Preparation of Mixture

FDOT 330-6

Transportation of Mixture

Transport the mixture in vehicles clean of foreign material properly equipped to be covered during inclement weather. Coat the inside surfaces of the truck with soapy water or approved emulsion containing less than 5 percent oil (not kerosene, gasoline or similar products) and raise beds to drain excess prior to loading.

Preparation of Application Surfaces

A. Cleaning: Thoroughly clean the surface to be covered of all loose and deleterious material before laying any mixture.

B. Patching and Leveling Courses: Where a surface course is constructed on an existing pavement or base and/or where called for in the Drawings, apply patching or leveling courses o bring the existing surface to proper grade and cross-section. Prior to spreading leveling courses, all depressions in the existing surface more than one inch deep shall be filled by spot patching with leveling course mixture, and then thoroughly compacted.

C. Coating Surfaces of Contacting Structures: Paint all structures such as manholes, inlet, valve boxes, etc., with a uniform coating of asphaltic cement.

D. Prime Coat: Prime materials shall be uniformly applied using a pressure distributor at the minimum rates of 0.10 gallons per square yard for limerock, limerock stabilized and local rock bases, and 0.15 gallons per square yard for sand, clay, shell and shell stabilized bases. The actual amount to be applied shall be dependent on the character of the surface and shall be sufficient to coat the surface thoroughly without having any access to form pools or to flow off the base. The temperature of the prime material shall be that temperature between 100º F and 150º F, which will insure uniform distribution. The moisture content of the base shall not greater than 90 percent of optimum to obtain adequate penetration.

Apply a light uniform application of cover material and roll with a traffic roller for at least 10 passes before opening to traffic. Where an emulsified asphalt is used for prime coat, the Engineer may require that cover material be hot-asphalt coated with two to four percent asphalt-cement, if necessary, to achieve a prime coat which will remain reasonably intact until the surface course is placed; the application rate shall be approximately 10 pounds per square yard.

Tack Coat

A tack coat will only be required on primed bases in areas that have become excessively dirty and cannot be cleaned, or in areas where the prime has cured to the extent that it has lost adequate bonding effect. Generally, a tack coat will be required on bituminous base or leveling courses before placing the surface course.

Apply tack, suitably heated, at the minimum rate necessary to bond the wearing surface to the base (between 0.02 and 0.08 gallons per square yard). The upper limit may be exceeded for resurfacing concrete. Apply tack sufficiently in advance of the wearing course to permit drying but not so far in advance to allow loss of adhesiveness from dust and other foreign material. No traffic shall be allowed on the tacked surface.

Placing Mixture

A. Mixture shall be placed and spread only after the surface to be overlayed is properly prepared, intact, firm, properly cured and dried. No mixture shall be spread that cannot be finished and compacted during the daylight hours of day of spreading.

Spread the mixture with mechanical spreaders, except where impracticable. A stringline shall be used to obtain an accurate, uniform alignment of the pavement edge. The temperature of the mixture at the time of spreading shall be between 230º F and 310º F.

1. Checking Depth of Layer: The depth of each layer shall be checked by the Contractor at intervals, not to exceed 25 feet. Any deviation from the required thickness, in excess of the allowable tolerance, shall be immediately corrected.

B. Surface Courses:

1. Spreading and Finishing: Immediately upon arrival, the mixture shall be dumped into the spreader, spread and struck-off to the full width required and to such loose dept to secure the specified thickness. Excess mixture shall be carried ahead of the screed at all times. Hand rake behind the machine as required
2. Thickness of Layers: Surface courses of thickness greater than two inches, shall be constructed in approximately equal layers and of less than two inches compacted thickness. Each layer shall be thoroughly compacted and shall conform to these specifications prior to overlaying.
3. Correcting Defects: Prior to rolling, the surface shall be checked, and irregularities adjusted. All drippings, fat sandy accumulations from the screed and fat spots from any source shall be removed and replaced with satisfactory material. No skin patching shall be done. Where a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture.

C. Leveling Courses:

1. Spreading: The initial and intermediate leveling courses shall be placed by a spreader box, working conjunction with two motor graders. The final leveling course shall be placed by a paving machine. However, if the total quantity of leveling to be applied is less than 150 pounds per square yard, the paving machine may not be required.
2. Application Rates: The application rate of leveling mixture shall not exceed 50 pounds per square yard per course except Type S-1 asphaltic concrete leveling shall not exceed 75 pounds per square yard per course. The actual application rate shall be as required to establish the finished lines and grades shown in the Drawings and shall not be limited to any average or typical rate or thickness which may be shown in the Drawings.
3. Leveling Over Existing Concrete Pavement: Remove all excess joint filler to flush with the existing pavement. For broken concrete pavement (with or without existing asphalt surface) the first leveling course shall be placed as soon after, but not later than 2 days after, the cracking and reseating operation.

Compacting Mixture

Density required for asphaltic concrete pavement, after final compaction, shall be at least 95 percent of the laboratory compacted density of the paving mixture. Tests shall be performed every 500 feet for roadways and 50,000 square feet for parking areas.

A. Equipment and Sequences: For each paving or leveling train in operation, the Contractor shall furnish a separate set of rollers, with operators. The rolling shall be done in sequence, and with the equipment as follows, unless otherwise permitted by the Engineer:
   1. Seal Rolling - Use tandem steel rollers weighing 5 to 12 tons, following as close behind the spreaders as is possible without pick-up, undue displacement or blistering of the material.
   2. Rolling Traffic Roller - Use self-propelled pneumatic-tied rollers, 6 to 10 tons and tire pressure to 55 pounds, following as close behind the seal rolling s the mix will permit. The roller shall cover every portion of the surface with at least five passes.
   3. Final Rolling - Use tandem steel roller, weighing 8 to 12 tons after the pneumatic-tired rolling has been completed, but before the pavement temperature has dropped below 140º F.

B. Compaction of Crossovers, Intersections, etc.: Where a separate paving machine is used to pave crossovers, compaction may be done by one 8 to 10 ton tandem steel roller. If crossovers, intersections and acceleration and deceleration lanes are placed with the main run of paving, a traffic roller shall also be used in the compaction.

C. Rolling Procedures: The rolling shall be longitudinal. Where the lane being placed is adjacent to a previously placed lane, the center joint shall be pinched or rolled, prior to rolling of the rest of the lane. Continue across the mat, overlapping each previous roller path by at least one-half the width of the roller wheel. The motion of the roller shall be slow enough to avoid displacement of the mixture, and any displacement shall be corrected at once by the use of rakes, and the addition of fresh mixture if required. Final rolling shall continue until all roller marks are eliminated.

Self-propelled, pneumatic-tired traffic rollers shall proceed at a peed of 6 to 10 miles per hour; the area covered by each roller shall not exceed 4,000 square yards per hour, except that for Type S-1 Asphaltic Concrete, the maximum shall be 3,000 square yards per hour.

D. Number of Traffic Rollers Required: A sufficient number of self-propelled pneumatic-tired rollers shall be used to assure that the rolling will not delay any other phase of the laying operation nor result in excessive cooling of the mixture. In the event that the rolling falls behind, the laying operation shall be discontinued until the rolling operations are sufficiently caught up.

E. Rolling Patching and Leveling Courses: Use self-propelled pneumatic-tired rollers for all patching and leveling courses. Where the initial leveling course is placed over broken concrete pavement, the pneumatic-tired rollers shall weight at least 15 tons. For Type S-I Asphaltic Concrete leveling courses, use a steel-wheeled roller, to supplement the traffic rollers. The use of a steel-wheeled roller will otherwise be at Contractor's option.

Areas which are inaccessible to a roller (such as areas adjacent to curbs, headers, gutters, manholes, etc.) shall be compacted by the use of hand tamps or other satisfactory means.

F. Correcting Defects: Rollers shall not deposit gasoline, oil or grease onto the pavement. Any areas damaged by such deposits shall be removed and replaced. While rolling is in progress, the surface shall be tested continuously and all discrepancies corrected to comply with the surface requirements. All drippings, fat or lean areas and defective construction of any description shall be removed and replaced. Depressions which develop before the completion of the rolling shall be remedied by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depressions remain after the final compaction has been obtained, the full depth of the mixture shall be removed and replaced with sufficient new mixture to form a true and even surface. All high spots, joints and honeycomb shall be corrected. Any mixture remaining unbonded after rolling shall be removed and replaced. Any mixture which becomes loose or broken, mixed or coated with dirt or in any way defective, prior to laying the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area.

Areas of defective surface may be repaired by the use of the indirect heat. No method of repair involving open-flame heaters shall be used.

G. Provisions Applicable to Shoulder Pavement Only: Where sand-asphaltic shoulders are constructed within the limits of curb and gutter, compaction shall be done by light weight rolling equipment, which will not displace the previously constructed curb and gutter.

Joints

A. Fresh mixture shall be laid against the exposed edges at joints (trimmed or formed as provided below) in close contact with the exposed edge so that an even, well compacted joint will be produced after rolling.

1. Transverse Joints: Placing of the mixture shall be as continuous as possible. The roller shall not pass over the unprotected end of the freshly laid mixture except when the laying operation is to be discontinued long enough to permit the mixture to become chilled. When the laying operation is thus interrupted, a transverse joint shall be constructed by cutting back on the previous run to expose the full depth of the mat.

2. Longitudinal Joints: Where a portion of the width of pavement is to be laid and opened to traffic, longitudinal joints shall be formed by rolling exposed edge of the strip first laid. When the adjacent strip is constructed, the Engineer may require the edge of the mixture in place to be trimmed back to expose an unsealed or granular vertical surface. Where the strip first laid is closed to traffic, the edge shall not be sealed but shall be left vertical and the adjacent strip placed against it without trimming.

Surface Requirements and Correction:

A. The Finished surface shall not vary more than 3/16 inch when measured by rolling or manual straightedge applied parallel to the center line of the pavement. Any surface irregularities exceeding such limits shall be corrected as specified herein.

1. Manual Straightedging: A 15-foot manual straightedge shall be furnished by the Contractor and shall be available at all times on the work. The Contractor shall designate an employee whose duty it is to handle the straightedge in checking the compacted surfaces.

2. Texture of Finished Surfaces: The finished surface shall have no pulled, torn or loosened portions, and shall be free of sand streaks, sand spots or ripples. (These requirements shall also apply to any areas where it is necessary to apply hand work.) Defective area shall be corrected as follows:

a. If the correction is made by replacing of the full thickness, it shall extend to at least 50 feet each side of the defective area.

b. If the correction is made by overlying, the overly shall consist of at least 100 pounds of mixture per square yard at the defective section and shall taper uniformly down from the full thickness of such weight, to zero thickness (feather-edged) at the end of a minimum length of 50 feet each side of the defective area.

Protection of Finished Surface

A. Finished surfaces including courses to be overlayed shall be kept clean and no dumping of any material onto the surfaces shall be permitted. Protect pavement against damage during shoulder construction by providing proper attachments to grader blades. Vehicular traffic shall not be permitted until the pavement has set sufficiently to prevent rutting or other distortion.

Traffic and Lane Markings

A. Cleaning: Sweep and clean surface to eliminate loose material and dust.

B. Striping: Apply Thermoplastic lane marker per FDOT Section 711.
1. Color: white and yellow as indicated on drawings.

Field Quality Control

A. Thickness Requirements & Corrections
1. Pavement thickness shall be determined from the length of the core borings as specified herein. The maximum allowable deficiency from the specified thickness and serious deficiency thickness shall be as follows:

a. Pavement of specified thickness 1 1/2 inches or less

Maximum allowable deficiency	3/16 inch or more
Serious deficiency	1/4 inch or more

b. Pavement of specified thickness greater than 1 1/2 inches but less than 2 1/2 inches

Maximum allowable deficiency	1/4 inch or more
Serious deficiency	3/8 inch or more

c. Pavement of specified thickness 2 1/2 inches or greater

Maximum allowable deficiency	1/2 inch or more
Serious deficiency	3/4 inch or more

2. Contractor shall correct seriously deficient areas either by replacing the full thickness for a length extending at least 50 feet from each end of the deficient area, or (when permitted by the Engineer) by overlaying as specified herein at his own expense.

   As an exception to the above, pavement outside a main roadway area (acceleration and deceleration lanes, crossovers and parking areas) may be left in place, without compensation (except for payment for the bituminous material), when so permitted by the Engineer, even though the thickness deficiency exceeds the serious deficiency tolerance specified above.

   Where the deficiency exceeds allowable but does not exceed serious, Contractor will be allowed to leave such pavement in place, but without compensation other than for the bituminous material contained therein. The areas of such pavement for which no square yard payment will be made shall be the product of the total distance between acceptable cores, multiplied by the width of the lane which was laid at the particular pass in which deficient thickness was indicated. To determine the extent of the deficiencies, additional cores will be taken as required.

3. Correcting Deficiency by Adding New Surface Material: For any case of excess deficiency of the pavement, Contractor will be permitted, if approved by the Engineer for each particular location, to correct the deficient thickness by adding new surface material and compacting to the same density as the adjacent surface. The area to be corrected and the thickness of the new material added shall be as specified herein. All costs of the overlaying and compacting shall be borne by the Contractor.

B. <u>Calculation for Thickness of Pavement</u>

1. Core Borings: The thickness of the pavement shall be determined from the length of cores, at least two inches in diameter, taken at random points along the roadway and the parking areas. Each core shall represent a roadway section not longer than 500 feet or a parking area not less than 10,000 square feet. The average thickness shall be determined from the measured thicknesses, and in accordance with the procedure and criteria specified herein.

If it is found that the specified pavement thickness has not been installed per this specification and if Contractor believes that the number of cores taken by the Owner is insufficient to properly indicate the thickness of the pavement, he may request the owner make additional borings at locations designated by him. The cost of these additional borings shall be deducted from any sums due Contractor unless such borings indicate that the pavement within the questioned area is of specified thickness.

2. Criteria for Calculations:

   a. Average thickness shall be calculated for the total length of project.
   b. When the thickness as measured by the cores is more than 1/2 inch greater than the specified thickness, it shall be considered in the calculation as the specified thickness plus 1/2 inch.
   c. Area of deficient thickness pavement which are left in place with no compensation shall not be taken into account in the calculations.
   d. Where areas of defective surface or deficient thickness are corrected by overlaying with additional material, the thickness used in the calculations shall be the specified thickness for such areas.

C. Testing

1. The contractor shall provide, at this expense, the following tests:
   a. Determination of the job mix formula
   b. Tests of the asphalt cement
   c. Sieve analysis of the aggregate
   d. Determination of bitumen content of the asphalt concrete

   The results of the tests are to be provided to the Engineer and Owner.

SECTION THREE
DIVISION 4 - MASONRY

04000 - General

Weeps and Vents

All exterior walls shall be weeped. Weeps shall be provided. No galvanized tubing is to be used.

04100 - Mortar

Mortar without a color admixture is preferred. ASTM C-27073, Type "S", shall be used for above grade use and Type "M" will be used for below grade. This may be revised for structural consideration.

Admixtures

Plasticizers, accelerators, retardants, water repellants agents, or other admixtures are not recommended. Prior approval of the Owner is required for admixtures.

04300 - Unit Masonry

For quality control, all materials, products and execution shall meet appropriate ANSI/ASTM Standards.

Tolerances

Tops of all Masonry walls, exterior and interior, where applicable, should allow for expansion and contraction, sealed to eliminate intrusion of elements and infiltration of mammals. Prior approval of Owner necessary for any change.

Mock-ups

Specifications shall require a composite Masonry mock-up. Erect a 4 x 8 foot panel. The panel shall demonstrate the quality of workmanship to include color range, texture of masonary units, bond mortar joints, joint uniformity, etc. Completed masonary work in the building shall conform to the approved panel. The panel shall not be removed until masonary work is complete or until removal is authorized. No masonary work shall be performed until mock up wall is erected and approved.

Concrete Unit Masonry

Concrete block units shall be used wherever feasible for walls. All units shall comply with all structural codes and shall be properly protected at the job site to ensure placing in the wall without excessive moisture content.

Wall exposed on both sides shall be 6" thick (minimum).

All block shall be culled for chips.

All exposed external corners which extend to the floor (or to top of base) is to be bullnosed. Rub out all casting irregularities (so as to result in smooth transition from flat face to rounded corner) before any finish treatment is applied.

Cleaning

All cleaning shall be completed in same day as placement.

Language should be added in the specifications regarding the cleaning of exterior brick-work. Excess mortar on the finish surfaces is not acceptable.

The finished Masonry should be scraped and cleaned with a solution of approved cleaner. Close inspection required prior to recommendation of final acceptance.

04210 - Veneer Masonry System

All veneer masonary proposed and the range of color must have the approval of the Owner before their purchase and use.

Mock-up (Sampled Panel

A mock-up is required for review and approval. Mock-ups shall be erected in 4 X 8 feet panels including specified mortar and any accessories. When accepted, the mock-up will set the standards for all building Masonry.

No veneer Masonry shall be erected until mock-up is reviewed and approved.

Weeps and Vents

Use treated wick in weep holes.

Cavity Wall

Where concrete blocks are veneer faced with brick or precast units, provide a cavity. Do not use units directly against the concrete block without employing a proven form of waterproofing.

Coursing

Masonry veneer shall be laid with modular coursing, three courses to 8", unless otherwise required to match existing coursing or to accentuate an architectural feature or pattern.

04500 - Masonry Cleaning

Refer to the Southern Brick and Tile Manufacturing Association for bulletins covering cleaning. Cleaning should be done sufficiently early for the wall to dry thoroughly at least four weeks prior to application of silicone or other recommended waterproofing. Specify that Masonry veneer must be inspected prior to application of waterproofing.

Cleaning Materials

Cleaning agents shall be detergent or solvent cleaners. No acid solution is permitted.

Exterior Waterproofing

Careful analysis and consideration must be given to the type of waterproofing applied to Masonry or stone walls.

See 09900 Painting - Exterior Waterproofing.

SECTION THREE
DIVISION 5 - METALS

05000 -General

All exterior/interior metals shall be compatible.

05210 – Steel Joists

PART 1 - GENERAL

1.4 DEFINITION

A. The purpose of this guideline is to establish minimum standards for the fabrication and installation of steel joists assemblies.

1.5 APPLICATION

A. This section includes open web steel joists, K series; long span steel joists, LH series; joist girders and joist accessories used for the support of roof and floor assemblies.

1.6 SELECTION CRITERIA

A. Industry Standards And Tests

1. Steel Joist Institute: Specifications for chord and web members
2. Steel Bearing Plates: ASTM A 36/A
3. Carbon Steel Bolts and Threaded Fasteners: ASTM A 307 Grade A
4. High Strength Bolts and Nuts: ASTM A 325
5. Welding Standards: AWS D1.1(steel) and AWS D1.3 (sheet steel)
6. Primer: SSPC-Paint 15, Type I, red oxide; FS TT-P-636

B. Applicable Publications

1. AISC: American Institute of Steel Construction, Allowable Stress Design, Ninth Edition.
2. AISI: American Iron and Steel Institute, Specifications for the Design of Cold-Formed Steel Structural Members August 1986 Edition with December 1989 Addendum.
3. ASTM: American Society for Testing Materials. References to ASTM standards shall be listed in the 1995 edition.
4. SREF: Structural Design, Load importance Factor. Design shall be based on ASCE 7-98, with a wind load importance factor for educational facilities of 1.1.
5. FS: Federal Standards.
6. OSHA: Occupational Safety and Health Association.

C. Submittals, General Instructions, Product Data, Shop Drawings, Samples, Certificates

1. Shop Drawings: Prepared by the joist manufacturer and showing layout, mark, number, location & spacing. Include anchorage details, bracing, bridging, connection locations, details and attachment of steel joists to other construction.

   a. Shop Drawing Submittals shall be signed and sealed by a professional engineer licensed to do business in the State of Florida.

2. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing steel joists with a successful in-service performance.

1. Manufacturer shall be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.

B. Contractor Qualifications

1. The contractor doing steel joist erection shall have a license for the work he is installing and be licensed to do business in Orange County, Florida.
2. The contractor shall comply with the requirements for welding as described in "Structural Welding Code--Steel"; and AWS D1.3 "Structural Welding Code—Sheet Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. The storage, handling and delivery of steel joists shall be as recommended in SJI "Specifications".

B. Steel joists shall be protected from corrosion, deformation and damage during delivery, storage and handling.

1.6 PREPARATION/FIELD VERIFICATION

A. Steel joists and accessories shall be delivered to the job site marked for sequence of erection.

PART 2 - PRODUCT/SCHEDULE

2.1 MATERIALS

A. Steel: Comply with SJI Specifications for chord and web members.

B. Bearing Plates: ASTM A36/A.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A.

D. Welding Electrodes: AWS Standards.

2.2 PRIMERS

A. Primer: Meeting the standards listed in SSPC Paint 15, Type 1, red oxide, or FS TT-P-636, red oxide.

2.3 STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, SJI Specification"' with steel angle top and bottom chord member.

B. Comply with AWS requirements for and procedures for shop welding.

C. Top chord extensions shall comply with SJI Type R.

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors of material, size and type required by SJI Specifications.

PART 3 - QUALITY ASSURANCE DURING EXECUTION

3.1 SAFETY

A. Safety Guidelines to be used in the erection and installation of steel joist systems shall be in accordance with OSHA Standards

3.2 EXAMINATION

B. Examine support substrates and embed plates for location and compliance with installation tolerances.

3.3 INSTALLATION

A. Supporting structures shall be complete and secure with all accessories and embeds in place before steel joists are installed

B. Installation shall be in accordance with manufacturers installation instructions.

C. Install Joists plumb, square and securely fastened to support construction according to SJI Specifications.

D. Field weld joists to supporting steel bearing plates. Comply with AWS requirements for welding, appearance and quality of welds and methods for correcting welding work.

E. Bolt joists to supporting steel framework using high strength bolts.

F. Install bridging concurrently with joist erection and before construction loads are applied. Anchor ends of bridging at top and bottom chords when terminating at walls and beams.

3.4 FIELD QUALITY CONTROL

A. The owner will engage a testing agency to test and inspect welds and bolted connections. Retesting or re-inspection of conditions failing to meet specified requirements shall be done at the Contractors expense.

1. Field welds will be visually inspected and tested according to AWS D1.1.
2. Bolted connections will be tested and verified according to procedures in ASTM 325.

3.5 REPAIRS AND CORRECTION

A. Repair damaged galvanized coatings on galvanized items using galvanized repair paint according to ASTM A 780.

B. Use touchup paint to re-prime field connections that have been burned by welding, rusted, or abraded.

1. Clean and prepare surfaces by hand-tool cleaning.
2. Apply shop primer to surfaces.

END OF 05210

05500 - Metal Fabrications

Use galvanized steel angles in all exterior masonary, stone or precast concrete walls and in all interior walls where used in conjunction with stone. Cutting and or trimming of galvanized metals is not permitted.

05520 - Handrails and Railings

Finishes - All exterior galvanized metals should be painted in conjunction with the overall color scheme.

Flashing, gutters, drainspouts, etc. should be mill aluminum or coater per project specifications.

All handrail and railing shall comply to SREF.

SECTION THREE
DIVISION 6 - WOOD & PLASTICS

06114 - Wood Blocking & Curbing

Pressure Treated Lumber

Pressure treated material shall be used for all lumber in contact with concrete, masonary or steel. Wolmanizing process is considered best of the treatments for lumber in buildings. Bolident salts are excellent and treatment is equivalent to Wolmanizing if pressure treatment of 100/150 psi used.

Finish Carpentry

Laminated Plastic

All millwork shall be laminated with a plastic laminate. This material shall meet flamespread rating requirements of NFPA 101 (latest edition) for interior finish consistent with the occupancy classification.

Back-Painting

Wood to be back-painted before setting should be specifically called for under Division 9 so there is no room for question on the part of the Contractor.

Millwork

If door sections are used to make up closet walls, the edges should be concealed where possible since the veneers exposed to view present an unsightly appearance.

If floor-to-ceiling openings are used (door and transom), check location of the ducts and pipe with engineers!

SECTION THREE
DIVISION 7 - THERMAL & MOISTURE PROTECTION

07000 - General

Shower Room Floors

Leakage in shower and drying rooms have been a most serious problem. This area must be addressed specifically in the drawings and specification to eliminate maintenance problems. Fiberglass pans are excellent for this purpose.

A (24) hour water test should be required prior to placement of the finish flooring; if leaks occur, another test should be required after repairs are made.

Shower Room Walls

Ceramic tile on a masonary wall is insufficient to prevent water from permeating a shower room wall. Parging or painting the back of the wall and providing a through-wall flashing near the base is one means of conducting the water back to the shower room floor. Also the use of Durawall is an acceptable product.

Dissimilar Metals

Great care should be exercised in the use of dissimilar metals, and where used, proper precaution should be taken.

Fiberglass pans are recommended.

Scuppers

Overflow scuppers should be provided in parapet walls to prevent water building up even though drains are in the specifications.

Gravel Stops

Where no gutter occurs but gravel stops are used over exterior entrances or decorative panels, specify a high gravel stop to prevent water from spilling over with resulting stain effect from the metal.

07115 - Elastomeric Sheet Waterproofing

The use of this material is acceptable for pr existing roofs or flat roofs. Insulation shall be monitored by third party consultant. All new roof construction shall be a standing seamless roof.

Include sheet butyl, PVC, EPDM, CPE, CSPE, neoprene, hypalon, or composite laminated membrane water-proofing products to function as principal moisture stop in arresting predominantly in a horizontal application, adhesive bonded, self-adhered, loose laid, or mechanically secured installation.

Slab on Grade

Careful attention shall be paid to the design of slabs on grade to prevent damage to membranes during construction. For special areas and where damp-proofing is considered necessary for any slab on grade; a double slab system is preferred in order to reduce chances of a punctured membrane. A product equal to "Bituthane" by W.R.Grace should be considered under the wear slab. The design of all sidewalks shall include a waterproof membrane.

Special consideration shall be given to design where a Radon Barrier is required.

Vertical Surfaces

A through-wall dampproofing membrane is necessary to prevent moisture in the soil from extending up the wall by capillary.

07175 - Water Repellent Coating

Include a breathable water or solvent based liquid application to masonary or cementitious surfaces as a repellent coating to retard moisture absorption to above grade porous surfaces, and for stain or soil resistance to inter-surfaces of all structures on the facility. All exposed masonary shall have water repelling coating.

07190 - Vapor and Air Barriers

Include a method used to continue a seal formed by a vapor and air barrier for each building enclosure construction, and to seal gaps between adjacent materials forming wall and roof opening.

07220 - Roof and Deck Insulation

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes parallel polyisocyanurate roof insulation and accessories.

1.2 SUBMITTALS

A. Product data:

1. Roof insulation boards
2. Fasteners
3. Installation instructions for HCFC FREE Polyiso insulation board
4. Product Data as per ASTM 2129 Standard for Data Collection for Sustainability Assessment of Building Products

B. Insulation manufacturer's certification that HCFC FREE Polyiso materials meet Zero ODP (Ozone Depletion Potential) and Zero GWP (Global Warming Potential) specification requirements.

1.3 QUALITY ASSURANCE

A. The insulation is to meet the physical properties of ASTM C 1289, Type II; Class 1. The insulation shall provide a minimum Long Term Thermal Resistance (LTTR) value of 6.0 per inch. 6.0 per inch shall be the basis for establishing thickness in inches required. The use of aged R-values based on the RIC-TIMA conditioning procedure 281-1 is not acceptable.

B. Hydrocarbon blowing agents: Third generation, using Zero Ozone Depletion (ODP) as in compliance with the US EPA requirements of January 1, 2003 requirement to eliminate production of HCFC 141b.

C. Roof system shall be designed to meet wind-loading requirements for Florida Building Code, 2001 with 2003 revisions. Refer to Structural Drawings for wind velocity

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original packaging, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture, and in accordance with manufacturer's instructions.

C. Protect from direct exposure to sunlight.

D. Do not install insulation that has become wet or damaged.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Products of the following manufacturers will be considered for polyisocyanurate roof insulation providing they can furnish products equal to those specified and are approved by the membrane manufacturer, and does not restrict the terms of the roofing warranty.

1. *Atlas Roofing Corp. www.atlasroofing.com*
2. *Celotex, Tampa, Florida; http://www.celotex.com/*
3. *Firestone Building Products, Carmel, Indiana*
4. *Hunter Panels, Chicago, Illinois; http://www.hpanels.com/*
5. *Johns Manville, Denver, Colorado; http://www.johnsmanville.com/*
6. *Rmax, Inc., Dallas, Texas; http://www.rmaxinc.com/*

B. Parallel Roof Insulation: Insulation shall have glass fiber reinforced facer sheets on both sides integrally laminated to the polyisocyanurate core material. Insulation shall meet FM Class 1 construction.

1. *Total LTTR value shall be minimum 20, unless otherwise indicated.*
2. *Achieve LTTR by a minimum assembly of two layers totaling 4-inches in thickness. Use additional layers depending on board thickness*
3. *Cover Board: Glass mat faced gypsum board with water resistant core, 1/2-inch thickness. Dens Deck roof board by Georgia Pacific. Cover board shall be as tested when a tested assembly is required.*
4. *Compressive Strength: 25 pounds per square inch minimum.*
5. *Board Size: 4' x 8' maximum*

C. Fasteners: Metal fasteners and the insulation shall be approved by the membrane manufacturer to assure that required conditions are met to provide a membrane manufacturer's roof warranty. The type of fastener shall be appropriate for the substrate to achieve maximum withdraw and anti-corrosion characteristics. The membrane manufacturer approved fasteners shall also meet the following requirements:

1. *FM 4470 SPRI Corrosion Test Procedure for Roofing Fasteners. To pass, the fasteners shall not accumulate more that 15 percent red rust after the "required number cycles" in the Kesternich cabinet.*

    a. *The required number of cycles is as currently recommended by FM and SPRI, but in no case shall it be less than 15.*

D. *Adhesives: Shall conform to manufacturer's recommendations.*

2.2 COMPATIBILITY OF PRODUCTS

A. *Verify the compatibility of products specified in this Section with products specified in Section 07412. Substitution of and components that would restrict or limit the Roof Guarantee will not be accepted.*

PART 3 - EXECUTION

3.1 INSTALLATION

A. *Comply with insulation manufacturer's instructions and recommendations for the handling, installation, and bonding or anchorage or insulation to substrate.*

B. *Roof Insulation: Lay in multiple courses. Edges shall be butted to provide moderate contact but not deformed or placed in surface compression. Neatly cut and fit insulation around projections and vertical surfaces. Edges shall be mitered at ridges and elsewhere to prevent open joints or irregular surfaces. Stagger end joints in adjoining courses or base course. Stagger joints in succeeding layers with joints of layer below.*

C. *All rigid roof insulation shall be attached to the roof deck in strict accordance with ASCE 7-98 requirements.*

3.2 COORDINATION

A. *Installation of insulation shall be coordinated with other relative work preceding and subsequent to actual installation of insulation. This includes, but is not necessarily limited to, the following:*

1. *Installation of nailers, blocking, and insulation strips.*
2. *Installation of roof curbs.*
3. *Installation of flashings.*
4. *Installation of roof membrane.*

3.3 GENERAL INSTALLATION PROVISIONS

A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

07270 - Fire Stopping

Include products intended to be used to close firestop openings created when site conditions require forming of cutting walls, partitions, or floors. This fire stop material is used to close openings and continue a fire resistance rating uninterrupted.
No flammable materials shall be used.

07412 - Preformed Metal Roofing

PART 1 - GENERAL

1.1 SUMMARY

A. Preformed metal roofing and related Work as specified herein, and as required for a complete and watertight installation. Work under this Section includes, but is not limited to:

1. *Metal roofing and fascia*
2. *Flashing, closures, and cap trim*
3. *Metal gutters and downspouts*
4. *Vent roof jacks and mechanical curbs*

1.2 SUBMITTALS

A. Shop Drawings: Show profile and gage of items, location and type of fasteners; location, gage, shape, and method of attachment of trim; and other details as may be required for a weathertight installation.

1. *Do not proceed with manufacture prior to review of shop drawings. Do not use Drawings prepared by Architect for shop or erection drawings.*
2. *Shop drawings shall show methods of erection, elevations, and plans of roof panels, sections, and details, anticipated loads, flashings, roof curbs, vents, sealants, interfaces with materials not supplied, and proposed identification of components parts and their finishes.*
3. *Shop Drawings shall bear the seal and signature of Structural Engineer registered in the State of Florida.*
4. *Calculations for wind load design shall be stamped, sealed and signed by a Professional Engineer in the State of Florida verifying compliance with ASCE 7-98.*
5. *Submit laboratory test report showing roof assembly compliance with SSTD 12-99.*

B. Submit 3 copies of appropriate color selection materials.

C. Final Statement of Compliance: Submit to the Architect, addressed to the Board of Education for Osceola County.

C. Submit pre-roofing conference meeting minutes.

D. Submit warranties as specified herein.

1.3 QUALITY ASSURANCE

A. Applicable standards:

1. AISC: "Steel Construction Manual," American Institute of Steel Construction.
2. AISI: "Cold Form Steel Design Manual," American Iron and Steel Institute.
3. ASTM A792-AZ55: Specifications for steel sheet, aluminum-zinc alloy coated (galvanized) by the hot dip process, general requirements (galvalume).
4. ASTM E283-84: "Air Infiltration Test."
5. ASTM E331-83: "Water Penetration Test."
6. ASTM A-525: Specifications for steel sheet, hot dipped galvanized steel, coated aluminum-zinc alloy, coated steel-hot dipped aluminum zinc alloy or painted galvanized with exterior color specified by manufacturer.

B. Manufacturer's qualifications: Minimum of 10 years experience in manufacturing panels of this nature, in a permanent, stationary, indoor production facility

C. The installer shall have been actively installing the type of roofing system defined in these Specifications for a minimum of 5 years and be approved by the manufacturer of the system being installed.

D. Design: The preformed metal roof system shall be designed to sustain the specified loads in accordance with governing building codes in the county and state that this Project is located in. Components of the preformed metal roof system shall meet the design loads and applied in load combinations as specified in governing building codes, without exceeding the allowable working stresses.

1. Roof system shall be designed to meet wind-loading requirements for the Florida Building Code, 2001 with 2003 revisions. Refer to Structural Drawings for wind velocity.

E. When tested in accordance with ASTM E 1680 and ASTM E 1646, the panel assembly shall show no more than 0.01 cfm/ft2 of air infiltration at 6.24 psf test pressure and no water leakage at 15 psf test pressure for 15 minutes with a volume spray of 5 gallons per hour.

F. Structural: Uniform load capacity shall be determined by testing in accord with the principles of ASTM E 1592 adapted to testing of formed sheet panels by clarifying specific sections of this standard as follows:

1. Roof test specimens shall be representative of the main body of the roof, free from influence of perimeter conditions. The setup shall be continuous over one or more supports and contain at least 5 panel widths.
2. No roof attachments are permitted at the sides other than the standard gable or rake condition. For uplift tests, at least one end seal shall be flexible and in no way restrain the crosswise distortion of panels. One end may simulate an eave condition if at least 12 feet away from the mid-roof clip under evaluation.
3. Roofing panels and accessories shall be production material of the same type and thickness proposed for use on the project.
4. Longitudinal seals or plastic film shall not span any crevice or cracks that may tend to separate under pressure (e.g. plastic films used to seal the chamber must be applied into the side seam of the panel so as to apply a uniform static pressure to the entire cross section of the panel).

G. Weathertightness: When tested in accord with the principles of NAAM TM-1, the roof system without sealant in the ribs shall show no leakage when exposed to dynamic rain and wind velocity up to 70 mph for 5 minutes.
H. Thermal Cycle Test: An assembly consisting of clips, 3 or more panels in width, and spanning 3 or more supports with clips positively loaded to 10 pounds shall resist 100,000 thermal cycles and show no visible signs of wear from the exterior and erode no more than 25 percent of the panel of clip material from the underside (non-exposed surfaces).

I. The roofing manufacturer's representative shall inspect the roof within one year after the Date of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver panels to job site properly packaged to provide against transportation damage.

B. Handling: Exercise extreme care in unloading, storing, and erecting panels to prevent banding, warping, twisting, and surface damage.

C. Storage: Store materials and accessories above ground on well skidded platforms. Store under waterproof covering. Provide proper ventilation to panels to prevent condensation build-up between panels.

1.5 JOB CONDITIONS

A. Pre-Roofing Conference

1. Prior to the installation of the roofing and associated work, meet at the project site with the installer, the installer of each component of associated work, the installers of deck or substrate construction to receive roofing work, the installers of other work in and around roofing that must follow the roofing work (including Mechanical Work), the Architect, and other representatives directly concerned with performance of the work, including (where applicable) insurers, test agencies, product manufacturers, governing authorities, and the Owner. Record (by Contractor) the discussions of the conference and the decisions and agreements (or disagreements) reached and furnish a copy of the record to each party attending. Review foreseeable methods and procedures related to the roofing work including, but not necessarily limited to, the following:

a. Review project requirements (Drawings, Specifications, and other Contract Documents).
b. Review required submittals, both completed and yet to be completed.
c. Review status of substrate work (not by the Metal Roofing Installer), including drying, structural loading limitations, and similar considerations.
d. Review required inspection, testing, certifying, and accounting procedures.
e. Review regulations concerning code compliance, environmental protection, health, safety, fire, and similar considerations.
f. Consider each party's extant judgment, as advanced in the interest of successful completion of Work.

1.6 WARRANTY

A. Furnish a written guarantee covering the roofing and flashing work including the installation of products in the system, against defects in materials and workmanship for a period of 2 years. Guarantees are not intended to serve as protection against poor workmanship or inferior or improper materials at the time the roof is installed, but are for the purpose of protecting the Owner against future failures during the intended life of the roof covering.

B. The manufacturer for the preformed metal roofing shall also furnish to the Owner a written guarantee covering the finish of exposed coated metal surfaces against blistering, peeling, cracking, flaking, checking, chipping, rusting, and excessive chalking and color change for a period of 20 years.

1. Also provide a manufacturer's 20 year weathertightness warranty equal to Industry Standard weathertightness warranty.

C. Guarantee/warranty shall include, but not be limited to, preformed metal roofing, fascias, roof insulations, flashings, cap flashings, closures and trims, fasteners, accessories, sealants, gutters, and watertight connection to downspouts.

D. Guarantee/warranty period shall begin on the Date of Substantial Completion for the Project or such date that the roof is accepted by the Architect and Owner.

E. Repairs required, either permanent or temporary, to preformed metal roofing or roof flashings under this guarantee to keep the roof watertight shall be started within 3 days after notice of the need for repairs. Should the Contractor fail to make such repairs within a reasonable time period, the Owner may have such repairs made and charge the cost to the Contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Preformed metal roofing shall be minimum 2 inches high, vertical leg field crimped, standing seam panels with concealed fasteners. Basis of design: VSR Panel, as manufactured by Butler Mfg. Co., Kansas City, Missouri.

B. Products of the following manufacturers will be considered, providing their products equal or exceed the quality specified; and they can provide products of the type, size, function, and arrangement required.

1. *Architectural Metal Systems, Inc., Eufaula, Alabama*
2. *Berridge Manufacturing Co., Huston, Texas*
3. *Centria Roof Systems, Moon Township, Pennsylvania.*
4. *MBCI, Inc., Shelbyville, Indiana.*
5. *Steelox Roofing Systems, Mason, Ohio.*

C. Finish to be factory applied Galvalume "Plus" coating over thoroughly cleaned and pretreated galvanized coated steel. Coating to be applied prior to fabrication of roofing components.

D. Metal sheets or coils selected for forming into panels must be cut to size before receipt of finish coating or have cut edges specially coated with similar film of same applied finish after being sized. Actual finish and coating method intended for provision must appear on submitted shop drawings.

2.2 DESIGN OF SYSTEM

A. Panel shall be designed in accordance with sound engineering methods and practices and in accordance with the latest edition of AISI's "Specification for the Design of Cold Formed Steel Structural Members."

B. Roof structure shall be designed with proper recognition for the "floating system" which must exist to have a roof panel that meets expansion and contraction requirements.

C. Panel shall be designed so that damaged panels may be replaced without interfering with adjacent panels. Replacement shall not require the use of through the roof fasteners.

2.3 MATERIALS

A. Panels shall be fabricated in full lengths from ridge to eave without end laps. Panels shall be 16 inches wide maximum with concealed anchors that resist wind uplift yet permit expansion and contraction with temperature changes. Standing ribs 2 inches high minimum shall have a continuous groove capillary break. Ribs shall be securely locked over anchor clips with an electrically driven, field operated, roll forming tool. Individual panels shall be removable for replacement of damaged material. A minimum of two, 3/8-inch high intermediate stiffener ribs shall be located in the flat pan to minimize oil-canning and telegraphing of structural members, striated panels are also acceptable. Panels shall be Galvalume "Plus" prefinished 50 ksi steel per ASTM A792.

1. *24 gauge "Galvalume" panels finished with clear coat.*
2. *Galvalume sheet shall be produced in accordance with ASTM A792 with coating designation of AZ55.*
3. *Provide regular spangle surface without chemical treatment.*
4. *Oil coating shall be kept at a minimum. Clean panels of all oil prior to shipment.*
5. *Use clean, dry gloves during handling and installation.*
6. *Care shall be exercised to prevent the roofing panels from sliding over each other during shipment and installation.*

7. *Galvalume shall have a clear coat applied at the factory. Coating shall be a clear acrylic coating applied to both sides of the sheet. Acrylic coating shall contain chromium. Basis of Design: Galvalume Plus by Bethlehem Steel.*
8. *Onsite fabrication, painting, rolling or forming of sheet metal roofing is **not** permitted.*

B. *Clip angle "bearing plate" shall be a minimum of 18 gauge 36,000 psi G90 hot dip galvanized steel. The concealed backing plate shall have recessed pre-punched holes for deck attachment.*

C. *Concealed clips shall be not less than 24 gauge galvanized coated, 50,000 psi minimum yield or nonmagnetic stainless steel. Clip design is to be such that it will accommodate expansion and contraction requirements while being anchored securely to structure.*

D. *Concealed fasteners shall be self drilling, self tapping sheet metal screws of SAE #1022 steel with .0003 inch minimum zinc coating meeting Federal Specification QQ-Z325 Type II.*

E. *Exposed fasteners shall be self tapping, stainless steel sheet metal screws. Provide self drilling, self tapping screws where required by conditions.*

F. *Roofing panels shall be manufactured in continuous lengths to eliminate perpendicular panel end laps. End laps will not be allowed.*

2.4 ROOF SYSTEM ACCESSORIES

A. *Ridge Cap*

1. *Closure strips formed to fit the roof panel profile shall be provided as required. The closure shall be closed cell "EPDM" synthetic rubber or factory formed metal closure to match roofing panel, or manufacturer's standard watertight detail and components.*
2. *Integrated steel roof curbs shall be fabricated with sides made in the form of roof panels and seamed directly to the roof panel during erection. Weathertight end laps shall require the roof panel to lap over the curb flange on the high side and curb flange to lap over the roof panel on the low side.*

B. Gutter, Downspout, Trim, and Flashings

1. Gutters, downspouts, ridge cap, and curbs shall be furnished in 24 gauge Galvalume "Plus" finish on all exposed sides and edges, matching the roof panel finish. Unexposed sides and edges shall be standard baked-on finish. Form to configuration indicated on the Drawings. Provide gutter straps of 24 gauge Galvalume "Plus" finish to match gutter and roof panels. Provide manufacturers standard gutter design.

2. Fascia, eave, and rakes shall be 22 gauge Galvalume "Plus" finish on all exposed sides and edges.

C. Sealant: The standard of quality shall be that of a reputable and established sealant manufacturer, approved by the manufacturer of the metal building in which the sealant is used. Sealants shall have good cohesion as well as good adhesion to the protective coated metal and shall not be corrosive to components on which it is applied. Each shall have adequate handling characteristics during normal ranges of construction or erection temperatures. The sealant shall be one that will retain its weather sealing properties under the conditions for which it is used and each (sealant) is recommended for only the applications listed hereafter.

1. Extrudable sealant, non-migratory, nondrying, and non-skinning synthetic elastomer base material conforming to the National Association of Architectural Metal Manufacturer's NAAMM Standard SS-1a-68, and except for the "tack free time", shall conform to the performance requirements of Federal Specification TTC-598-b Type 1. Use at the following locations:

a. Factory applied sealant in longitudinal ribs of standing seam roof panels.
b. Spot sealing laps (where applicable) of standing seam roof panels.
c. Sealing ridge cover and miscellaneous flashing.
d. Sealing curbs for roof accessories.

2. Extruded butyl material conforming to performance requirements of Military Specification #MIL-C-18969B Type II Class B. With the exception of the "compressor set" requirement, it shall also conform to the National Association of Architectural Metal Manufacturer's NAAMM Standard #SS-1b-68 Class A for nonskinning resilient preformed compounds. Size of tape shall be that recommended by the building manufacturer. Use at the following locations:

a. Sealing swaged end laps of standing seam roof panels.

3. *Extrudable sealant, nondrying (but skinning) and nonmigratory synthetic elastomer base material, conforming to the performance requirements of Federal Specification TT-C-598-b Type 1. Use at the following locations:*

   a. *Sealing ridge channels*
   b. *Sealing exposed seams, butts, and laps at roof curbs*

D. *Prefabricated Metal Roof Curbs: Fabrication of the prefabricated metal roof curbs shall be furnished by the same manufacturer as the roof covering sheets to assure an exact match with roof configuration. Metal gage shall equal or exceed the following: Cricket metal-24 gage; curb metal-14 gage. The finish for both the cricket and curb metal shall be equal or exceed the roof covering sheet. Component connections between the prefabricated metal roof curbs, cricket, and base sheet shall be continuous welded to obtain watertight connections. Exposed surfaces shall match the color finish of the roof sheets. Color shall match color of roof panels.*

E. *Pipe Flashings: EPDM (ethylene propylene diene monomer) flashings for vent pipe penetrations in metal roof. Provide clamping rings, sealant, and fasteners recommended by manufacturer.*

F. *Membrane Underlayment:*

   1. *"WinterGuard HT," CertainTeed Corp., Valley Forge, Pennsylvania.*
   2. *"Grace Ultra," Grace Construction Products, Cambridge, Massachusetts; www.grace.com*
   3. *"TW Metal and Tile Underlayment," Tamko Roofing Products, Joplin, Missouri; www.tamko.com*

G. *Provide manufacturers standard valley flashing for valleys. Gauge and finish shall match roof panels as a minimum. All valleys shall be watertight and shall be included in the manufacturers standard roof watertightness warranty. Provide all items as required for a complete installation in every respect.*

H. *Any composite roofing system to include insulation, shall comply with the requirements of ASTM C 1301 for LTTR (Long Term Thermal Resistance).*

PART 3 - EXECUTION

3.1 INSTALLATION

A. *Areas on which insulation and metal roofing is to be installed shall be completely secured and free of dirt and debris.*

B. Notify Architect in writing of defects in substrate that would be detrimental to metal roofing installation prior to start of Work.

C. Start of insulation and metal roofing installation shall constitute acceptance of substrates by this Contractor.

D. Membrane Underlayment:

1. Install membrane underlayment over 100% percent of the roof area in accordance with the membrane manufacurer's written installation instructions.

2. Membrane shall be installed directly on top of the oriented strand board, roof and deck insulation specified in Section 07220, Roof and Deck Insulation.

3.2 METAL ROOFING INSTALLATION

A. Erection of the preformed metal roofing system shall be performed in accordance with the manufacturer's erection drawings.

B. Set bearing plates on surface of insulation board at standing slip angle locations.

C. Install concealed clips on top of bearing plates with self drilling shoulder screws into metal roof deck below. Size and length of screws and bearing plates shall be as recommended by manufacturer.

D. Install concealed backing plates on surface of insulation at locations where panel end laps occur. The concealed backing plate shall be continuous under panel end laps. The backing plates shall be fastened to the metal deck with self drilling screws at 16 inches on center.

E. Interlocking ribs shall be crimped together by an electric powered mechanical device in accordance with the roof manufacturer's instructions, immediately after securing in place.

F. Preformed metal roofing, fascia, and gutter work shall be watertight and weathertight, lines and angles sharp and true, plain surfaces free from waves and buckles. Workmen shall be experienced in the trade and thoroughly capable of performing the Work in accordance with these requirements.

G. Fasteners are to be concealed wherever possible. Exposed fasteners shall be stainless steel painted to match.

H. Brake formed cap, trim, closure, and flashing sections are to be furnished with a minimum of joints.

1. Brake formed members with exposed corner intersections shall have corner pieces shop fabricated. Other miscellaneous trim corners may be field cut, mitered, or butted.

2. Trim shall be of the same material as, and have a finish to match, the metal roofing panels.

I. Install roof jacks at pipe penetrations in metal roofing and roof curbs at all roof mounted equipment indicated on the Drawings. Provide required fastened, foam rods, plastic cement, and other sealant or material to provide watertight and weathertight construction.

J. Install panels and accessories in strict accordance with the panel manufacturer's written instructions and the approved shop drawings. Use electrically driven "crimper tool" for closing seams wherever possible. Attach panels to framing members per the manufacturer's written instructions, providing fixed anchorage or allowing thermal movement where specified on shop drawings.

K. Use appropriate clips, fasteners, braces, and anchors as indicated on the Drawings and any other items required for a complete installation and as recommended by manufacturer.

L. Make repairs and perform additional work necessary to provide a roof watertight and acceptable to the Architect prior to start of roofing guarantee.

M. The installation shall be designed to safely resist the positive and negative loads.

N. Roof panels shall be able to support walking loads without excessive distortion or telegraphing of the structural supports. For the maximum span used on the project, panels shall withstand a 250 pound concentrated load applied to a 4 square inch pad located at the center of the panel flat without buckling of the rib or noticeable permanent distortion of the panel.

O. Roof panel and flashing attachments shall be designed to accommodate the thermal expansion and contraction of the exterior material through a total of 150 degrees F. temperature change.

P. Factors of safety on design loads to ultimate strength of fasteners shall be as stated in the industry standard for the material into which the fastener is driven.

1. AISI for steel

Q. Provide all items and accessories as required for a complete installation in every respect.

3.3 GENERAL INSTALLATION PROVISIONS

A. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

B. Inspect materials immediately upon delivery and again prior to installation. Reject damaged and defective items.

C. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

C. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

E. Recheck measurements and dimensions, before starting each installation.

07416 – Preformed Curved Metal Roofing

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Preformed curved metal roofing.

B. Refer to Section 07412 – Preformed Metal Roofing for the following requirements:

1. *Submittals*
2. *Quality Assurance*
3. *Delivery, Storage, and Handling*
4. *Pre-Roofing Conference*
5. *Warranty Issues*

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Curved preformed metal roofing shall be 2-3/8 inches high, vertical leg, standing seam panels with concealed fasteners. Basis of design: "Series 300" as manufactured by Imetco, Tucker, Georgia.

B. Products of the following manufacturers will be considered, providing their products equal or exceed the quality specified; and they can provide products of the type, size, function, and arrangement required.

1. *Centria Roof Systems, Moon Township, Pennsylvania.*
2. *Berridge Manufacturing Company, San Antonio, Texas*

C. Finish, Basis of Design: Factory applied Galvalume "Plus"Bethlehem Steel. Coating to be applied prior to fabrication of roofing components.

D. Metal sheets or coils selected for forming into panels must be cut to size before receipt of finish coating or have cut edges specially coated with similar film of same applied finish after being sized. Actual finish and coating method intended for provision must appear on submitted shop drawings.

2.2 DESIGN OF SYSTEM

A. Refer to Section 07412 – Preformed Metal Roofing

2.3 MATERIALS

A. Panels shall be fabricated in full lengths from ridge to eave with end laps patterned in a repeating arrangement. Panels shall be 16 inches wide maximum with concealed anchors that resist wind uplift yet permit expansion and contraction with temperature changes. Standing ribs 2-3/8 inches high, with 1" wide cap. Ribs shall be securely locked over anchor clips with an electrically driven, field operated tool. Individual panels shall be removable for replacement of damaged material. A minimum of two, intermediate stiffener ribs shall be located in the flat pan to minimize oil-canning and telegraphing of structural members, striated panels are also acceptable. Panels shall be Galvalume "plus" prefinished 50 ksi steel per ASTM A792.

1. 24 gauge "Galvalume" panels finished with Galvalume "Plus" as ecified above are acceptable.
2. Galvalume sheet shall be produced in accordance with ASTM A792/A792M and shall have a coating designation of AZ55.
3. Care shall be exercised to prevent the roofing panels from sliding over each other during shipment and installation.

B. Clip angle "bearing plate" shall be a minimum of 16 gauge 36,000 psi G90 hot dip galvanized steel. The concealed backing plate shall have recessed pre-punched holes for deck attachment.

C. Concealed clips shall be not less than 16 gauge galvanized coated, 50,000 psi minimum yield or nonmagnetic stainless steel. Clip design is to be such that it will accommodate expansion and contraction requirements while being anchored securely to structure.

D. Concealed fasteners shall be self drilling, self tapping sheet metal screws of SAE #1022 steel with .0003 inch minimum zinc coating meeting Federal Specification QQ-Z325 Type II.

E. Exposed fasteners shall be self tapping, stainless steel sheet metal screws. Provide self drilling, self tapping screws where required by conditions.

F. Roofing panels shall be manufactured in continuous lengths to eliminate perpendicular panel end laps. End laps will be allowed as specified herein.

G. Gutter, and Downspouts

1. Gutters, downspouts, shall be furnished in 24 gauge Galvalume "Plus" on all exposed sides and edges, matching the roof panel finish. Unexposed sides and edges shall be Galvalume "Plus" finish. Form to configuration indicated on the Drawings. Provide gutter straps of 24 gauge Galvalume "Plus", color and finish to match gutter and roof panels. Provide manufacturers standard gutter design.

a. All downspouts from grade to an elevation of 8 feet above grade shall be 18 gauge Galvalume "Plus".

2. Fascia, eave, and rakes shall be 22 gauge Galvalume "Plus" finish on all exposed sides and edges in Galvalume "Plus".

2.4 ROOF SYSTEM ACCESSORIES

A. Trim, and Flashings: Fascia, eave, and rakes shall be 22 gauge Galvalume "Plus" finish on all exposed sides and edges.

B. Sealant: The standard of quality shall be that of a reputable and established sealant manufacturer, approved by the manufacturer of the metal building in which the sealant is used. Sealants shall have good cohesion as well as good adhesion to the protective coated metal and shall not be corrosive to components on which it is applied. Each shall have adequate handling characteristics during normal ranges of construction or erection temperatures. The sealant shall be one that will retain its weather sealing properties under the conditions for which it is used and each (sealant) is recommended for only the applications listed hereafter.

1. Extrudable sealant, non-migratory, nondrying, and non-skinning synthetic elastomer base material conforming to the National Association of Architectural Metal Manufacturer's NAAMM Standard SS-1a-68, and except for the "tack free time", shall conform to the performance requirements of Federal Specification TTC-598-b Type 1. Use at the following locations:

a. Factory applied sealant in longitudinal ribs of standing seam roof panels.
b. Spot sealing laps (where applicable) of standing seam roof panels.
c. Sealing ridge cover and miscellaneous flashing.
d. Sealing curbs for roof accessories.

C. Underlayment: Refer to Section 07412 – Preformed Metal Roofing

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with installation requirements of Section 07412 – Preformed Metal Roofing.

B. Curve panels to radius as indicated on the drawings.

07520 – Modified Bituminous Sheet Roofing

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modified bituminous sheet roofing system.

1.2 SUBMITTALS

A. Product Data:

1. *Manufacturer's technical data, installation instructions and recommendations for each type of roofing product required*
2. *Data substantiating that materials comply with requirements*
3. *Maintenance instructions*

B. Shop Drawings: Include roof outline, dimensions, penetrations, insulation type and thickness, piece layout, parapet size and location, and other information that may affect the suitability and installation of the roofing system.

1. *Calculations for wind load design shall be sealed and signed by a Professional Engineer in the State of Florida verifying compliance with ASCE 7-98*

2. *Submit laboratory test report showing roof assembly compliance with SSTD 12-99.*

C. Copy of draft warranties

D. Pre-Roofing Conference minutes

E. Mock-up

F. Manufacturer's Inspection Reports

G. Final Statement of Compliance: Submit to the Architect, addressed to the School District of Osceola County.

1.3 QUALITY ASSURANCE

A. All SBS membrane systems shall be a multi-layer, homogenous roofing sheet assembly with a granular surfacing on the cap sheet layer. All roofing sheets shall be made with identical SBS blend formulations and manufactured using the same process for sheet construction.

B. Performance Features: All SBS membrane systems shall have the following performance features as a minimum:

1. Each SBS sheet shall be manufactured as an independent waterproofing layer. The independent waterproofing layer design will allow for phased construction between layers.
2. Granule Surfacing: The finish membrane system shall have a factory applied granule surfacing to allow for ease of inspection, maintenance and repair.
3. Detail Treatments: The SBS membrane terminations and associated roof penetrations shall be waterproofed using manufacturer's detail configurations.
4. Underwriter's Laboratories Rated: The SBS membrane system shall be UL rated Class A without the necessity for maintenance oriented coating or surfacings.

C. Roof system shall be designed to meet wind-loading requirements of Florida Building Code, 2001 with 2003 revisions. Refer to structural drawings for wind velocity.

D. Obtain from the roofing manufacturer copies of each roof inspection and furnish a copy to the Architect. Inform the roofing manufacturer, with regard to warranties, that warranties shall be issued, based upon the acceptance of the roofing work, and that deficiencies noted on inspection reports have been corrected. The manufacturer shall not refuse or restrict the provisions of its warranty, based upon deficiencies noted on inspection reports, especially any report that may not have been furnished to the Architect. Inspections shall be weekly. The Architect will not approve final payment of roofing work until final and interim inspection reports and warranty are in hand. The Architect's representative shall accompany the manufacturer's inspector and Roofing Installer during final inspection prior to issuing manufacturer's warranty.

1. The roofing manufacturer's representative shall inspect the roof within one year after the Date of Substantial Completion.

E. Manufacturer's Qualifications: Manufacturer shall have 10 year minimum experience manufacturing SBS roofing similar to that specified.

F. Roofing firm (installer) must have a least 5 years successful experience in the type of roofing system specified.

G. The roofing installer shall have on the job whenever roofing work is being done, a foreman/supervisor with a minimum 3 years experience in the type of roofing specified or the roofing manufacturer's technical field representative.

H. Roofing and associated work shall be performed by a single firm called the "Installer" in this Section, so that there will be undivided responsibility for the specified performance of components.

I. Quality Assurance Program: Provide primary roofing materials manufactured under a quality control/quality assurance program. A certificate of analysis for reporting the tested values of the actual materials being supplied for the project will be required prior to project closeout.

J. Mock-up

1. Mock-up Size: 10 x 10 feet including insulation, surfacing, and typical base and counter flashings specified at location designated.
2. Mock-up may remain as part of the work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and rolls with labels intact and legible. Materials having fire resistance classifications shall be delivered to the Project with labels attached as required. Deliver materials in sufficient quantity to allow continuity of work.

B. Product shall be stored indoors or in protected areas outdoors to providing protection against wetting and moisture absorption. Emulsion shall be stored in temperature above 40 degrees F.

1. Materials stored outdoors shall be on raised platforms and cover top and sides with waterproofed materials properly tied down. Remove wet products from project site.
2. Handle roll goods as to prevent damage to edge or ends.
3. Provide continuous protection of products during delivery, storage, handling, and application.
4. Do not store roofing materials in concentrated areas of roof deck.

1.5 JOB CONDITIONS

A. Pre-roofing Conference

1. Prior to the installation of the roofing and associated work meet at the project site with the installer, the installer of each component of associated work, the installers of deck or substrate construction to receive roofing work, the installers of other work in and around roofing that must follow the roofing work (including Mechanical Work, if any), the Architect and other representatives directly concerned with performance of the work, including (where applicable) insurers, test agencies, product manufacturers, governing authorities, and the Owner. Record the

discussions of the conference and the decisions and agreements (or disagreements) reached and furnish a copy of the record to each party attending. Review foreseeable methods and procedures related to roofing work, including, but not necessarily limited to, the following:

a. Contract Documents
b. Submittals, both completed and yet to be completed
c. Status of substrate work (not by the roofing installer), including drying, structural loading limitations, and similar considerations
d. Availability of materials, tradesmen, equipment, and facilities needed to make progress and avoid delays
e. Required inspection, testing, certifying, and accounting procedures
f. Weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including the possibility of temporary roofing.
g. Regulations concerning code compliance, environmental protection, health, safety, fire, and similar considerations
h. Procedures of protection for roofing through out the construction period
i. Consider each party's extant judgment, as advanced in the interest of successful completion of the work.

B. Weather Condition Limitations

1. Proceed with roofing and associated work only when weather conditions will permit unrestricted use of materials and quality control of the Work being installed, complying with the requirements and with the recommendations of the roofing materials manufacturer.

a. Proceed only when the Installer is willing to guarantee the work as required and without additional reservations and restrictions.

2. Apply in dry weather on a dry deck only. Where rain or inclement weather occur during application, the Work shall stop and not resume until the weather has cleared and the deck is properly dry.

1.6 ROOF MAINTENANCE MANUAL

A. Submit a Roof Maintenance and Inspection Manual with warranties and project closeout submittals. (Final payment will not be made until roof maintenance manual is submitted).

B. Manual shall be bound in a 3 ring binder with name of project, Owner, Architect, and Contractor on front cover.

C. Include the following:

1. *Cover letter recommending that 2 roof maintenance inspections be conducted per year. Also, cover letter shall include instructions directing the Owner to inform (copy) the manufacturer as well as the Roofing Contractor when reporting roofing problems, regardless of when they occurred during the warranty period.*
2. *Table of Contents.*
3. *Visual inspection checklist indicating specific flashings and details to be inspected. Include items such as base flashing seams, reglets and counterflashings, roof edge flashings, roof penetration flashings, roof curb flashings, boot flashings, roof drain areas, parapet wall flashings, copings, roof membrane seams, and skylight flashings. Applicable items shall be listed per project.*
4. *Copies of as-built roofing details.*
5. *Roof plan indicating penetrations, detail locations, roof drains, and seams.*

1.7 WARRANTIES

A. Provide a written guarantee warranting the roof insulation and flashing work, including the installation of products furnished by others and installed under the Section of Work, against defects in materials and workmanship for a period of 2 years from the Date of Substantial Completion.

1. *Guarantee shall include, but not be limited to, roofing, roof insulation, sheet metal flashings and gravel stops, gutters and downspouts, roofing flashing, expansion joints, control joints, and curbs at roof openings.*
2. *Guarantee period shall begin on the Date of Substantial Completion for the project or such date that the roof is accepted by the Architect and Owner, if the date is after the Date of Substantial Completion.*
3. *Manufacturer shall perform annual inspections for the initial three years of warranty.*
4. *Repairs required, either permanent or temporary, to roofing or roof flashings under this guarantee to keep the roof watertight shall be made within 3 days after notice of the need for repairs. Should the Contractor fail to make such repairs within the time period, the Owner may have such repairs made and charge the cost to the Contractor.*

B. In addition to the guarantee above, provide to the Owner a written warranty from the roofing membrane manufacturer, warranting the roofing system membrane, insulation, and flashing against leaks and defects in materials and workmanship for a period of 20 years from the Date of Substantial Completion. This shall be a "No Dollar Limit" type of warranty.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMEN ROOFING SYSTEM

A. Basis of Design: SBS membrane system by Soprema Roofing and Waterproofing, Inc., Wadsworth, Ohio

B. Products of the following manufacturers are acceptable, providing their products and systems equal or exceed the quality and standards specified.

1. *GAF Materials Corporation, Wayne, New Jersey*
2. *Johns Manville, Littleton, Colorado*
3. *Siplast, Irving, Texas*
4. *M.B. Technologies, Fresno, California*

C. Provide SBS membranes to comply with ASTM D 6163, Type I, Grade G

2.2 MATERIALS

A. Base Membrane: Elastophene HD, 120 mils thick, 90 pounds per square with fiberglass reinforcement and fine sand bottom and top surface

B. Cap Membrane: Elastophene FR, 138 mils thick, 91 pounds per square with fiberglass reinforcement mat and embedded ceramic granules on top

C. Asphalt: Type IV hot steep asphalt, ASTM D-312-IV

D. Base Flashing: Sopralene 180 Flam, 118 mils thick, non-woven polyester

E. Cap Flashing: Sopralast 50 TV Aluminum

F. Walkway Pads: Mineral-granule-surfaced, slip-resisting pads, acceptable to roofing system manufacturer

G. Miscellaneous Materials:

1. *Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing membrane.*
2. *Provide fasteners, primers, sealants, and other miscellaneous materials as approved by the manufacturer.*

PART 3 - EXECUTION

3.1 INSTALLATION

A. All materials shall be installed by "mopping-in" with hot asphalt as specified, except cap ply flashing may be torched.

B. Install the modified bitumen membrane in strict accordance with the manufacturer's written instructions. Application temperature of asphalt shall be EVT (+ or -) 25 degrees F. for proper adherence.

1. Minimum Application Temperature: 425 degrees F.

C. Install flashing and expansion joints in strict accordance with the manufacturer's written instruction. Flashing requirements include, but not limited to, curbs and walls, stacks, vents, and other roof protrusions.

D. Miscellaneous Materials: Install fasteners, primers, solvents, sealants, and other materials in accordance with the membrane manufacturer's written instructions.

E. Install base and ply sheets in solid mopping of asphalt at the rate of 20-25 pounds per 100 square feet, side and end laps without fishmouths or wrinkles.

F. Install cap membrane in solid mopping of asphalt at the rate of 20-25 pounds per 100 square feet, with side and end laps, staggered between plies.

G. Flashing sheet shall be installed to flash up and over the top of all parapet walls, no exceptions.

H. Pedestrian Walkway Traffic Pad:

1. *Install a 1 1/2 roll width of cap sheet around roof top mechanical equipment and as shown on the Drawings*
2. *Install a 10 inch square of walkway pad under each conduit/piping support*
3. *Install using notched trowel with recommended cement to a minimum 3/8" thick*

3.2 GENERAL INSTALLATION PROVISIONS

A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Recheck measurements and dimensions, before starting each installation.

F. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

G. All new materials shall be sealed from moisture intrusion at the end of each day. Phased construction is not allowed.

3.2 CLEAN-UP

A. Remove masking, protection, equipment, materials, and debris from the work and storage areas and leave areas in an undamaged and acceptable condition.

3.3 MANUFACTURER'S INSPECTION

A. Upon completion of the work and prior to final payment, the membrane manufacturer's representative, in the presence of the Owner and Architect, shall inspect roofing work. Discrepancies shall be recorded and immediately rectified. Final payment will not be issued until the manufacturer's representative has given his/her approval for roofing work.

07534 – Mechanically Attached Flexible Sheet Roofing

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes mechanically attached flexible sheet roofing system.

1.2 SUBMITTALS

A. Product Data:

1. *Manufacturer's technical data, installation instructions and recommendations for each type of roofing product required*
2. *Data substantiating that materials comply with requirements*
3. *Maintenance instructions*

B. Shop Drawings: Include roof outline, dimensions, penetrations, insulation type and thickness, piece layout, parapet size and location, and other information that may affect the suitability and installation of the roofing system.

1. *Calculations for wind load design shall be sealed and signed by a Professional Engineer in the State of Florida verifying compliance with ASCE 7-98*
2. *Submit laboratory test report showing roof assembly compliance with SSTD 12-99.*

C. Copy of draft warranties

D. Pre-Roofing Conference minutes

E. Mock-up

F. Manufacturer's Inspection Reports

Final Statement of Compliance: Submit to the Architect, addressed to the School District of Osceola County.

1.3 QUALITY ASSURANCE

A. The Roofing Contractor shall obtain from the roofing manufacturer copies of each roof inspection and furnish a copy to the Architect. The Contractor shall inform the roofing manufacturer, with regard to warranties, that warranties shall be issued, based upon the acceptance of the roofing work, and that deficiencies noted on inspection reports have been corrected. The manufacturer shall not refuse or restrict the provisions of its warranty, based upon deficiencies noted on inspection reports, especially any report that may not have been furnished to the Architect. Inspections shall be weekly. The Architect will not approve final payment of roofing work until final and interim inspection reports and warranty are in hand. The Architect's representative shall accompany the manufacturer's inspector and Roofing Installer during final inspection prior to issuing manufacturer's warranty.

1. The roofing manufacturer's representative shall inspect the roof within one year after the Date of Substantial Completion.

B. Roofing firm (installer) must have a least 5 years successful experience in the type of roofing system specified.

C. A foreman/supervisor with a minimum 3 years experience in the type of roofing specified or the roofing manufacturer's technical field representative shall be present at all times when roofing work is being preformed.

D. Roofing and associated work shall be performed by a single firm called the "Installer" in this Section, so that there will be undivided responsibility for the specified performance of components parts including, but not limited to, the following (even though some parts may be subcontracted to others):

1. Insulation and saddles, Section 07220.
2. Metal flashing and counterflashing in connection with roofing, Section 07600.
3. Prefabricated metal reglets, Section 07600.
4. Provide wood insulation stops, wood nailers, and blocking required for installation of new roof and sheet metal in conformance with requirements of Section 06100.

E. The wind load design shall be based upon the requirements of the Florida Building Code, 2001 revision 2003. Refer to the Structural Drawings for wind Velocity.

F. All roofing materials shall be labeled Class A per ASTM E 108 and shall be certified by a nationally recognized independent testing laboratory.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and rolls with labels intact and legible. Materials having fire resistance classifications shall be delivered to the Project with labels attached as required. Deliver materials in sufficient quantity to allow continuity of work.

B. Product shall be stored indoors or in properly protected areas outdoors to provide continuous protection against wetting and moisture absorption. Emulsion shall be stored in temperature above 40 degrees F.

1. Materials stored outdoors shall be on raised platforms and cover top and sides with waterproofed materials properly tied down. Remove wet products from project site.
2. Handle roll goods as to prevent damage to edge or ends.
3. Provide continuous protection of products during delivery, storage, handling, and application.
4. Do not store roofing materials in concentrated areas of roof deck.

1.5 JOB CONDITIONS

A. Preroofing Conference

1. Prior to the installation of the roofing and associated work meet at the project site with the installer, the installer of each component of associated work, the installers of deck or substrate construction to receive roofing work, the installers of other work in and around roofing that must follow the roofing work (including Mechanical Work, if any), the Architect and other representatives directly concerned with performance of the work, including (where applicable) insurers, test agencies, product manufacturers, governing authorities, and the Owner. Record (by Contractor) the discussions of the conference and the decisions and agreements (or disagreements) reached and furnish a copy of the record to each party attending. Review foreseeable methods and procedures related to roofing work, including, but not necessarily limited to, the following:

a. Review project requirements (Drawings, Specifications and other Contract Documents).
b. Review required submittals, both completed and yet to be completed.
c. Review status of substrate work (not by the roofing installer), including drying, structural loading limitations, and similar considerations.
d. Review availability of materials, tradesmen, equipment, and facilities needed to make progress and avoid delays.

e. Review required inspection, testing, certifying, and accounting procedures.

f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including the possibility of temporary roofing.

g. Review regulations concerning code compliance, environmental protection, health, safety, fire, and similar considerations.

h. Review procedures needed for protection of roofing during the remainder of the construction period.

i. Consider each party's extant judgment, as advanced in the interest of successful completion of the work.

B. Weather Condition Limitations

1. Proceed with roofing and associated work only when weather conditions will permit unrestricted use of materials and quality control of the Work being installed, complying with the requirements and with the recommendations of the roofing materials manufacturer.

a. Proceed only when the Installer is willing to guarantee the work as required and without additional reservations and restrictions.

2. Apply in dry weather on a dry deck only. Where rain or inclement weather occur during application, the Work shall stop and not resume until the weather has cleared and the deck is properly dry.

1.6 ROOF MAINTENANCE MANUAL

A. Roofing membrane manufacturer shall submit a Roof Maintenance and Inspection Manual with warranties and project closeout submittals. (Final payment will not be made until roof maintenance manual is submitted).

B. Roof Maintenance and Inspection Manual shall be bound in a 3 ring binder with name of project, Owner, Architect, and Contractor on front cover.

C. Roof Maintenance and Inspection Manual shall include:

1. Cover letter recommending to the Owner that 2 roof maintenance inspections should be conducted per year.

2. Table of Contents.

3. *Visual inspection checklist indicating specific flashings and details to be inspected. Include items such as base flashing seams, reglets and counterflashings, roof edge flashings, roof penetration flashings, roof curb flashings, boot flashings, roof drain areas, parapet wall flashings, copings, roof membrane seams, skylight flashings, etc. Applicable items shall be listed per project.*
4. *Copies of as-built roofing details.*
5. *Roof plan indicating penetrations, detail locations, roof drains, and seams.*

1.7 WARRANTIES

A. *Furnish a written guarantee warranting the roofing insulation and flashing work, including the installation of products furnished by others and installed under this Section of the Work, against defects in materials and workmanship for a period of 2 years from Date of Substantial Completion.*

1. *Guarantee shall include, but not be limited to, roofing, roof insulation, sheet metal flashings and gravel stops, gutters and downspouts, flexible flashings, expansion joints, control joints, and curbs at roof openings.*
2. *Guarantee period shall be gin on the date of Substantial Completion for the Project or such date that the roof is accepted by the Architect and Owner, if the date is after the date of Substantial Completion.*
3. *Repairs required, either permanent or temporary, to roofing or roof flashings under this guarantee to keep the roof watertight shall be made within 3 days after notice of the need for repairs. Should the Contractor fail to make such repairs within the time period, the Owner may have such repairs made and charge the cost to the Contractor.*

B. *In addition to the guarantee above, provide to the Owner a written warranty from the roofing membrane manufacturer, warranting the roofing system membrane, insulation, flashing, walkways, and expansion joint covers against leaks and defects in materials and workmanship for a period of 10 years from the Date of Substantial Completion.*

PART 2 - PRODUCTS

2.1 FLEXIBLE SHEET ROOFING SYSTEM

A. *Refer to Section (07220) for the description of the roof deck insulation and substrates.*
B. *Basis of Specification: Flexible sheet roofing system indicated is based on products and installation details as manufactured by Seaman Corp., "FiberTite EIP".*

C. Products of the following manufacturers are also acceptable:

1. Flex International Membrane, Morgantown, PA
2. Sarnafil S327 by Sarnafil Inc., Canton, Mass.

2.2 ROOFING MEMBRANE

A. Roofing membrane shall be an ethylene interpolymer (EIP) alloy, reinforced with knitted polyester fabric conforming to the following physical properties:

MATERIAL PROPERTY	***TEST METHODS (UNITS)***	***PRODUCT DATA***
Thickness Minimum	*ASTM D-751 (inches)*	*.045*
Tensile	*ASTM D-751 (lbs.)*	*375 X 350*
Strength	*ASTM D-882 (psi)*	*8500*
Elongation	*ASTM D-751 (%)*	*20 warp X 30 fill*
Tear Strength 8"X10" Sample	*ASTM D-751 (lbs.)*	*100*
Puncture Resistance	*Fed.Std. 101B Method 2031 (lbs.)*	*250*
Water Vapor Transmission	*ASTM E-96 Proc. A (gm/m2/24 hours)*	*1.3*
Water Absorptic 14 days @ 70°F Maximum	*ASTM D-471 (%)*	*1*
Dimensional Stability	*ASTM D-1204 (%)*	*0.5*
Low Temperature Flexibility	*ASTM D-2136 (F)*	*-30*
Factory Seam Strength	*ASTM D-751, Grab Method (% of Fabric Strength)*	*100*
Shore "A" Hardness	*ASTM D-2240*	*80*
Accelerated Weathering	*Carbon Arc with water spray*	*5,000 hrs.- no cracking, blistering, or crazing*
Hydrostatic Resistance	*ASTM D-751 Method A. Proc. 1 (psi)*	*500*
Wicking Test Maximum	*U.S. Army Natick Test (inches)*	*1/8"*
Flame Resistance	*Mil-C-20696C Type II Class 2*	*Pass*

MATERIAL PROPERTY	*TEST METHODS (UNITS)*	*PRODUCT DATA*
Oil Resistance	*Mil-20696C*	*No swelling, cracking, or leaking*
Hydrocarbon Resistance	*Mil-C-20696C*	*No swelling, cracking, or leaking*

1. *Exposed Face Color: White or cream.*
2. *Reinforcing Scrim: Polyester, nylon, fiberglass.*
3. *Membrane shall be manufactured with Dupont Evaloy Kee resin modifiers by Dupont Company, Wilmington, Delaware.*
4. *Membrane shall be U.L. Class A Rated.*

2.3 FASTENING DEVICES

A. Membrane attachment shall utilize 2 inch barbed round, hot dipped, galvanized stress plate (Part No. 300). Membrane fastener shall be as listed within manufacturers approved fastener list.

B. Any deviation from the manufacturers approved fastener list shall require written approval from Technical Service Department.

2.4 ACCRESSORIES

A. Sealants, Mastics, and Solvents: As supplied or approved by the manufacturer. All sealants, mastics and solvents shall be listed on the Submittal Form. A short description of its use shall also be included.

B. Roof Walkway Materials: Walkways/protection boards shall be as furnished or approved by the Seaman Corporation, FiberTite Division. Contact Fibertite technical department for installation instructions.

C. Expansion Joints: Expansion joints shall be flashed with EIP membrane or prefabricated from neoprene, factory bonded to 26 gauge hot dipped G-90 galvanized or 20 oz.. copper metal flashing.

D. Overnight Seal: Maintain a watertight seal during any interruption of roof construction or at the end of each day. Phased construction may not be allowed.

PART 3 - EXECUTION

3.1 INSPECTION OF SURFACES

A. Inspect roof deck surface as to suitability for roofing. Do not proceed with roofing work until unsatisfactory conditions have been corrected.

B. Examine surfaces for inadequate anchorage, low areas that will not drain properly, foreign material, ice, wet insulation, and unevenness or any other defect which would prevent the execution and quality of application of the membrane roofing as specified.

C. Clean all exposed metal surfaces such as pipes, pipe sleeves, drains, duct work, pitch pockets, etc., by removing loose paint, rust and any asphalt or coal tar pitch of any kind. Remove and discard lead sleeves at soil stacks.

3.2 INSTALLATION OF WOOD NAILERS

A. Install treated lumber at the same heights as insulation layer. Wood nailers are to be installed at all perimeters.

B. Nailers shall be installed and anchored in such a manner to resist a force of 75 lb. per linear foot in any direction.

C. Nailers around curbs and expansion joints are required.

3.3 INSTALLATION OF FLEXIBLE SHEET MEMBRANE

A. Quality Control

1. *Initiate a QC program to govern all aspects of the installation of the roofing system.*
2. *Appoint a representative for the daily execution of the QC program which will include but is not limited to the inspection and probing of all heat welding incorporated within the system.*
3. *If inconsistencies in the quality of the welds are found, all work shall cease until corrective actions are taken to insure the continuity of all field and detail welding.*
4. *Installation shall follow approved Shop Drawings and manufacturer's published installation instructions.*

B. Paneled Rolls

1. *10 ft., 15 ft., and 20 ft., wide rolls shall be installed snug, but not taut, utilizing chalk lines, and maintaining (good lay flat) characteristics.*
2. *Adjoining rolls shall overlap the fastened edge a minimum of 4 1/2 inc. maintaining proper roll staggering as to avoid back water seams.*
3. *Stagger the factory welds so that each weld falls equal distance between the factory welds on adjacent rolls.*

C. Non Paneled Rolls

1. When job conditions necessitate the utilization of roll roofing application procedures, follow all standard Manufacturers Written Installation Specifications, in addition to the following:

a. Install rolls so that rolls overlap 5" to the back line of the underlying, adjacent roll.
b. Stagger the rolls so that the tails, or roll ends do not line up.

D. Perimeter Sheets

1. A minimum of two perimeter sheets shall be installed, paralleled to all exterior roof perimeters, including parapet walls, expansion joints and other changes in the plane of the deck.
2. Install perimeter sheets square to chalk lines with proper staggering to avoid back water seams.
3. Adjoining rolls shall overlap the fastened edge a minimum of 4 1/2" maintaining proper staggering to avoid back water seams.
4. Additional perimeter sheets may be required at roof perimeters, with a minimum of 24" above the plain of the deck. Consult the Manufacturer for additional perimeter fastening data.

E. Perform pullout testing on all desks not approved by Factory Mutual for mechanical attachment.

1. Attach panels wit patterns established or compliance with ASCE 7.

F. Welding

1. All field seams exceeding 10 ft. in length shall be welded with an approved automatic welder.
2. All field seams must be clean and dry prior to initiating any field welding.
3. Remove foreign materials from the seams (dirt, oil, etc.,) with Acetone, MEK, or approved alternative. Use Clean cotton cloths and allow approximately five minutes for solvents to dissipate before initiating the automatic welder. do not use denim or synthetic rags for cleaning.
4. All welding shall be performed only by qualified personnel to ensure the continuity of the weld.
5. All finished seams shall exhibit a homogeneous bond a minimum of 1 1/2" in width.

G. Inspection

1. *Initiate daily inspections of all completed work which shall include, but is not limited to the probing of all field welding with a dull pointed instrument to assure the quality of the application and insure that any equipment or operator deficiencies are immediately resolved.*
2. *Insure that all aspects of the installation (sheet layout, attachment, welding, flashing details, etc.) are in strict conformance with the most current Manufacturers Specifications and Details*
3. *Excessive patching of field seams because of inexperienced or poor workmanship will not be accepted at time of Final Inspection for Warranty.*
4. *Any deviation from Manufacturers Specifications or details requires written approval from the manufacturer prior to application to avoid any warranty disqualifications.*

3.4 FLASHING

A. Clean all vents, pipes, conduits, tubes, walls, and stacks to bare metal. All protrusions must be properly secured to the roof deck with approved fasteners. Remove and discard all lead, pipe and drain flashings. Flash all penetrations according to approved details.

B. Remove all cant strips and loose wall flashings.

C. Flash all curbs, parapets and interior walls in strict accordance with approved details.

D. All flashing shall be totally adhered to approved substrate with FTR #201 mastic applied in sufficient quantity to insure total adhesion.

E. The base flange of all membrane flashing shall extend out on to the plane of the deck, beyond the wood nailer to a maximum width of 8".

F. Vertical flashing shall be terminated no less than 8" above the plane of the deck with approved termination bar or metal cap flashing.

G. Vertical wall flashings terminations shall not exceed 30" without additional, parallel horizontal rows of termination bar between the deck and the termination point of the flashing. Spacing between horizontal rows shall not exceed 24".

H. Complete all inside and outside corner details with membrane as recommended by the manufacturer.

I. Probe all seams with a dull, pointed probe to insure the weld has created a homogeneous bond.

3.5 CORNERS

A. All inside/outside corners shall be installed in strict accordance with details for a complete watertight installation. Non-reinforced membrane, either field fabrication sheets or pre-sized inside/outside corners shall be used.

3.6 PENETRATION ACCESSORIES

A. Install penetration accessories in strict accordance with approved details. Insure penetration accessories have not impeded in any way the working specification of the penetration. (Refer to the related trade for the technical specification).

3.7 FLASHING (METAL)

A. All perimeter edge details are to be fabricated from clad metal or an approved two piece locking system.

B. Insure all fascias are 2" lower than the bottom of the wood nailers.

C. Fasten all metal flashing to wood nailers or approved substrates with approved fasteners 8" O.C.

D. Break and install clad metal in strict accordance with approved details, insuring proper attachment, maintaining 1/2" expansion joints.

E. Solidly weld clad expansion joints with a 5" strip of membrane welded to clad metal (Cover Plates).

3.8 ROOF DRAINS

A. Flash all roof drains in strict accordance with manufacturers roof drain details - Replate all worn parts that may cut the membrane or prevent a watertight seal. Replace all drain bolts or clamps holding the drain compression ring to the drain basin. Unreinforced 60 mil membrane or lead sheet may be used as drain flashing. Lead shall be set in mastic. Lead sheets and drain basins must be free of any asphalt or coal tar pitch residue prior to installation.

3.9 EXPANSION JOINTS

A. Flash all expansion joints in strict accordance with approved details. Fasten all expansion joint material according to specifications. Insure the expansion material has sufficient material to expand to the widest point in expansion without causing undue stress on the expansion joint material.

B. If the expansion joint is a "factory system" insure installation instruction and warranties have been submitted.

3.10 TEMPORARY SEALS

A. At the sign or rain, install temporary watertight seal where the exposed edge of the completed new roofing terminates at the uncovered deck or existing roof surface. If the old roof surface is covered with slag; spud back an area 6" from where the membrane will be sealed to the deck. Use a sufficient size strip of membrane or tape to bridge the new membrane and the roof deck. If using membrane, the strip must be welded to the new roofing membrane and cemented to the cleaned roof deck.

B. Prior to the commencement of work, remove all temporary seals if they will cause a water dam and any exposed roof cement if used. Do Not Track Roof Cements Onto The Roof Membrane.

C. All new materials shall be sealed from moisture intrusion at the end of each day. Phased construction is not allowed.

3.11 INSTALLATION OF WALKWAY PADS

A. Consult manufacturer for walkway installation procedures.

3.12 CLEAN-UP

A. Remove masking, protection, equipment, materials, and debris from the work and storage areas and leave areas in an undamaged and acceptable condition.

3.13 MANUFACTURER'S INSPECTION

A. Upon completion of the Work and prior to final payment, the membrane manufacture's representative, in the presence of the Owner, Architect, and Construction Manager shall inspect the Work. Discrepancies shall be recorded and immediately rectified. Final payment will not be issued until the manufacturer's representative has give his approval for the Work.

3.14 TECHNICIANS TRAINING

A. Prior to the Date of Substantial Completion, hold a training secession for the Owners Roofing Technicians to certify them to perform warranty repairs and modifications for subsequent penetrations.

07536 - Roofing “Special Treatment”

Architect/Engineers General Terms and Conditions for roofing is included in Appendix L.

07631 - Gutters and Downspouts

Where gutters and downspouts are used, the hangers, straps and shoes should be completely detailed and/or described. Gutters and downspouts should be held 1” from the building wall to allow air to circulate between gutter/downspout and wall surface.

07900 - Joint Sealants

Specify that this work be done by experienced mechanics. Ensure the highest quality of sealants be used for each individual application. There is no substitute for life-cycle costs in a sealant product. All sealants shall have a minimum of 15 years manufacturers warranty or ASTM C920 or latest edition.

SECTION THREE
DIVISION 8 - DOORS & WINDOWS

08110 - Requirements for Fire Rated Glazing
Compliant with FBC, 2004 Edition

60 Minute Walls :

- 20 Minute Rated Doors
- Safety Glazing, Category II
- Wireless
- Individually labeled for Safety and Fire Rating
- Glazing Exempt from Hose Stream Endurance testing
- Basis-of-Design, TGP's Fireglass 20

- 45 Minute Rated Borrowed Lites
- Sidelites, Transoms, individually "Punched Openings"
- Safety Glazing, Category II, all locations
- Individually labeled for Safety and Fire Rating
- MUST have Hose Stream Endurance Testing
- ¾" Laminated low-iron glass w/intumescent
- Basis-of-Design, TGP's Pyrostop

120 Minute Walls :

- 90 Minute Rated Doors and Borrowed Lites
- Safety Glazing, Category II
- Wireless
- Individually Labeled for Safety and Fire Rating
- MUST have Hose Stream Endurance Testing
- Basis-of-Design, TGP's Firelite Plus

Fire Rated Framing :

- Must not exceed 120 Square Feet in surface area
- No lineal greater than 144" in length
- Exceptions only "as tested."

08111 - Standard Steel Doors and Frames

Where hollow metal doors and frames are used, the reinforcing of frames for hardware should be completely described. Reinforcement of frames for the butts is generally too light, e.g., 10 gauge flat plate does not have sufficient stiffness to resist the load on the top butt. A light angle is desirable. Where two doors swing from the same mullion, the metal should be of heavier material and reinforced.

Use 16 gauge steel frames for door widths up to 2'-6"; 14 gauge frames if over 2'-6" and floor hinges on extra wide door as a minimum requirement. For simplification, all frames specified may be of 14 gauge. *All exterior door frames (exposed to the elements) shall be hot dip galvanized.*

All doors used as mean of egress (to include corridors) that require vision panels shall have wire or other approved glass panels installed to meet NFPA 80 (latest edition) requirements. *All exterior doors (exposed to the elements) shall be hot dip galvanized.*

If fume hoods or other large equipment occurs in a room, size width of the doors to provide adequate clearance for moving the items in or out. If size is questionable, use large size opening.

All exterior doors should be insulated metal doors with adequate weather stripping utilized to conserve energy. If glass is used, the glass should be thermal/safety glass, and non-reflective.

All operable items on exterior doors shall have an integral finish - not applied, painted, baked on, etc.

At least one main entry door shall be accessible from adjacent sidewalks by wheelchair and shall display the proper handicapped signage. All other entry doors shall have proper signage to direct wheelchair handicapped persons. In addition, the current ANSI standards shall apply as to raised letter signage for the blind. Automatic door opening for the handicapped is preferred. All shall conform to required Accessibility Codes and ADA.

Exterior doors shall be of "monumental" quality unless determined otherwise, each leaf 3'-0" wide X 7'-0" high for 32 inches clear opening.

08210 - Wood Doors

All corridor doors and doors to closets shall be 1 3/4" solid core to meet requirements of NFPA "80" and "101" and to enable the District to use standard locksets i.e., where cutouts for closures are required, the head rail should be not less than 6 inches. If hardwood edges are desired, they should be completely specified with the thickness given. Wood doors shall meet the Standards of the National Woodwork Manufacturers Association.

All doors used as means of egress (to include corridors) that require vision panels shall have wire or the approved glass panels installed to meet NFPA 80 (latest edition) requirements.

Seven foot high doors should be used as a standard rather than 6'-8".

Wood door quality should be specifically called for as well as manufacturer. For example, the term "equal to Mengel" is not sufficient.

To prevent the flexing and breaking of the wall along the door frames, a nest of studs shall be provided around each door installation to accommodate the weight of the door and the shock caused by the closing of the door. The finished wall shall extend into the door frame throat opening a minimum of 1 1/2" for wrap-around frames.

Interior doors will be 3'-0" X 7'-0" solid or solid core. Classroom doors shall have wired glass view panels set in steel framing or stops according to code.

All doorways shall be numbered. Numbering shall be placed either at the upper level of door jam or at the latch side of door opening. All signage must be in accordance with ADA requirements.

08213 - Plastic Faced Wood Doors

Facing and Adhesives

Plastic laminate shall conform to NEMA LD-3 and adhesives for both exterior and interior shall conform to ANSI-NWMA-1.S.1.

08500 - Metal Windows

General

Consideration should be given to the provision of operable windows as a means of ventilation in the event air-conditioning equipment is not in operation. Consideration should also be given to the use of double panes (thermopane) with outer shield of solar glass especially if window area exceeds 3% of wall area. Glass should be installed so it can be cleaned from the inside of the building. Operable windows shall be provided with positive locking dances.

Consideration shall be given to all metal windows having dual pane glass and thermal break-insulation filled frames.

All classroom windows, unless otherwise advised by the District Project Manager, shall be equipped with audiovisual blinds or acceptable window coverings.

Guardrails will be necessary at all full height glass panels in accordance with applicable codes.

08700 - Finish Hardware

General

Builders hardware is hereby defined to include all items known commercially as builders hardware, required for proper operation of swing and sliding doors, except special type of unique hardware specified in the same section as the door and door frame.

This section is a design guideline intended as a general guideline for the entire Division 08700. Any statements in this section shall have precedent over any statements in the attached "suggested" specification divisions.

Quality Assurance

Acceptable Designs: PART 2 -PRODUCTS section indicates products which are of acceptable design for primary exposure, such as lock sets. Do not change the selection of products, except with Architect/Engineer's acceptance.

Acceptable Manufacturers: PART 2 -PRODUCTS section indicates acceptable manufacturers for the primary items of builder's hardware. Manufacturer's products which comply with the indicated requirements are acceptable for other items.

Manufacturer: Insofar as possible obtain each kind of hardware from only one manufacturer, even though several may be indicated as acceptable manufacturers.

Supplier: A recognized builder's hardware supplier who has been furnishing hardware in the same area of the project for a period of not less than two years~ and ~ho is, or has in employment, an experienced hardware consultant who IS available at reasonable times during the course of the work for project hardware consultation to the Owner, Architect/Engineer and Contractor.

Americans with Disabilities Act (ADA):

Doors to hazardous areas, i.e. electrical rooms, mechanical room, storage rooms, and doors to mechanical equipment mezzanines shall have hardware complying with tactile warnings. Doors with closers shall comply with ADA requirements for door closers.

Submittals

Manufacturer's Data: Submit manufacturer's product data in accordance with SECTION 01300-SUBMITTALS. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and exposed finishes. Wherever needed, furnish templates to fabricators of other work which is to receive finish hardware.

Hardware Schedule: Submit copies of the hardware schedule for approval. Schedule format shall be similar to the one included at the end of this section. The hardware schedule shall be prepared by a certified AHC (Architectural Hardware Consultant)

Product Handling

Marking of all pieces of hardware with schedule item (or code numbers), is the responsibility of the supplier. As material is received by the hardware supplier from the various manufacturers, sort and repackage in containers marked with the hardware item number.

Job Conditions

Coordination: Coordinate hardware with other work. Contact SDOC Maintenance and local hardware representative at commencement of installation for verification and consultation regarding proper templating and installation of all hardware. Tag each item or package separately, with identification related to the final hardware schedule, and include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function. Deliver individually packaged hardware items at the proper times to the proper locations for installation.

Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check the shop drawings of other work to confirm that adequate provisions are made for the proper installation of hardware.

Products

Materials and Fabrication

Hand of Door: The drawings show the direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of the door movement as shown.

Fasteners: Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specified.

Except as otherwise indicated. Furnish exposed screws to match the hardware finish or, if exposed in surfaces of other work, match the finish of other work as closely as possible, including prepared surfaces to receive paint.

Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners. Use sex bolts for installation where the bolt head or the nut on the opposite face is exposed in other work, all wood doors must be sex bolted.

Tools for Maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance, and removal of builder's hardware.

Butt Hinges

Hinges shall be sized as follows: 4½ x 4½ for all doors. Provide 4 each (2 pair) heavy duty ball bearing hinges for each door leaf over 36"wide. These shall be used in lieu of those listed in the hardware sets.

*All reverse bevel exterior which are specified with keyed locks shall be furnished with safety studs for security ("NRP" not acceptable). Approved manufacturers are: * **IVES**, Stanley, Hager and McKinney.*

Locks, Cylinders, and Keying

General: Coordinate with Owner to incorporate owners established Corbin Russwin keyway. Provide Construction Master Key feature for General Contractor who will be responsible for turning system over from Construction Key to School District's permanent key system. All keys shall be factory cut and all key bows factory stamped with "Do Not Duplicate". Coordinate with School District for labeling of keys and their assigned location in key control cabinet.

Locksets shall be BHMNANSI 156.13 Grade 1 for all functions listed in hardware sets.
Locks shall be Corbin Russwin ML2200 series mortise locks, Newport with NSA trim.
Interior locks may be Corbin Russwin CL3300 lever lock sets. NO SUBSTITUTIONS.

Exit Devices

Furnish types and functions listed in the hardware sets as manufactured Corbin Russwin ED 5000 series, or Von Duprin 98 series. ***For exterior doors exposed to the weather (courtyard) *Monarch F-18-R-EO 32D), (see attached sample hardware schedule for exposed exterior doors).***

Electronic Locks

All electronic card access readers (CAC) must be LonWorks Compliant.

Closers and Door Control Devices

Door closers shall be BHMA standard CO2021 or CO2011 (PT 4B). Approved Manufacturers are Russwin/Corbin (DC 6200 Series) or LCN (4110 Series). NO SUBSTITUTIONS. ***For exterior doors exposed to the weather (courtyard)* LCN 4110 SCUSH-SRI or equal (see attached sample hardware schedule for exposed exterior doors).***

Reverse bevel doors shall have parallel arm mount.

*Closers for metal doors shall be **drilled and tapped for machine screw mounting**. Closers for wood doors shall **be sex-bolt** mounted.*

Door Stops

Door stops shall be as manufactured by Ives, Baldwin, Quality, Rockwood or Trimco.

Stops shall be 406'/2 32-D.
Door holders shall be 455 B 26-D.

On exterior and interior "paired" doors opening into corridor and or to exterior of building shall swing 180° (or maximum allowable by space) and shall not have an overhead door stop. This is owing to damage being sustained in current schools with such. If a location is questionable please contact your SDOC Project Manager.

****For exterior doors exposed to the weather (courtyard) Gylnn-Johnson GJ90-US32D (see attached sample hardware schedule for exposed exterior doors).***

Flush Bolts

Flush Bolts shall be Type L24082-12" x L24011 Strike. Approved manufacturers are: Rockwood, or Baldwin.

Plates – Push, Pull, and Kick

Push plates shall be type J301., 0.51 thick stainless steel, size 8" x 16".

Pull plates shall be type J405 with cast pull mounted on a .051 thick stainless steel plate, size 4" x 16". Pull shall be a minimum of 7Y2" center to center.

Kick plates shall be J102, .051 stainless steel, 8" x 2" LDW for single doors, and 1" LDW for pairs of doors and double acting doors unless noted otherwise. Kick plates for all handicapped (HC) classrooms shall be 18" X 2" LDW for single doors and 18" X 1" LDW for pairs of doors.
Use only stainless steel screws in areas exposed to the weather.
Weather Stripping and Thresholds

For exterior doors, provide thresholds and weather stripping as listed in the hardware sets. Equivalent products, in function appearance and quality as manufactured by Pemko, Reese, National Guard or Zero will be approved. Pemko 2005A V ANSI 117.1 approved for basis of bidding.

- Pemko Rain Drip 346A at exterior openings without cover

Astragals and Meeting Stiles

Where called for in hardware sets, astragals shall be type specified, ANEMOSTAT.

Meeting stiles shall be Type 804A as manufactured by Reese. Types 309AW by Pemko and 185AP by National Guard are approved.

Finishes

All exposed hardware shall be US26D (626) or US32D (630) except door closers which shall be finished with the manufacturer's standard aluminum paint (689). 2.13 SILENCERS:

Door silencers shall be L03011 for metal frames.

Use 3 per single door and 2 per leaf for pairs of doors.

Key Cabinet

Coordinate with the Owner for the organization, setup and installation of the cabinet. A complete cross index Key Control System shall be furnished for the full capacity of the locks and cylinders of this section and 50% excess. Provide index folder, loose-leaf sets of index cards upon which alphabetical, hook numerical, core, master, grand master and change key numerical information may be listed separately. A permanent record system shall be provided to enable the user to record requisitions for the c release of each individual key and list borrower's names, amounts of key deposit, dates of issue and return, plus other pertinent data. These forms shall be furnished in a quantity for transactions three times the hook capacity of the system or quantity as otherwise specified.

Execution

Installation

Consult with the School District prior to and/or during installation of any hardware, to determine certain particulars that may cause problems or be rejected at time of walk down. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware" by the Door and Hardware Institute (DHI), except as otherwise specifically indicated or required to comply with governing regulations, and except as may be otherwise indicated on the drawings. Center of all locksets, or opening devices, push, and pull plates shall be 34" AFF.

Install each hardware item in compliance with the manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

Drill and countersink units which are not factory-prepared for anchorage fasteners.

Space fasteners and anchors in accordance with industry standards.

At exterior doors, and elsewhere as indicated, set thresholds in abed of butyl rubber sealant or polyisobutylene mastic sealant to completely fill concealed voids and exclude moisture. Do not plug drainage holes or block weeps. Remove excess \ sealant.

Adjust and Clean

Adjust and check each operating item of hardware and each door, to ensure proper operation and function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

Instruct School District's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

School District Keying Procedures and Standards

All Keying schedules are to be reviewed and approved by the State Russwin/Corbin Representative prior to ordering of and installation of all locking hardware!

*Keying Scheme Abbreviations: GGM-County Great Grand Master, GM-Grand Master/School Master, M-Master/Building Master, CK-Change Key/Room Key, MECH-All Mechanical Rooms, **KGGM**-Kitchen **Great** Grand Master(all kitchens), K**G**M-Individual Kitchen Master.*

*A. Schools to be keyed under the S**D**OC GGM System*
B. All locks to have Russwin 6pin D or H series cylinders/cores. To be determined by SDOC.
C. Schools to be keyed to a master key(GM) Russwin to determine. Each building will have individual master (M) and a (CK) change key.
D. Mechanical Rooms need to be keyed to the (GGM,GM) and the county issued (MECH) mechanical key.
*E. The kitchen needs to keyed separate from the school master. The kitchen needs to be keyed under **SDOC GGM, KGGM KGM** Russwin to determine. Back door key needs to have (CK) change key for deliveries.*
*F. **8**-(M) building masters are required.*
G. 12-(GM) are required.
*H. **5**-(CK) per lockset.*
I. No (GGM or KGM) keys are to be cut or issued.
J. All IDF/MDF rooms are to be keyed to GGM,GM,and MECH.
K. All gate locks shall be interchangeable core padlocks.
L. All Gates Keyed GGM, GM, MECH, & CK – Qty of 50 Change Key's
M. 200 Extra blanks – stamped "Do Not Duplicate" required.
*N. 2 copies of **bitting** list supplied to SDOC Maintenance Department.*

REQUIRED HARDWARE SETS FOR EXPOSED EXTERIOR DOORS

OSCEOLA SCHOOLS HARDWARE GROUPS

Hardware Group No. EXTERIOR OPENING WITH HANDICAP OPERATOR
Provide each PR door(s) with the following:

Quantity		Description	Model Number	Finish	Mfgr
6	EA	HINGE	BB1199 4-1/2 X 4-1/2 NRP	630	HAG
1	EA	MULLION	KR9954 X 154	689	VON
1	EA	PANIC DEVICE	CD98DT 990DT	626	VON
1	EA	PANIC DEVICE	CD98NL 990NL	626	VON
3	EA	MORTISE CYLINDER	1080-114	626	C-R
1	EA	RIM CYLINDER	3080-178	626	C-R
2	SET	MULLION SEAL	S88D	BRN	PEM
*1	EA	CLOSER	4111EDA	689	AL
*1	EA	AUTO-EQUALIZER	4642	689	LCN
2	EA	WALL STOP	WS407CVX	630	IVE
1	EA	THRESHOLD	2005AS SS25MS/ES	GRY	PEM
2	EA	WALL PLATE	7910-956	689	LCN
1	SET	WEATHERSTRIP	S88D	DRK	PEM

HANDICAP OPERATOR BY PUSH BUTTON IN/OUTSIDE
MANUAL DOGGING EXIT DEVICES FOR DAYTIME USE

Hardware Group No. EXTERIOR PAIR FROM CORRIDOR
Provide each PR door(s) with the following:

Quantity		Description	Model Number	Finish	Mfgr
6	EA	HINGE	BB1199 4-1/2 X 4-1/2 NRP	630	HAG
1	EA	MULLION	KR9954 X 154	689	VON
1	EA	PANIC DEVICE	CD98DT 990DT	626	VON
1	EA	PANIC DEVICE	CD98NL 990NL	626	VON
3	EA	MORTISE CYLINDER	1080-114	626	C-R
1	EA	RIM CYLINDER	3080-178	626	C-R
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 10 X 2 LDW	630	IVE
2	EA	WALL BUMPER	WS407CVX	630	IVE
2	SET	PERIMETER SEAL	S88D HEAD AND JAMBS	BRN	PEM
1	EA	THRESHOLD	2005AS SS25MS/ES	GRY	PEM

Hardware Group No. EXTERIOR PAIR GATES FROM COURTYARD

Provide each PR door(s) with the following:

Quantity		Description	Model Number	Finish	Mfgr
6	EA	HINGE	BB1199 4-1/2 X 4-1/2 NRP	630	HAG
1	EA	MULLION	CRF4023 x 4051	689	MON
2	EA	PANIC DEVICE	F-18-R-BA w/cylinder dogging, w/o label	630	MON
3	EA	MORTISE CYLINDER	1080-114	626	C-R
2	EA	SURFACE CLOSER	4111 *SCUSH SRI EDA	689	LCN
2	EA	KICK PLATE	8400 10 X 2 LDW	630	IVE
2	EA	WALL BUMPER	WS407CVX	630	IVE
2	EA	SILENCERS	SR64	GRY	IVE
*1	EA	RAIN DRIP	346A	AL	PEM

08710

FINISH HARDWARE

(SUGGESTED SPECIFICATION SECTION)

PART 1 – GENERAL

1.1 WORK INCLUDED

A. The work in this section shall include furnishing of all items of finish hardware as hereinafter specified or obviously necessary to complete the building, except those items that are specifically excluded from this section of the specification.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Hollow Metal Doors and Frames
B. Aluminum Doors and Frames
C. Wood Doors and Frames

1.3 DESCRIPTION OF WORK

A. Furnish labor and material to complete hardware work indicated, as specified herein, or as may be required by actual conditions at building.
B. Include all necessary screws, bolts, expansion shields, other devices, if necessary, as required for proper hardware application. The hardware supplier shall assume all responsibility for correct quantities.
C. All hardware shall meet the requirements of Federal, State and Local codes having jurisdiction over this project, notwithstanding any real or apparent conflict therewith in these specifications.
D. FIRE-RATED OPENINGS:
   1. Provide hardware for fire-rated openings in compliance with ANSI, NFPA Pamphlet No. 80, NFPA Standards NO. 101, UBC 702 (1997) and UL10C. This requirement takes precedence over other requirements for such hardware. Provide only hardware that has been tested and listed by UL for the types and sizes of doors required, and complies with the requirements of the door and door frame labels.
   2. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label indicating Fire Door to be equipped with fire exit hardware and provide UL label on exit device indicating “Fire Exit Hardware”.
E. FASTENERS:
   1. Hardware as furnished shall conform to published templates generally prepared for machine screw installation.
   2. Furnish each item complete with all screws required for installation. Typically, all exposed screws installation.
   3. Closers for metal doors shall be drilled and tapped for machine screw mounting. Closers for wood doors shall be sex-bolt mounted.

1.4 QUALITY ASSURANCE

A. The supplier to be a directly franchised distributor of the products to be furnished and have in their employ an AHC (Architectural Hardware Consultant). This person is to be available for consultation to the architect, owner and the general contractor at reasonable times during the course of work.

B. The finish hardware supplier shall prepare and submit to the architect six (6) copies of a complete schedule identifying each door and each set number, following the numbering system and not creating any separate system himself. He shall submit the schedule for review, make corrections as directed and resubmit the corrected schedule for final approval. Approval of schedule will not relieve Contractor of the responsibility for furnishing all necessary hardware, including the responsibility for furnishing correct quantities.

C. No manufacturing orders shall be placed until detailed schedule has been submitted to the architect and written approval received.

D. After hardware schedule has been approved, furnish templates required by manufacturing contractors for making proper provisions in their work for accurate fitting, finishing hardware setting. Furnish templates in ample time to facilitate progress of work.

E. Hardware supplier shall have an office and warehouse facilities to accommodate the materials used on this project. The supplier must be an authorized distributor of the products specified.

F. The hardware supplier is to supply both a pre-installation class as well as a post-installation walk-thru. This is to insure proper installation and provide for any adjustments or replacements of hardware as required.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Wrap; protect finishing hardware items for shipment. Deliver to manufacturing contractors hardware items required by them for their application; deliver balance of hardware to job; store in designated location. Each item shall be clearly marked with its intended location.

1.6 WARRANTY

A. The material furnished shall be warranted for one year after installation or longer as the individual manufacturer's warranty permits.

B. Mechanical locks and Electronic Access locks shall be warranted, in writing by the manufacturer against failure due to defective materials and workmanship, for a period of five (5) years commencing from the Date of Purchase. All other electronic hardware (i.e. Power supplies, EL/RX/LX switches ect.) shall be warranted for one (1) year from the Date of Purchase.

C. Overhead door closers shall be warranted, in writing by the manufacturer against failure due to defective materials and workmanship, for a period of ten (10) years commencing on the Date of Final Completion and Acceptance. In the event of failure, the manufacture is to promptly repair or replace the defective with no additional cost to the Owner.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. To the greatest extent possible, obtain each kind of hardware from only one manufacturer.
B. All numbers and symbols used herein have been taken from the current catalogues of the following manufacturers.

PRODUCT	SPECIFIED MANUFACTURER	**(Alternate Manufacturers)**
1)	Hinges	**Hager,**(Stanley)
2)	Pivots	**LCN,** (Dor-O-Matic)
3)	Locks & Latches	***Corbin/Russwin, (Schlage, Sargent)***
4)	Electronic Access Locks	**Schlage/Von Duprin,** (Locknetics)
5)	Power Supplies	**Von Duprin,** (Locknetics)
6)	Cylinders, Keys, Keying	**Corbin/Russwin,** (No Substitution)
7)	Exit Devices	**Corbin/Russwin**, **(**Von Duprin, Precision, *Monarch)
8)	Door Closers	**Corbin/Russwin**, (LCN, Norton)
9)	OH Stops/Holders	**Glynn Johnson,** (Rixson)
10)	Magnetic Hold Opens	**LCN,** (Dor-O-Matic)
11)	Automatic Flushbolts Coordinators, DP Strikes	**Ives,** (Glynn Johnson)
12)	Wall Stops/Floor Stops, Flushbolts	**Ives, (**Rockwood, Glynn Johnson)
13)	Kick Plates	**Ives**, (Quality, Rockwood)
14)	Lock Guards	**Glynn Johnson, (**Ives)
15)	Threshold/Weather-strip	**National Guard, (**Pemko, Zero)
16)	Silencers	**Glynn Johnson**, (Rockwood, Ives)
17)	Key Cabinet	**Lund, (**Key Control)

C. If material manufactured by other than that specified or listed herewith as an equal, is to be bid upon, permission must be requested from the architect seven (5) days prior to bidding. If substitution is allowed, it will be so noted by addendum.

2.2 FINISH OF HARDWARE:

A. Exterior Hinges to be Stainless Steel (32D), Interior Hinges to be Satin Chrome (26D). Door Closers to be Aluminum. Locks to be Satin Chrome (26D), Exit Devices to be Satin Chrome (26D). Overhead Holders to be Satin Chrome (26D), Flat Goods to be Satin Chrome (26D) or Stainless Steel (32D) and the Thresholds to be Mill Finish Aluminum.

2.3 HINGES AND PIVOTS:

A. Exterior butts shall be Stainless Steel. Butts on all out swinging doors shall be furnished with safety studs (exterior only).

B. Interior butts shall be as listed.

C. Doors 5' or less in height shall have two (2) butts. Furnish one (1) additional butt for each 2'6" in height or fraction thereof. Dutch door shall have two (2) butts per leaf.

2.4 CYLINDERS AND KEYING:

A. All locks and cylinders shall be Corbin/Russwin, Grand Master keyed into the existing system at the factory.

B. Contact Osceola County Schools Facilities for the bitting and registration number for this project

C. Hardware supplier to provide temporary cylinders or cores during the construction phase. The contractor is to change out the temporary cylinders for the permanent cylinders.

School District Keying Procedures and Standards

All Keying schedules are to be reviewed and approved by the State Russwin/Corbin Representative prior to ordering of and installation of all locking hardware!

*Keying Scheme Abbreviations: GGM-County Great Grand Master, GM-Grand Master/School Master, M-Master/Building Master, CK-Change Key/Room Key, MECH-All Mechanical Rooms, **KGGM**-Kitchen **Great** Grand Master(all kitchens), K**G**M-Individual Kitchen Master.*

*A. Schools to be keyed under the S**D**OC GGM System*

B. All locks to have Russwin 6pin D or H series cylinders/cores. To be determined by SDOC.

C. Schools to be keyed to a master key(GM) Russwin to determine. Each building will have individual master (M) and a (CK) change key.

D. Mechanical Rooms need to be keyed to the (GGM,GM) and the county issued (MECH) mechanical key.

*E. The kitchen needs to keyed separate from the school master. The kitchen needs to be keyed under **SDOC GGM, KGGM KGM. To be keyed under SDOC GGM, KGGM KGM.** Russwin to determine. Back door key needs to have (CK) change key for deliveries.*

*F. **8**-(M) building masters are required.*

G. 12-(GM) are required.

*H. **5**-(CK) per lockset.*

I. No (GGM or KGM) keys are to be cut or issued.

J. All IDF/MDF rooms are to be keyed to GGM,GM,and MECH.

K. All gate locks shall be interchangeable core padlocks.

L. All Gates Keyed GGM, GM, MECH, & CK – Qty of 50 Change Key's

M. 200 Extra blanks – stamped "Do Not Duplicate" required.

*N. 2 copies of **bitting** list supplied to SDOC Maintenance Department.*

REQUIRED HARDWARE SETS FOR EXPOSED EXTERIOR DOORS

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Provide each PR door(s) with the following:

Quantity		Description	Model Number	Finish	Mfgr
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1	EA	MULLION	KR9954 X 154	689	VON
1	EA	PANIC DEVICE	CD98DT 990DT	626	VON
1	EA	PANIC DEVICE	CD98NL 990NL	626	VON
3	EA	MORTISE CYLINDER	1080-114	626	C-R
1	EA	RIM CYLINDER	3080-178	626	C-R
2	SET	MULLION SEAL	S88D	BRN	PEM
*1	EA	CLOSER	4111EDA	689	AL
*1	EA	AUTO-EQUALIZER	4642	689	LCN
2	EA	WALL STOP	WS407CVX	630	IVE
1	EA	THRESHOLD	2005AS SS25MS/ES	GRY	PEM
2	EA	WALL PLATE	7910-956	689	LCN
1	SET	WEATHERSTRIP	S88D	DRK	PEM

HANDICAP OPERATOR BY PUSH BUTTON IN/OUTSIDE
MANUAL DOGGING EXIT DEVICES FOR DAYTIME USE

Hardware Group No. EXTERIOR PAIR FROM CORRIDOR
Provide each PR door(s) with the following:

Quantity		Description	Model Number	Finish	Mfgr
6	EA	HINGE	BB1199 4-1/2 X 4-1/2 NRP	630	HAG
1	EA	MULLION	KR9954 X 154	689	VON
1	EA	PANIC DEVICE	CD98DT 990DT	626	VON
1	EA	PANIC DEVICE	CD98NL 990NL	626	VON
3	EA	MORTISE CYLINDER	1080-114	626	C-R
1	EA	RIM CYLINDER	3080-178	626	C-R
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 10 X 2 LDW	630	IVE
2	EA	WALL BUMPER	WS407CVX	630	IVE
2	SET	PERIMETER SEAL	S88D HEAD AND JAMBS	BRN	PEM
1	EA	THRESHOLD	2005AS SS25MS/ES	GRY	PEM

Hardware Group No. EXTERIOR PAIR GATES FROM COURTYARD

Provide each PR door(s) with the following:

Quantity		Description	Model Number	Finish	Mfgr
6	EA	HINGE	BB1199 4-1/2 X 4-1/2 NRP	630	HAG
1	EA	MULLION	CRF4023 x 4051	689	MON
2	EA	PANIC DEVICE	F-18-R-BA w/cylinder dogging, w/o label	630	MON
3	EA	MORTISE CYLINDER	1080-114	626	C-R
2	EA	SURFACE CLOSER	4111 *SCUSH SRI EDA	689	LCN
2	EA	KICK PLATE	8400 10 X 2 LDW	630	IVE
2	EA	WALL BUMPER	WS407CVX	630	IVE
2	EA	SILENCERS	SR64	GRY	IVE
*1	EA	RAIN DRIP	346A	AL	PEM

2.5 LOCKSETS:

A. Locksets shall be Mortise type with two piece, hinged, anti-friction, ¾ inch throw, stainless steel, latchbolt, 1 inch throw stainless steel deadbolt, non-handed auxiliary latch, unless specified otherwise, as manufactured by ***Corbin/Russwin, Schlage, or Sargent.*** Owner approval required.
B. All locksets shall be tested to ANSI/BHMA A156.13 test requirements by a BHMA certified testing laboratory. All locksets are to have the ability to change the handing in the field without taking the lockset apart.

2.6 ELECTRONIC ACCESS CONTROL LOCKING SYSTEMS

A. Exit trim for ***Russwin ED5200*** Series exit device

B. Trim shall use patented, clutch mechanism to deter vandalism and maximize durability. Disablement of secured levers shall not permit latchbolt retraction from secure side while allowing emergency egress.

C. Escutcheons and levers will be supplied with Satin Chrome – 626 finish

D. Emergency mechanical key override utilizes 1 ¼" mortise cylinder with standard straight.

E. Trim for exterior application shall be furnished with an outside escutcheon gasket to resist intrusion of dust, weather and foreign materials. Recommended for environmentally controlled interior doors and exterior doors, with environmentally controlled interior and uncontrolled exterior doors.

F. Electrical operation shall be battery operated, capable of 80,000 operating cycles using non-proprietary four "AA" alkaline batteries. Trim shall be capable of operation for exterior applications, at temperatures of 4 degrees F to 131 degrees F, at relative humidity of 0-85%, continuous, non-condensing. Trim shall be resistant to radio frequency and electro-static discharge.

G. Trim shall be made available with the following integrated, multi-credential platform combinations:
   1. iButton only

H. Visual red and green LED indicators shall indicate activation, operational systems status, system error conditions and low power conditions.

I. Controller board shall support keypad, iButton, magnetic stripe card, and HID proximity credentials. Credential combinations shall allow administrators to determine how operationally, credential holders will access the restricted areas, by the use of a single credential, or dual credentials. Controller board shall also support the following:

1. 1,000 user capacity with 1,000 audit capacity.
2. SmarTime features as standard.
   a. Time zones.
   b. First person in for auto unlocks.
   c. Credential activation and expiration.
3. PROVIDE Current LockLink Express software
4. Indicate operations systems, system error and low power conditions.
5. Optional automatic magnetic stripe card replacement. Incremented cards will be accepted by the lock while older cards will no longer accepted.
6. 500 ibuttons for owners use

J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include:
   1. Von Duprin – IR CM993 Series
   2. Locknectic – wall reader TR-84

2.7 EXIT DEVICES:

A. All devices may be Von Duprin 98 ***or Russwin ED 5200*** series in types and functions specified. All devices must be listed under "Panic Hardware" in accident equipment list of Underwriters Laboratories. All labeled doors with "Fire Exit Hardware" must have labels attached and be in strict accordance with Underwriters Laboratories. Where lockable lever trim is specified, use Von Duprin 994L Break Away trim.
B. All exit devices shall be tested to ANSI/BHMA A156.3 test requirements by a BHMA certified testing laboratory.
C. All surface strikes shall be roller type and come complete with a plate underneath to prevent movement. And shall be provided with a dead-latching feature to prevent latchbolt tampering.
D. Gaps between the Touch Bar and the door will not be acceptable.
E. Where Removable Mullions are used, use the ***non keyed*** Removable Mullion, KR4954 or KR9954 as manufactured by Von Duprin.

1. Acceptable substitutions:
   A. Corbin/Russwin – must meet all of the requirements of the specification as stated above.
   B. Precision – must meet all of the requirements of the specification as stated above.

2.8 DOOR CLOSERS:

A. All closers shall be LCN 4110 EDA series having non-ferrous covers, forged steel arms separate valves for adjusting backcheck, closing and latching cycles and adjustable spring to provide up to 50% increase in spring power. Provide and Advanced Variable Backcheck (AVB) at all exterior doors. ***SRI finish at exterior gates.**

B. Closers shall be furnished with parallel arm mounted on all doors opening into corridors or other public spaces and shall be mounted to permit 180 degrees door swing wherever wall conditions permit. Furnish with non-hold open arms unless otherwise indicated. Provide a special template arm on closers where there is an additional overhead stop.
C. Door closer cylinders shall be of high strength cast iron construction to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
D. Door closer spindles shall be of high strength heat treated steel with a minimum diameter of 11/16th of an inch by 3 ¼ inches in length with a minimum of 12 teeth.
E. Door closers shall utilize temperature stable fluid capable of withstanding temperature ranges of 120 degrees Fahrenheit to -30 degrees Fahrenheit, without requiring seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with the standards UBC 7-2 (1997) and UL 10C.
F. Door closers shall incorporate tamper resistant non-critical screw valves of V-slot design to reduce possible clogging from particles within the closer. Closers shall have separate and independent screw valve adjustments for latch speed, general speed, and hydraulic backcheck. Backcheck shall be properly located so as to effectively slow the swing of the door at a minimum of 10 degrees in advance of the dead stop location to protect the door frame and hardware from damage. The use of Pressure Release Valves (PRV) are not acceptable.

1. Acceptable substitutions:
    A. Corbin/Russwin – must meet all of the requirements of the specification as stated above.
    B. Norton – must meet all of the requirements of the specification as stated above.

2.9 TRIM AND PLATES:

A. Kick plates, mop plates, and armor plates, shall be .050 gauge with 32D finish. Kick plates to be 8” high, mop plates to be 4” high. All plates shall be two (2) inches less full width of door.
B. Push plates, pull plates, door pulls, and miscellaneous door trim shall be shown in the hardware schedule.

2.10 DOOR STOPS:

A. Doorstops shall be furnished for all doors to prevent damage to doors or hardware from striking adjacent walls or fixtures. Wall bumpers equal to Glynn Johnson 60W Series are preferred, but where not practical furnish floor stops equal to Glynn Johnson FB13 or 17 and FB19X series.

B. Where conditions prohibit the use of either wall or floor type stops, furnish surface mounted overhead stops equal to Glynn Johnson, 90 series exterior and 450 series interior.

2.11 THRESHOLDS AND WEATHERSTRIP:

A. Thresholds and weather-strip shall be as listed in the hardware schedule.
B. *** Pemko 346A Rain Drip at exterior openings without cover.**

2.12 DOOR SILENCERS:

A. Furnish rubber door silencers equal to Glynn Johnson SR64 for all new interior hollow metal frames, (2) per pair and (3) per single door frame.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. All hardware shall be applied and installed in accordance with the Finish Hardware schedule. Care shall be exercised not to mar or damage adjacent work.
B. Contractor to provide a secure lock-up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items that are not immediately both before and after installation.
C. No hardware is to be installed until the hardware suppliers have provided a pre-installation class. This is to insure proper installation of the specified products.

3.2 ADJUSTING AND CLEANING:

A. Contractor shall adjust all hardware in strict compliance with manufacturer's instructions. Prior to turning project to owner, contractor shall clean and make any final adjustments to the finish hardware.

3.3 PROTECTION:

A. Contractor shall protect the hardware, as it is stored on construction site in a covered and dry place.
B. Contractor shall protect exposed hardware installed on doors during the construction phase.

3.4 KEY CABINET:

A. Set up and index one (1) Key Cabinet that allows room for expansion for 150% of the number of keys for the project.

3.5 HARDWARE SCHEDULE:

A. The hardware schedule shall be prepared by an AHC (Architectural Hardware Consultant). This person is to be available for consultation to the architect, owner and the general contractor at reasonable times during the course of work.

SECTION 08720
AUTOMATIC DOOR OPERATOR

PART 1 - GENERAL

1.1 SUMMARY

A. Provide labor, materials, and equipment necessary to furnish and install automatic door operators as shown on the Drawings and as specified herein. The automatic door operator shall consist of the following major components:

1. Power operator
2. Flush wall switch, interior and exterior

1.2 QUALITY ASSURANCE

A. Automatic door operator shall comply with the requirements of ANSI Standard A117.1. Providing accessibility and usability for physically handicapped people.

B. Automatic entrances shall comply with American National Standard for power operated doors, ANSI A156.10. Provide custom designed installation utilizing slow opening, low powered automatic doors as described in paragraph 1.1.1 of ANSI A156.10, not opening to backcheck faster than 3 seconds and requiring no more than 15 lbf to stop door movement.

C. Manufacturer: Provide units produced by a firm with not less than 5 years successful experience in the fabrication of automatic door operator units of the type required for this Project.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND OPERATOR TYPE

A. Basis of Design: "Senior-Swing" by Dor-O-Matic Division, Republic Industries, Inc., Harwood Heights, Illinois.

B. Products of the following manufacturer's are acceptable, providing their products equal or exceed the quality specified, and they can provide products of the type, size, function, and arrangement required.

1. Horton Automatics, Corpus Christi, Texas
2. Besam Inc., East Windsor, New Jersey
3. Norton Door Controls, Charlotte, North Carolina

C. Provide materials and equipment necessary for the proper installation of a surface applied "Senior Swing" handicap low energy power operated door system.

1. Unit shall be completely electromechanical with micro compressor control requiring no micro switches on the operator.
2. In the handicap mode, the activating switch, on either side of the door, shall open the door slowly to back check (80 degrees) in 3 to 6 seconds and to fully open position in 4 to 7 seconds. The door shall remain open 5 to 30 seconds. After the time delay, the door will close from 90 degrees to 10 degrees in 3 to 6 seconds and from 10 degrees to full closed in 1-1/2 to 2 seconds. The power boost feature shall increase the closing force from 6 lbf to 15 lbf against wind pressure. Manual opening force shall not exceed 15lbf. Control box and motor/gear box shall be contained in a full door width extruded aluminum housing, 4-1/2 inches wide by 5-3/4 inches high, designed for surface applied, interior application.
3. Operator in nonactivated mode shall be manual with no push-n-go feature.
4. Activation Switches: Low voltage, stainless steel wall mount type. Exterior shall a custom unit to be post mounted on an electrified bollard. Switches shall be wired to operating unit. (No RF switches required).
5. Provide door decals visible from either side, instructing the user as to the operation and function of the door.
6. Door operator shall be installed on stop side of doors. Provide mounting plates, angles, and brackets as required.

D. Finish: Match aluminum door and frame finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine the doors and frames for which automatic door operators are to be installed.

B. Install automatic door operators in strict accordance with manufacturer's instructions.

C. Automatic door operators shall be installed as a complete system with peripheral items and concealed wiring as required.

D. Coordinate the time delay setting for holding the door open with the Owner’s representative.

3.2 ADJUST AND CLEAN

A. Clean aluminum surfaces and adjacent area. Remove excess dirt and other substances.

B. Demonstrate operation and maintenance of operator and peripheral items to the Owner.

END OF SECTION 08720

08800 - Glazing

The types of glass and location should be indicated on the drawings or in the specifications as follows:

Assign a “type number” to each type of glass being used on the job;

Void lengthy descriptions of the glass on the drawings, merely locating each by the simple note, “glass type 1”, “glass type 2”, etc.

Precisely define each of the glass types in the specifications.

Use obscure glass in toilet and bathroom windows.

Window glass should be replaceable from inside the building wherever feasible.

Future replacement of glass

Windows should be glazed in the closed position and left closed for several weeks. This applies particularly to awning or projected types.

Safety glass shall be used in all hazardous locations to comply with Life Safety Code, etc.

SECTION THREE

DIVISION 9 - FINISHES

09200 - Lath and Plaster

09260 – Gypsum Board Assemblies

PART 1 - GENERAL

1.1 SUMMARY:

A. The purpose of this standard is to identify the metal studs used for interior non-load-bearing gypsum board partitions. The partitions are lightweight, fire and sound resistant assemblies that consist of gypsum panels that are screw attached to the steel framing.

1.2 RELATED DOCUMENTS:

A. DGM 09261 Abuse Resistant Gypsum Wall Board

B. Underwriters Laboratories Inc.: Fire Resistance-Rated Assemblies indicated by design designations.

1.3 REFERENCES

A. Florida Building Code (FBC)
www.sbcci.org/floridacodes.htm

B. State Requirements for Educational Facilities (SREF)
Chapter 423 of FBC
www.sbcci.org/Florida%20Building%20Code/changed/ch-4/Sec%20423.pdf

C. ASTM: American Society For Testing And Materials.

1. *Designation: E 90-90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Materials.*
2. *Designation: C 645-95 Standard Specification for Non-Load Bearing (Axial) Steel Studs, Runners (Tracks), and Rigid Furring Channels for Screw Application of Gypsum Board.*
3. *Designation: C 754-88 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.*
4. *Designation: A 653/A 653M-95 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.*

D. United States Gypsum Company SA923.

E. STC Ratings: Sound Transmission Characteristics measured in accordance with ASTM E 90-90.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years. Installers shall be state-certified or licensed Sub-Contractors, or locally registered Sub-Contractors in Osceola County, Florida.

B. Manufacturer Qualifications: Employ only manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item.

1. Verify that Shop Drawings have been successfully submitted, reviewed and returned before installation of metal framing.

C. Source Limitations: Unless specifically noted otherwise, provide products of the same manufacturer for each type of unit specified. This includes studs, channels, rails, brackets, bridging and fasteners.

1.5 DELIVERY STORAGE AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer.

B. Store materials in original packing or shipping crates, on pallets, inside a roofed structure, out of the weather and free of moisture.

1.6 SUBMITTALS

A. Manufacturer's Product Data sheets shall be required for each item specified.

B. Shop Drawings shall be submitted for each building material named in this standard.

C. Samples and a request for substitution shall are required for non-specified manufacturer's products submitted for approval as a Substitution.

1.7 WARRANTY

A. Project Warranty shall be as stated in Division 1 of the Specifications.

B. Installer's Warranty

1. The metal stud contractor shall agree to repair or replace components of the wall system that fail in materials or workmanship within the specified warranty period.

C. Unless otherwise stated in this Guideline, duration of all warranties shall begin on the date of Substantial Completion.

PART 2 - PRODUCT SYSTEM

2.1 ACCEPTABLE MANUFACTURERS AND SPECIFIC PRODUCTS

A. Steel Framing and Furring:

1. *National Gypsum Company.*
2. *Unimast, Inc.*
3. *Clark Steel Framing Systems.*
4. *Dietrich Industries, Inc.*
5. *Consolidated Systems, Inc.*
6. *Gold Bond Building Products.*

2.2 STEEL PARTITION AND SOFFIT FRAMING

A. ASTM C 754 and C 645 are referred to in steel studs and steel framing that receive screw-attached gypsum board.

1. *Stud height and spacing shall be based on L/240*

B. United States Gypsum Company SA923 has details for UL rated partitions and framing conditions at wall corners and wall openings that can be referenced. SA923 also identifies Sound Transmission Characteristics (STC) for wall assemblies.

C. Metal door and borrowed light frames shall be 16 ga., double stud steel framing, 3-5/8" minimum.

D. Steel stud spacing may be placed on 12", 16" or 24" centers. It is the recommendation of SDOC to have all steel stud spacing on 16" centers.

2.3 FABRICATION

A. Steel studs are rolled formed and have a corrosion resistant coating, hot-dip galvanized in accordance with ASTM A 653.

B.

2.4 ALLOWABLE SUBSTITUTIONS: Products other than those named in Acceptable Manufacturers and Specific Products above may be substituted when in conformance with individual requirements stated in Component Characteristics and approved by SDOC Standards And Design.

2.5 BASIS OF DESIGN type specifications shall NOT be used in the preparation of this Section. The Architect shall clearly specify a minimum of three named manufacturers complete with type and specific product selected.

PART 3 - QUALITY ASSURANCE DURING EXECUTION

3.1 DESIGN CONSIDERATIONS

A. For steel stud partition detailing, fire ratings and sound transmission the United States Gypsum Company has a published "Handbook" that defines minimum standards for metal stud framing systems. These standards shall be followed by the design professional.

3.2 INSTALLATION ENVIRONMENTAL CONDITIONS:

A. Specified items in this standard shall not be delivered or installed until the building is enclosed. Enclosed means the exterior walls are erected and the roof system is installed.

3.3 PARTITION INSTALLATION

A. Attach steel runners at floor and ceiling to structure with mechanical fasteners spaced at 24" on center.

B. Position steel studs vertically with open side facing in the same direction, and connect to top and bottom runners with 2 (two) positive attachments per stud flange.

3.4 SPECIAL INSTALLATION PROCEDURES/ADJUSTMENT PROCEDURES

A. Provide all items and accessories as required for a complete installation. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of any items indicates all conditions are satisfactory and acceptance of previous Work by other Contractors.

09261 – Abuse Resistant Gypsum

PART 1 - GENERAL

1.1 DEFINITION: Gypsum wallboard (GWB) panels for interior partitions that have been specifically engineered to provide increased resistance to abrasion, indentation and penetration than standard, paper-faced gypsum panels. Refer to ASTM C11 for other gypsum industry definitions and terminology.

1.2 APPLICATION:

A. Intended Use

1. *Use as a finished wall material in lieu of CMU on selected corridors and partitions within and between classrooms.*
2. *Use only from floor level to height 8 or 9 feet above finished floor, depending on length of panel used. Use standard GWB products of matching thickness above the abuse resistant product.*

B. Justification

1. *More cost effective than CMU.*
2. *Offers increased flexibility for future modifications than heavier, more rigid and more permanent wall assemblies.*
3. *Similar to durability of CMU.*
4. *Provides less institutional appearance than CMU.*
5. *Easier to repair and maintain.*
6. *Faster installation time than CMU.*

C. Limitations

1. *Shall not be used in areas of known intense use (gymnasiums, dance studios, etc.).*
2. *Shall not be used in areas subject to continuous moisture, high humidity or extreme temperatures (kitchens, locker/shower rooms, swimming pools, etc.)*
3. *Not intended for use in ceilings, although abuse resistant products may have some special applications.*

1.3 SELECTION CRITERIA

A. Gypsum Wallboard (GWB) panels for interior partitions that have been specifically engineered to provide:

1. *Increased resistance to abrasion,*
2. *Increased resistance to indentation, and*
3. *Increased resistance to penetration than standard, paper-faced gypsum panels.*

B. Industry Standards and Tests

1. *ASTM C11-98 Standard Terminology Relating to Gypsum and Related Building Materials and Systems.*
2. *ASTM C36 / C 36M-99e1 Standard Specification for Gypsum Wall- board.*
3. *ASTM C840-99a Standard Specification for Application and Finishing of Gypsum Board.*
4. *ASTM C919-98 Standard Practice for Use of Sealants in Acoustical Applications.*
5. *ASTM C1288-95 Standard for non-asbestos fiber cement flat sheets.*
6. *GA 216-96 Specification for Application and Finishing of Gypsum Wallboard.*
7. *GA 600-97 Fire Resistance Design Manual.*
8. *Underwriters Laboratories, Inc., Fire Resistance Directory, January 1998.*

C. Applicable Publications

1. *SREF: 1999 Section 2.3(9)(b)*
2. *Masterspec Section 09620*

1.4 QUALITY ASSURANCE

A. Contractor Qualifications: Employ only experienced Installers skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five years. Installers shall be state-certified or licensed Sub-Contractors, or locally registered Sub-Contractors in Osceola County, Florida.

B. Manufacturer's Qualifications: Employ only manufacturers making the specified materials as a regular production item.

C. Pre-Construction Conference

1. *Review use and installation of specified materials and assemblies with Contractor and Subcontractor.*
2. *Review acceptable level and quality of finishes with Contractor, Installation Subcontractor and Painting Subcontractor. Compare to mock-up, if required.*

D. Mock-Up: If it is necessary to assess the quality of finishes or should the use of the product be unusually complex, the Contractor shall provide a full size mock-up of the assembly showing all details and finishes. Upon approval, mock-up shall establish acceptable level of quality and may be incorporated into the Work.

E. Preparation: Provide material and construction identical to those tested for required fire resistance and STC sound ratings as stated in assemblies shown in Contract Documents.

1.5 SUBMITTALS

A. Certifications

1. *Statement by Manufacturer that product meets specifications.*

2. *Statement by Manufacturer that product complies with industry standards and tests.*

B. *Samples: Submit samples of each product specified.*

C. *Product Data Sheets: Provide Product Data Sheets of each product specified.*

D. *Special Instructions regarding product's peculiarities (if any) in applying taping, finishing and priming/painting.*

E. *Shop Drawings showing locations and proposed details of expansion and control joints. Shop Drawings shall also show attachments to other units of work.*

1.6 COMMISSIONING

A. *Contractor Statement of Compliance: Certification by the Contractor that fire and sound rated assemblies have been built in accordance with the Contract Documents and the specified ratings required of each assembly.*

PART 2 - PRODUCT SYSTEM

2.1 COMPONENTS

A. *Fire Ratings: Maintain fire ratings as required by reference or direct requirement in current editions of SREF, State Uniform Building Code for Public Educational Facilities Construction (UBC), Florida Building Code (FBC) and Standard Building Code (SBCCI).*

B. *STC Ratings[1]: Maintain the following general STC ratings:*

1. *Wall/ceiling assembly between corridors and classrooms: STC 45*
2. *Wall/ceiling assembly between adjacent classrooms: STC 45*
3. *Wall/ceiling assembly between corridors and offices: STC 50*
4. *Wall/ceiling assembly between offices: STC 50*
5. *Wall/ceiling assembly at music, dance, theaters, etc.: STC 55*

2.2 ACCEPTABLE PRODUCTS:

A. *Abuse Resistant GWB: United States Gypsum Company 5/8" Fiberock brand VHI Abuse Resistant gypsum fiber panel or other equal products as approved by SDOC Standards Development.*

B. *Joint Compound: Setting-type such as USG Sheetrock brand Durabond.*

[1] The STC ratings indicated are guidelines only. Individual situations may require in-depth study. The level of continuous background noise (i.e. HVAC) has significant impact on quality of construction and must be coordinated with other design parameters including budget.

C. Metal Bead and Trim: USG Sheetrock brand paper-faced metal bead and trim.

2.3 ALLOWABLE SUBSTITUTIONS: From time-to-time, SDOC Standards Development may approve other products and additional items meeting both Guidelines and Specifications when submitted in accordance with the Substitution provisions contained in Division 1.

PART 3 - QUALITY ASSURANCE DURING EXECUTION

3.1 INSTALLATION ENVIRONMENTAL CONDITIONS: Comply with ASTM C840 requirements or gypsum board manufacturers written recommendations, whichever is more stringent.

3.2 SEQUENCING

A. Prior to installation of fixed ceilings, the Architect shall conduct an above ceiling review with SDOC and report deficiencies in the Work in writing back to the Contractor.

B. The Contractor shall not proceed with the Work until deficiencies have been corrected and re-reviewed.

3.3 INSTALLATION PROCEDURES

A. Framing shall be in strict accordance with manufacture's instructions.

B. Framing shall be with 20 ga members only, installed at 16" centers for abuse resistant GWB assemblies.

C. Install panels vertically with ends of boards 3/8-inch above finished floor.

D. Joint Treatment

1. *Provide setting-type joint compound (non-lightweight type) for pre-fill and tape embedment coats.*
2. *Provide drying-type (non-lightweight type) joint compound for finish coats.*

E. Level of Finish

1. *Provide Level 4 finish in accordance with GA-214-96. All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fasteners heads, trim flanges and accessories shall be covered with two separate coats of joint compound.*
2. *Joint compound and panel surfaces shall be smooth and free of tool marks and ridges.*
3. *Spray apply finish coat of "smooth pebble" texture of joint compound to all surfaces. Sample texture finish shall be reviewed with Architect and SDOC. Approved sample shall be representative of acceptable level of finish.*
4.

F. Control Joints

1. ***In general, design control and expansion joints similar to standard GWB products.***
2. ***Provide control joints in uninterrupted straight planes every 30 feet. (Note that a full height doorframe to the ceiling may be considered a control joint.)***
3. ***Provide a control joint where a partition, wall or ceiling traverses a building expansion joint.***

G. Seal Construction of STC-rated assemblies at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations.

H. Comply with ASTM C919 and manufacturer's written recommendations for locating trim and closing off sound-flanking paths around and through gypsum board assemblies, including sealing around partitions extending above acoustical ceilings.

I. Primer

1. ***Prime finished panels with a quality drywall primer to equalize the porosities between surface paper and joint compound.***
2. ***Primer shall be made specifically for drywall as recommended by, and the same brand as, the applied final drywall finish (paint or epoxy) manufacturer.***

09300 - Tile and Marble

General

The Architect/Engineer should determine preferences for finishes from conferences with the District Project Manager. All grout shall be sealed.

Quarry Tile

Because of its enduring quality, ease of maintenance and fire resistance, quarry tile is a desirable material for quarry kitchens.

Ceramic Tile

Ceramic tile shall be used for floors and walls or wainscot in toilets as well as in some laboratories and utility rooms. Toilet floors shall have sealed grout.

J. PERFORMANCE REQUIREMENTS

1. ***Purpose: Provide a factory manufactured tile product which is easily cleanable, has an impervious surface which protects the substrate from penetration of liquids spilled or room-use (i.e. kitchens, toilet rooms, showers).***
2. ***Static Coefficient of Friction (Slip Resistance): ASTM C 1028.***
   a. ***Level Surfaces: Minimum 0.6.***
   b. ***Step Treads: Minimum 0.6.***
   c. ***Ramp Surfaces: Minimum 0.8.***
3. ***Summary of tile types and location:***
   a. ***Kitchen Floors: mud-set, non-slip variety of either quarry tile (NSQT) or porcelain tile (NSPT) sloped to drain, using epoxy mortar with epoxy grout.***
   b. ***Kitchen Serving Area Floors: either thin-set quarry tile (QT) or non-slip porcelain tile (NSPT) using epoxy mortar with epoxy grout. Kitchen serving area tile may match Kitchen floor with the exception that the serving area is not required to have the non-slip tile. Typically, these areas are not sloped to drain.***
   c. ***Group Toilet Room Floors: thin-set ceramic floor tile (CFT) using latex-Portland cement mortar with epoxy grout.***
   d. ***Shower Floors: mud-set unglazed ceramic mosaic floor tile (CMT) or porcelain mosaic floor tile (PMT) sloped to drain, using standard Portland cement mortar with latex-Portland cement grout.***
   e. ***Wall Tile: thin-set glazed ceramic wall tile (CWT) using latex-Portland cement mortar with latex-Portland cement grout. Wall tile in restrooms shall be 50" on the plumbing wall only. Shower walls shall be full height. All other walls in restrooms shall be painted.***
   f. ***Thresholds and Sills: thin-set marble thresholds and sills using latex-Portland cement mortar.***

K. QUALITY ASSURANCE

1. ***Installer Qualifications:***
   a. ***An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project].***
      1) ***Experienced: When used with an entity, "experienced" means having successfully completed a minimum of 5 projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.***
2. ***Manufacturer Qualifications:***
   a. ***A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.***

3. *Preinstallation Conference:*

   a. *Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".*

4. *Comply with: ANSI A108 Series; Tile Council of America Installation Guidelines.*

L. SUBMITTALS DURING CONSTRUCTION

1. *Product Data and Samples: For each type of product indicated.*
2. *Shop Drawings: Indicate plans, elevations, sections, details and attachments to other work.*
3. *Extra Materials: 2% of each type of type, color and pattern installed.*

M. MATERIALS, PRODUCTS, EQUIPMENT, MANUFACTURED UNITS

1. *Acceptable Tile Manufacturers/Distributors:*

   a. *American Olean: www.aotile.com*
   b. *Crossville Ceramics Company, LP: www.crossville-ceramics.com*
   c. *Daltile: www.daltile.com*
   d. *Florida Tile Industries, Inc.: www.fltile.com*
   e. *Shaw Commercial Hard Surface: www.shawfloors.com*
   f. *Trinity Tile Group: www.trinitytile.com*

	American Olean	Crossville Ceramics	Daltile	Florida Tile	Shaw Commercial	Trinity Tile Group
Kitchen Floors	Sure Step® (NSQT)	Cross-Dot (NSPT) Cross-Tread (NSPT) Ecocycle (NSPT)	Suretread™ (NSQT)	Metropolitan Quarry Basics® X-Colors (NSQT)	Quarry Tile (NSQT)	Metropolitan Quarry
Kitchen Serving Area Floors	Quarry Tile (QT) Quarry Naturals® (QT)	Cross-Dot (NSPT) Cross-Tread (NSPT) Ecocycle (NSPT	Quarry Tile (QT) Quarry Textures™ (QT)	Metropolitan Quarry Basics® Clear Tones (QT)	Quarry Tile (QT)	Metropolitan Quarry
Group Toilet Room Floors	Terra Granite™ (CFT) Terra Paver®, Unpolished (PFT)	American Classics (PFT)	Vitrestone Select (CFT) Porcealto™ (PFT)	Granite (CFT) Liberty (CFT) Tough-One (CFT)	Zodiac (CFT)	Interceramic Metallic II
Shower Floors	Unglazed Ceramic Mosaics (CFT)	Cross-Colors Mosaics (PMT)	Keystones (PMT)	Unglazed Mosaics (PMT)	Unglazed Mosaics (PMT)	Lone Star Mosaics
Glazed Wall Tile	Bright (CWT)	N/A	Semi-Gloss™ (CWT)	Bright (CWT)	Tone Series (CWT)	Interceramic IC Brites

2. *Acceptable Setting and Grout Manufacturers:*

   a. *American Olean Tile Co., Inc.*
   b. *H.B. Fuller Co.*
   c. *Laticrete International, Inc.*
   d. *Mapei Corporation*
   e. *Summetville Tiles, Inc.*

3. *Product Performance:*

   a. *Non-Slip Quarry Tile (NSQT) and Non-Slip Porcelain Tile (NSPT): Unglazed, nominal 6" square vitreous clay or porcelain tile units with water absorption no higher than 3.0 percent. In addition to the recommendation for slip resistance listed in paragraph "A" above, these types of floor tiles shall contain supplementary means to provide an extra level of non-slip surface performance. This may be in the form of surface textures or metallic abrasives added to the actual clay material. These additional methods are necessary due to the preponderance of water and grease on kitchen floors and the chemicals used in their cleaning.*
   b. *Quarry Tile (QT): Unglazed, nominal 6" square vitreous clay or porcelain tile units with water absorption no higher than 3.0 percent. Although the design intent is for this tile to match the color range of the non-slip variety described above, it is not mandatory.*
   c. *Ceramic Floor Tile (CFT): Nominal 2" x 2" units with moisture absorption less than 3.5%. Tile may be either glazed or unglazed, meeting the slip-resistance in paragraph "A" above.*
   d. *Ceramic Mosaic Tile (CMT) and Porcelain Mosaic Tile (PMT): Unglazed impervious natural clay or porcelain units no larger than 3" x 3" with a moisture absorption less than 0.5%.*
   e. *Glazed Ceramic Wall Tile (CWT): Nominal 4" x 4" units with a high-gloss or semi-gloss impervious glazed finish fused to a ceramic tile body that may be non-vitreous but with water absorption not exceeding 20%. Furnish Master Grade Certificate signed by both tile manufacturer and Tile Sub-Contractor stating that installed tile meets ANSI 137.1 and provide manufacturer's minimum ten-year glaze wear warranty.*
   f. *Cove Base: Provide matching tile sanitary cove base in rest rooms and kitchens and serving areas. Base used in showers may match glazed wall tile.*
   g. *Marble Thresholds: Use at doorways of dissimilar floor materials shall have beveled edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Height of bevel shall not exceed ½" with finish bevel to match face of threshold. Marble thresholds will be uniform, fine-to-medium-grained white stone with gray veining, conforming to ASTM C503, minimum abrasion resistance of 10-12 per ASTM C 1353 or ASTM C 241 with honed bottom, ¼" radius on outstanding edges.*
   h. *Marble Sills: Comply with recommendations and requirements of MIA, with a minimum abrasion-hardness value of 10 per ASTM C 241. Provide matched*

marble from a single quarry for each type, variety, color and quantities required. Minimum thickness shall be ½-inch.

i. Waterproofing Membrane: Use at "thick-set" applications and where floor has minimum slope to drain(s); non-plasticized chlorinated-polyethylene sheet, 40-mil thickness.

N. FINISHES

1. Tile Systems Schedule:

	Material	*Setting Method*[2]	*Grout*
Kitchen Floors (Food Prep; Slab on grade)	*Non-Slip Quarry Tile (NSQT)* *Non-Slip Porcelain Tile (NSPT)*	*Mud Set (slope to drain)* *F132-02* *ANSI A108.1*	*Epoxy* *ANSI A108.6* *ANSI A118.3*
Kitchen Serving Floors (Slab on grade)	*Quarry Tile (QT)* *Porcelain Floor Tile (PFT)*	*Thin Set* *F131-02* *ANSI A118.3*	*Epoxy* *ANSI A108.6* *ANSI A118.3*
Group Toilet Floors (Slab on grade)	*Ceramic Floor Tile (CFT)* *Porcelain Floor Tile (PFT)*	*Thin Set* *F115-02* *ANSI A108.5* *ANSI 118.4*	*Epoxy* *ANSI A108.6* *ANSI A118.3*
Group Toilet Floors (Supported Structure)	*Ceramic Floor Tile (CFT)* *Porcelain Floor Tile (PFT)*	*Thin Set* *F122-02* *ANSI A108.5* *ANSI 118.4*	*Epoxy* *ANSI A108.6* *ANSI A118.3*
Group Toilet Floors (Supported Structure)	*Ceramic Floor Tile (CFT)* *Porcelain Floor Tile (PFT)*	*Thin Set* *F122-02* *ANSI A108.5* *ANSI 118.4*	*Epoxy* *ANSI A108.6* *ANSI A118.3*
Shower Floors (Slab on Grade)	*Glazed & Unglazed Ceramic Mosaic Tile (CMT)* *Porcelain Mosaic Tile (PMT)*	*Mud Set (slope to drain)* *F112-02* *ANSI A108.1*	*Latex-Portland Cement* *ANSI A118.7*
Shower Walls & Other Select Areas	*Glazed Ceramic Wall Tile (CWT)*	*Thin Set* *W202, W244 or W245* *ANSI A118.7*	*Latex-Portland Cement* *ANSI A118.7*

[1] "F" and "W" prefixed numbers refer to system designs designated by Handbook for Ceramic Tile Installation by the Tile Council of America.

O. ERECTION TOLERANCES

1. *The "mud-set" Portland cement setting method that is sloped to floor drains is used only in kitchen and locker room shower areas that could be fully immersed in water. Even though other areas have floor drains, floors are not required to be warped since total immersion would only be an occasional accident. As kitchens and locker room shower areas occur only in ground floor locations, a waterproof membrane is not thought to be beneficial or cost effective.*
2. *Latex additives have been selected for use in all thin-set (dry-set) and normal grouting applications for floors and walls due to their improved adhesion and greater resistance to impact and cracking achieved from the flexibility of the latex. Latex additives also improve hydration of the cement by retarding evaporation.*
3. *An epoxy grout is selected for use in kitchens and gang restrooms only, due to their resistance to stain and dirt, and ease of cleanability. Standard latex-Portland cement grouts are used at all other locations. Epoxy adhesives are not used.*

4. *Include expansion joints, control joints, construction joints caused by concrete shrinkage cracks and joints between dissimilar materials.*

    a. *In general, if the larger dimension of a floor is less than 12 ft, movement or control joints will not be required. In floors of large expanse, spacing of joints completely through the setting bed may be as close as 12 ft or as far apart as 24 ft. Joints should be provided in both directions, and there should be a perimeter joint where the floor abuts walls. In addition, joints should be provided between the floor and any other restraining surfaces such as curbs, columns and pipes.*
    b. *Where there is a movement joint in the concrete subfloor, there should be a corresponding joint in the bedding mortar and tile at least the same width. Joints should not be less than ¼ in wide. They must also be filled with a suitable back-up strip and sealant, and carefully installed to ensure that the sealant bonds firmly to the sides of the tiles.*

P. FIELD QUALITY CONTROL

1. *Installation Environmental Criteria:*

    a. *Do not install specified items until building is enclosed, wet work completed and HVAC system is operating and maintaining temperature and humidity at occupancy level during remainder of construction period.*
    b. *Remove grout residue from tile as soon as possible.*
    c. *Clean haze from tile according to tile and grout manufacturer's written instructions.*
    d. *Prohibit foot traffic from tiled floors for at least seven days after grouting is completed.*

e. Protect installed tile work with Kraft paper or other heavy covering during remaining construction period.

f.

Q. COORDINATION / EXHIBITS

1. Drawing Items: In addition to general requirements for coordinating drawings with specifications, drawings should indicate the following:

a. Details where all tiling occurs.
b. Schedules where tiling is indicated.

2. Specification Items:

a. Division 09 Design Criteria "Gypsum Board Assemblies" for furnishing tile backer board.

09511 - Suspended Acoustical Ceilings

All ceilings shall be Armstrong finefissured RH90 or performance equal approved by District Project Manager. All tile shall be 2' x 2' square.

No tiles to be placed prior to HVAC completion and operational. All buildings shall be humidity controlled prior to installation.

09569 - Resilient Flooring

No products specified shall contain asbestos. All floors per School Board directive shall be VCT tile, except kitchens and bathrooms. Utilization of carpet shall have prior School Board approval.

09680 - Carpet

Carpet Specifications

Collins & Aikman and Shaw Industries per State Contract. Equivalent vendors maybe considered if on the FSPMA certified list .

09900 - Painting

General

The following recommendations will assist in obtaining the quality desired:

Require undercoats to have slightly different tints and to be inspected and approved by the Architect/Engineer prior to application of the next coat.

Specify the total thickness of paint by "dry mil" or "wet mil" thickness (according to recommendation by the paint manufacturer), and verify the thickness on the job by use of special low-cost guages. The Architect/Engineer in specifying the quality of paint required shall be in compliance with SREF Specifications. This information contains acceptable vendor products as well as paint specifications for specific types of paint and their application and may be included in the Project Manual.

Substrate preparation requirements shall be clearly described. Door frames in masonary wall shall be back-painted (primed) prior to installation. Care should be taken to prevent Indoor Air Quality problems.

Ferrous Metal

Paint on steel iron items should be specified on the basis of mill thickness rather than number of coats. For items exposed to the weather a total of six mills is considered necessary; for Work exposed inside a building, four or five mills is desirable (dry film measurement). This includes structural steel and miscellaneous iron and steel items.

Coatings on galvanized surfaces are unacceptable unless circumstances prevail. In such cases complete documentation as to procedures shall be submitted for approval.

Exterior Waterproofing

The use of clear silicone waterproofing or approved alternative is desired on the exterior of all brick buildings including the stone. A 3% silicone is considered adequate; more than 4 1/2% is of no benefit. For limestone a 5% silicone is desirable. Products which have been used and found acceptable are: Florida Laboratories Chemclear 30 and Sonneborn-Hydrocide S-X.

Suggested Specification

A clear silicone solution containing a minimum of 3 - 5% silicone resin solids in a hydrocarbon solvent conforming to formulation and performance standard of Federal Specifications SS-W-00110 (G.S.A.). Container label shall certify that it meets above requirements. Where an interior paint is used on masonary or concrete surfaces, no silicone waterproofing is desired.

PAINT SPECIFICATIONS UTILITY LINE/SITE EQUIPMENT COLOR CODE STANDARDS

The following information is provided to address the paint manufacturer, color code, paint selection, and paint type to be applied to the various site utility fixtures and equipment. The preparation of the items to receive the paint shall comply to the paint manufacturer's recommendations and/or Division 8 Section 08900 of the standard specifications section for finishes.

SPECIFICATIONS FOR PAINTING CONTRACTORS

A. Contractor should furnish Material Safety Data Sheet on all paints and coating that he is going to use on this job.

B. Regular Sheet Rock

Primer - one coat of quick-drying interior latex primer-sealer such as Pittsburgh Speedhide 6-2 or equivalent.

Finish - apply two coats of latex eggshell enamel such as Pittsburgh Speedhide 6-411 series or equivalent

C. New Interior Wood

Primer - one coat interior enamel undercoat water base such as Pittsburgh Speedhide 6-755 or equivalent.

Finish - apply two coats of latex eggshell enamel 6-411 or acrylic latex semi-gloss enamel Pittsburgh 6-510 series or equivalent.

D. New Interior Wood Doors that are to be Painted

Primer - one coat of interior enamel undercoat water base such as Pittsburgh Speedhide 6-755 or equivalent.

Finish - apply two coats of interior/exterior water base gloss enamel Pittsburgh 53-610 series or equivalent.

New exterior wood doors use same material as interior doors

E. New Exterior Wood

Primer - apply one coat of exterior latex wood primer such as Speedhide 6-609 Pittsburgh or equivalent.

Finish - apply two coats of Pittsburgh Sun-Proof 721 line flat latex house paint.

F. New Exterior Wood Trim

Primer - exterior latex wood primer P.P.G. 6-609 or equivalent.

Finish - apply two coats of Pittsburgh Sun Proof 78-line semi-gloss acrylic latex house & trim paint.

G. Factory finish metal wall panels or vinyl covered sheetrock that are to be painted with latex paint.

1. Primer - Zinsser Bulls Eye 1-2-3 white pigmented water-based primer sealer.

2. Finish - two coats latex eggshell enamel Pittsburgh Speedhide 6-411 series or equivalent.

H. Properly primed metal doors

Finish - apply two coats of water base gloss enamel 53-610 series or equivalent.

Note: Any equivalent paint or coating must be approved by Facilities Planning and Construction.

SPECIFICATION GUIDE FOR PAINTING OF DISTRICT FACILITIES

A. When every possible waterborne type of paints and coating should be used on district facilities.

B. Quality Assurance

Product Manufacturer: Company specializing in manufacturing quality paint and coating with at least 20 years experience.

C. All vendors' paints and coating should be top-of-their-line products.

D. Recommended Vendors

1. Paint Center of Central Florida (Pittsburgh)

2. M. A. Bruder and Sons Inc.

3. DeVoe and Raynolds Co.

4. Watkins Paint and Wallpaper Co. (Benjamin More)

5. Sherwin-Williams Co.

6. Glidden Coating & Resins

7. Porter Paints

1) Exterior waterproofing of masonary and concrete should be done with a water-based waterproofing sealer like OKON W-1 and OKON W-2 or equivalent.

2) Recommended exterior paint systems

These products listed are DeVoe and Raynolds Co. or equivalent systems.

3) Recommended interior paint systems

These products listed are DeVoe and Raynolds Co. or equivalent systems.

SECTION THREE

DIVISION 10 - SPECIALTIES

10100 - Markerboards and Tackboards

The Architect/Engineer should schedule the sizes and locations of Markerboards and tackboards in accordance with SREF installation specifications.

Markerboards shall be dry marker type in accordance with SREF guidelines.

10165 - Toilet Compartments

Toilet partitions and urinal screens (wall mounted) shall be surfaced units equal to products as manufactured by Santana Products Company, Scranton, PA *(Color to be Paisley only)*. All exposed fastening devices shall be tamper proof. Ceiling above the toilet partitions shall be dropped to (7) feet (6) inches AFF to enable a sturdier installation to result. (Note: single stalls and other situations where an unsturdy installation could result may be floor mounted/overhead braced following discussion and approval by the Owner.)

Hinges

Toilet stall hinges shall comply with latest Florida Accessibility Requirements.

10440 - Identifying Devices

The Architect/Engineer shall assign room numbers to all spaces during the review of the Design Development Phase in accordance with F.I.S.H. Requirements. These numbers will be on the construction bid documents and can be used under doors, hardware, etc. This broadscope section can include building directories, door signs, address signs, and similar directional material, and generally is used when more that one of those items will be required. A narrowscope section dealing with the particular item is common when only one item (such as “building directory”) is required.

Signs

All signage shall be in accordance with SREF requirements.

The Architect/Engineer shall also include directional signs for direction of the public through corridors to destination together with identification of specific functions of rooms such as, MEN, WOMEN, CUSTODIAL CLOSET, MECHANICAL ROOM, DEPARTMENTAL NAMES, HIGH VOLTAGE, etc. Observe requirements of the Florida Accessibility Codes and F.I.S.H.. Particular attention should be given placement of exit signs to ensure compliance with applicable codes and occupancy limit at designation on signs at specific areas. Design placement, and other details will be in accordance with the Fire Marshall's requirements. See Appendix P for F.I.S.H. numbering system.

10420 - Plaques

The material shall be cast bronze with narrow border raised polished letters, leatherette background and theft-proof fastenings. Refer to Appendix I for typical layout and size of plaque.

Plaque will contain the following:

Name of the building and date constructed and names of the Architect and Contractor. Board Member identifications are those members who approve the monitory funding dollars for said school.

District policy prohibits naming associates or consultants to the Architect/Engineer and subcontractors.

10522 - Fire Extinguishers, Cabinets and Accessories

UL approved fire extinguishers shall be provided as per NFPA "10" and SREF for all buildings. Fire extinguisher placement shall be reviewed as part of Life Safety Requirements. All cabinets shall be recessed.

10800 - Toilet and Bath Accessories

The following accessories are typical and specific items shall be verified with the District Project Manager. Careful placement of accessories are required to protect sight lines.

Feminine Napkin Disposal

Partition mounted Bobrick B-354 (or American #47) Provide at each female water closet.

Feminine Napkin - Tampon Vendor

Combination dispenser, 10 1/3" x 30 1/4" x 5 1/2", white enamel, wall mounted. Provide at each female toilet room.

Mirror

Stainless steel framed without shelf, Bobrick Series B-290 (or American series 500) minimum 16" x 24". Mirror for handicapped usage shall have the bottom mounted at 40" above the floor or shall be a fixed tiled units (Bobrick B-293 or American #573). Provide above for each student lavatory .

Soap Dispenser

Owner supplied.

Toilet Tissue Dispenser

Owner supplied/flush mounted.

Towel Dispenser

Owner supplied/flush mounted.

Waste Receptacle

Owner supplied.

Coat Hooks

Provide at staff restrooms only!

Grab Bars

Note: All items shall be securely installed in compliance to SREF and ADA Codes. Use solid wood blocking at drywall locations.

10810 - Mounting Heights

A. PERFORMANCE REQUIREMENTS

1. ***Purpose: Mounting heights are required to comply with Civil Rights legislation, provide ergonomic compatibility, achieve universal design and ADA accessibility for adults and children of various ages. Although a particular age group or population with a particular disability may not necessarily be the primary user of a facility, the accompanying charts should be utilized to serve the primary and ancillary users. The Access Board has issued additional guidance to DOJ and DOT for building elements designed for children ages 12 and younger and are included as part of this Criteria.***

2. *References:*

   a. *Florida Building Code 2004 including latest Supplements.*

B. *QUALITY ASSURANCE*

1. *Verify installations are complete and at the correct heights prior to Substantial Complete*
2. *Install items in accordance with manufacturers instructions and anchorage requirements, and at the elevations stated above finished floor (AFF) contained in the following listing.*

Counter Tops and Fixed Tables		Wall Cabinets	Marker/Tack Boards	Pencil Sharpener
	Standing AFF	Standing AFF To Bottom Edge	Tray Hgt. AFF	Center Line AFF
Adults	35”	54”	36”	48"
Kindergarten	26”	44”	22”	27”
Primary	26”	44”	25”	31"
Intermediate	30"	44”	29”	36"
Middle School	30”	60”	36”	Coordin. w/OCPS
High School	34”	54”	36”	Coordin. w/OCPS

Tack Strip
Top of tack strip (if separate from marker board) shall be located at 6’-0” AFF.

Book Shelves
Adjustable, not to exceed 48” high, vertical KV standards 36” o.c.

Signage
In educational facilities from Kindergarten through Intermediate grades including auxiliary spaces used by these students, mount bottom of signage at 42” AFF, unless noted otherwise (UNO). Mount bottom of all other signage at 60” AFF. Place closest vertical edge 4” from the outside of latch side door jamb edge. Dedication plaques shall be mounted 64” AFF to top of plaque. (See DC 10 14 00 - Signage).

TV Monitor Brackets
Mount bracket so that the clear space below the TV including VCR is 80” AFF. See DGM 11457 for details.

Coat Hooks

Kindergarten, Primary & Intermediate – In Cubbies: Middle & High Schools – In Lockers

Toilet Room Accessories, Other Fixtures

Grab Bars			*Soap Dispensers*	*Drinking Fountains & Water Coolers*
	Center Line, AFF	*Diameter*	*Center Line, AFF to Operator or Spout*	*Spout Hgt. AFF*
Adults	*33"*	*1 ½”*	*45”*	*36"*
Kindergarten	*25" (UNO)*	*1 ½”*	*37”*	*30"*
Primary	*25" (UNO)*	*1 ½”*	*37”*	*30"*
Intermediate	*25" (UNO)*	*1 ½”*	*42”*	*30”*
Middle School	*33"*	*1 ½”*	*42”*	*36”*
High School	*33”*	*1 ½”*	*45”*	*36"*

Mirrors			*Toilet Paper Holders*	*Feminine Napkin Trash Receptacle*
	Mtg. Hgt. AFF (to Bottom Edge of Mirror)	*Size*	*Center Line of Roll AFF*	*Inside of Each Toil. Comp. Adjacent to Paper Holder, AFF*
Adults	*40”*	*18” x 36”*	*19”*	*19”*
Kindergarten	*34”*	*16” x 24”*	*17”*	*N/A*
Primary	*34”*	*16” x 24”*	*17”*	*N/A*
Intermediate	*34”*	*18” x 36”*	*17”*	*19”*
Middle School	*40”*	*18” x 36”*	*19”*	*19”*
High School	*40”*	*18” x 36”*	*19”*	*19”*
All (K-12)	*16”*	*20” x 60”, 24” x 60” where indicated.*		

Recessed or Surface Mounted Paper Towel Dispensers / Trash Receptacles		*Surface Mounted Hand Towel Dispenser*	
	Mtg. Hgt. to Centerline of Dispenser	*Mtg. Hgt. to Centerline. of Dispenser*	
Adults	*40”*	*40”*	
Kindergarten	*40”*	*34”*	
Primary	*40”*	*34”*	

Intermediate	*40”*	*42”*	
Middle School	*40”*	*40”*	
High School	*40”*	*40”*	

Electric Hand Dryers
Mount bottom of hand dryers from 38” AFF to bottom of mounting box.

Toilet Room Fixtures				
	Lavatories	*Water Closets*		*Urinals*
	Rim AFF	*Rim AFF*	*Controls AFF*	*Rim AFF*
Adults	*33"*	*17”*	*44"*	*17"*
Kindergarten	*25"*	*15"*	*36"*	*14”*
Primary	*25"*	*15"*	*36"*	*14"*
Intermediate	*30"*	*15"*	*36"*	*14"*
Middle School	*30"*	*17"*	*44"*	*17"*
High School	*33"*	*17"*	*44"*	*17"*

Shower Heads
All shower heads shall be mounted at 78" AFF except as required by ADA shower stalls.

Electrical Switches and Outlets	
	AFF
Wall Switches, Dimmers	*48" top of box*
Standard Wall Receptacles	*16" bottom of box*
Receptacles Above Counter Tops	*
Exterior Wall Receptacles	*24” bottom of box*
Exit Lights	*Above top of door frame openings or suspended from ceilings, noted on drawings per code requirements.*
Standard Telephone Outlets	*16” bottom of box*
Wall Mounted Telephone	*48” top of box*
Wall Mounted Telephone – Handicap	*40” top of box*
Telephone Above Counter Tops	*
TV Outlet (Ceiling/Wall)	*80” bottom of box*
TV Outlet (Table Top)	*16” bottom of box*
Standard Wall Data Outlets	*16" bottom of box*
Data Outlets Above Counter Tops	*
Fire Alarm Pull Station	*48” top of box*
Fire Alarm Audio/Visual Device	*80” bottom of box*
Electrical Shunt trip	*80” bottom of box*

**** Coordinate exact location of outlet with design of casework, counter top and backsplash. The intent is to have outlets centered in 4" backsplashes (preferably horizontally). If no backsplash, center vertical box about 4" above the counter top in a stud wall; in a CMU wall, locate top or bottom of box at a block joint, whatever makes sense.***

DIVISION l1 – EQUIPMENT

The American National Standards Institute (ANSI) Z9.2-1971 is adopted as the new standard for "fundamentals governing the design and operation of local exhaust systems". This ANSI code refers back to NFPA 91 for the installation of "Blower and Exhaust Systems".

Environmental Health and Safety requires that all fume hood exhaust systems meet these OSHA standards and that the installation and design meet NFPA 91 and 68 codes. The "Fire Protection Handbook" (13th NFPA edition, 1969 section 9, chapter IV) is also recognized by the State Fire Marshal's Office as regulating the design and installation of Blower and Exhaust Systems.

11400 – FOOD SERVICE EQUIPMENT

11160 Loading Dock Equipment

This section again is one of the broadscope type, used for specifying a complete system of loading dock equipment. CSI's Masterformat lists several narrowscope section numbers and titles for use when only individual items of equipment are required.

Dock levelers
Adjustable dock ramps
Portable ramps, bridges and platforms
Seals and shelters
Dock bumpers

Close attention to loading dock design can result in benefits during operation of the facility. Use improved loading dock seals rather than wood dock bumpers.

11860 - Waste Handling Equipment

Trash Disposal

The District recommends trash compactors, i.e. "BFI".

SECTION THREE

DIVISION 12 - FURNISHINGS

General

The Owner will coordinate furnishings and equipment needs and bid/purchase through the Owner's Purchasing Department.

Blinds

Provide heavy duty scissors track assembly with (1) inch aluminum slats, decorator valences and all mounting hardware to be consistent with District and/or State Contract.

12305 - PLASTIC LAMINATE FACED CASEWORK

PART 1 - GENERAL

SUMMARY

Provide labor, materials, and equipment necessary for the complete installation of educational casework shown on the Drawings, specified herein, or listed in the Casework Schedule.

Refer to Section 01030, Alternates, for a description of the alternate that affects the work of this Section.

This Work includes special and modified stock design pre-assembled units for installation as movable, fixed, or built-in, as noted on the Drawings, or listed in the schedule.

The catalog numbers of the manufacturer listed on the Casework Schedule are intended to include a complete and total item, as the catalog number is specified in the manufacturer's current catalog. Although the description in the schedule is brief, the item shall be provided complete with hardware, accessories, features, and components.

The use of dimensions and specific requirements set forth in Drawings and Specifications are not intended to preclude the use of other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction, and workmanship.

Work Not Included: Resilient base, general millwork, blocking within walls, floors, or ceilings required for reinforcement and support, stainless steel sinks and fittings, and electrical outlets.

Installation of manufactured casework (does not include millwork items 06200) by the General Contractor is prohibited unless approved by the casework manufacturer and the Architect.

Casework and finish shall conform to ADA and Florida Accessibility Code for Building Construction, latest edition.

DEFINITIONS

Exposed Portions of Casework: Include surfaces visible when doors and drawers are closed. Bottoms of cases that are more than 4 feet above the floor shall be considered exposed. Visible members in open cases or behind glass doors or bottom of wall-hung cabinets also shall be considered as exposed portions.
Semi-Exposed Portions of Casework: Includes those members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors. Tops of cases 6'-6" or more above floor shall be considered semi-exposed.
Concealed Portions of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

SUBMITTALS

Bidder shall submit to the Architect, within 21 days of bid receipt, a sample base cabinet and countertop constructed in accordance with these specifications by one of the specified casework manufacturers. Owner/ Architect review of sample cabinet will occur prior to awarding contract. Bid may be rejected by Owner if sample cabinet is not included with the Bid Proposal. Bid may be rejected by Owner if sample cabinet is not constructed in accordance with these specifications.
The casework manufacturer shall furnish shop drawings giving details and sizes including methods of attachment and anything pertinent to the installation work, as soon as possible after the award of the Contract. He shall include full Specification requirements; include 3 color samples of finishes for the Architect's selection. Show locations for support in metal stud walls (09250).
The casework manufacturer and supplier shall keep aware of the progress of the Project and shall make sure that shop drawings are furnished in adequate time so that the casework covered thereby can be fabricated and delivered in accordance with the scheduled completion.

1. *Submit guarantee as specified herein.*

2. *Submit complete and working shop drawings for all casework items.*

JOB CONDITIONS

Do not deliver casework to project site until dry and heated storage space is provided. The casework specified under this Section is prefinished and precaution must be taken to protect it against damage during installation and until fmal acceptance.
Contractor shall be responsible for quantities as shown on casework layouts on Drawings.
The manufacturer/supplier shall be responsible for making field measurements to insure proper fit of casework items.

QUALITY CONTROL

Defective workmanship or damaged components shall be corrected, repaired, or replaced as requested by the Architect, without further cost to the Owner.
Manufacturer Qualifications: At least 7 years experience in the manufacturer and installation of the type of cabinets specified.
Installer Qualifications: At least 5 years experience in the installation of the type of cabinets specified.

GUARANTEE

The entire installation shall be guaranteed for a period of 3 years from the Date of Substantial Completion against defects in material and workmanship in accordance with the terms of the Contract. The guarantee shall cover repair or replacement, without cost to the Owner, of items that become defective within the 3-year period. Damage to the equipment caused by improper operation or misuse is not covered by this guarantee.

PART 2 - PRODUCTS

MANUFACTURER

Products of the following manufacturers are acceptable provided they comply with all technical specification requirements, materials, construction, and details in every respect. Standard production casework will not be allowed. Manufacturers shall conform to all requirements as specified herein.

1. *LSI Corporation of America, Minneapolis, Minnesota*

2. *Stevens Cabinet Co., Teutopolis, Illinois*

3. *Trimline, Dickinson, North Dakota*

4. *Case Systems, Normal Wood Products, Midland, Michigan*

5. *Westmark Commercial Casework, Tacoma, Washington*

Catalog numbers shown on the Educational Casework Schedule on Drawings refer to items manufactured by Trimline (TMI), Dicksonson.

WORKMANSHIP

Verify machine parts for accurate fit and assemble with appropriate fastenings and adhesives to result in true, square, level, and plumb units.
Verify dimensions of other trades to be built into casework. Provide removable or false backs for access or concealment of heating or plumbing items. Scribe tops and back splashes to walls and other adjoining vertical surfaces. There shall be a minimum scribe with cabinets at end walls unless shown otherwise.

MATERIALS

Plastic Laminate

Plastic laminate shall be high pressure laminate conforming to NEMA LD3-1991. Thickness: .028 inch, GP28 grade, with a density of 90 pounds per cubic foot.

Required kinds shall be chosen from current Wilsonart "Design Group 1" series of all solid color and wood grain and patterned laminate materials with low luster textured finish, as produced by the Ralph Wilson Plastics Company of Temple, Texas, or Pionite, Formica or Nevamar or Architect approved equivalent palette with similar number of available choices. Colors/patterns shall be selected by the Architect from among the full complement of choices for each component. Palettes of limited available choices for casework colors are not acceptable.

Exposed horizontal surfaces: Shall be nominal .050 inch thick minimum with textured finish and conforming to NEMA standards for GP50 horizontal grade.

Exposed, interior and exterior vertical surfaces: Shall be .028 inch thick minimum with low luster textured finish and conforming to NEMA standards for GP28 vertical grade.

Backing sheet for concealed surfaces: Shall be .030 or .020 inches thick, conforming to NEMA standards for GP28 vertical grade or CL20 cabinet liner.

Backing sheet for semi-exposed surfaces: Shall be .030 or .020 inches thick, conforming to NEMA standards for GP28 vertical grade. Use to balance face laminate.

Color of laminate

Exposed Interior: To match exterior.

1. Exposed interiors include open cabinets and cabinets with glass doors.

Exposed exterior, as selected by Architect.

Concealed exterior, manufacturer's standard or other color as may be selected by Architect.

Melamine

Melamine shall be saturated paper laminated to core. Weight of paper shall not be less than 80 grams.

Semi-exposed surfaces: Melamine shall conform to NEMA LD3-3.1-1991 for wear requirements for GP28 vertical grade.

Color of melamine: Manufacturers standard neutral color or other color as may be selected by Architect.

Leading Edges

Door and drawer fronts shall be edged with a 3mm thick high impact PVC extrusion, with satin finish.

Horizontal and vertical front cabinet members shall be flat edged with a 1mm thick high impact PVC extrusion, with a satin finish.

Colors of PVC leading edges:

1. *Open Units: Shall match exterior plastic laminate color.*

2. *Horizontal and Vertical Front Cabinet Members: Shall match exposed plastic laminate color or as selected by Architect.*

3. *Semi-Exposed Locations: Shall match interior plastic laminate color.*

4. *Drawer and Door Fronts: As selected from colors to match plastic laminate or as selected by Architect.*

Particleboard

Cabinets and Countertops: Provide Premium Industrial Grade, conforming to the Commercial Standards CS-236-66 Type I, Density B, Class 2, Property Requirements, (CS IB2), also known as ANSI A208.I -1979.

Density, Ib. per cu. ft. ……..47

Modules or Rupture, Ib. per sq. in. ……2500

Modulus of Elasticity, Ib. per sq. in. ……..450000

Internal Bond, Ib. per sq. in. ……100

Thickness Swell (24 hr immerse) ……4%

Moisture Content % by weight ……..6.0

Screw Holding Face ……..330

Edge ……..250

Surface Strength Ib. per sq. in. ……..275

Hardness Ib. ……..900

Hardboard

Hardboard used in the cabinets whether exposed or semi-exposed shall be ANSI AI35.4, Class I tempered, smooth, 2 sides equal to "Duron" by U.S. Gypsum Company.

Plywood, Hardwood

Solid lumber or plywood concealed members; solid wood to be hardwood, kiln dried, select Poplar, or mill option lumber and plywood shall be Baltic Birch 7-ply.

Provide Marine grade boat plywood, 4 feet either side of sinks (Wet Areas) back splash shall also be marine grade boat plywood. Provide plywood (non-marine grade) at remaining countertops and back splashes.

Refer to Alternate for 7-ply Baltic Birch Plywood for cabinets

Locks

Locks shall be of cylinder type cast with 5-disc tumbler mechanism. Each lock shall be provided with milled brass key and keying as specified in keyed different and master keyed or keyed alike. Locks shall be provided as shown on equipment drawings or described in cabinet description.

Each area or room shall be keyed alike.

Locks shall be master keyed using the casework manufacturer's keying system. (This is independent to the building master keying system.)

HARDWARE AND MISCELLANEOUS

Hinges: Institutional 5 knuckle with interlaying leaves capable of 270 degree swing. They shall be of nominal .090 inch minimum thickness steel and shall be hospital tipped with non-removable pins fastened with 4 screws each leaf into faces. No edge fastening allowed.

Finish: Powder coat baked-on enamel, finish.

Color: As selected by Architect.
Pulls: Shall be accurately positioned on drawer and door fronts and positively through fastened with machine screws.

Brushed, polished chrome: Similar to color selected by Architect.

Drawer Slides

Provide one of the following: Manufacturer's standard, epoxy coated metal, nylon rollers, 100 pounds dynamic load (or) European style, bottom mounted, captive profile, epoxy finished, nylon rollers, and 100 pounds dynamic loading with positive in-stop and out-stop.

Provide out-stop and out-keeper to maintain drawer in 80 percent open position.

File drawers and paper storage drawers: Same as above except full extension and load rating static position to be no less than 125 pounds, Accuride 3832.

Adjustable Shelf Supports: Molded nylon or nickel, 2 pin, anti-Iift, minimum 200 pounds capacity support clip.

Catches: Shall be roller type. Manufacturer's standard roller catch equivalent to LSI "LH-345" catch assembly.

PARTICLE BOARD CABINET CONSTRUCTION

Cabinet Bases

Manufacturer's standard 4 inch high base construction of water repellent treated 3/4 inch plywood. Provide additional center support for cabinets over 24 inches wide.

Base, Wall, and Tall Cabinet Boxes

Sides, bottom, and top: Constructed of glued and spline doweled 3/4 inch particleboard, providing balanced construction, surfaced with cabinet liner CL20 for semi-exposed and vertical grade laminate for exposed locations.

Wall cabinet bottoms and tops: Constructed of glued and spline doweled one inch thick particleboard, providing balanced construction surfaced with vertical grade laminate for exposed locations and cabinet liner CL20 for semi-exposed locations.

Back panel: Constructed of minimum 3/8 inch particleboard or 1/4 inch pre-finished tempered hard board, surfaced with melamine for semi-exposed and vertical grade laminate for exposed locations, inset and glued into sides, bottom, and top.

Exposed backs: Constructed of 3/4 inch particleboard, surfaced with vertical grade laminate of balanced construction for semi-exposed locations, glued and spline doweled, and mechanically attached if required.

Intermediate support rail: Minimum 3/4 inch particleboard, surfaced with vertical grade laminate of balanced construction, glued and doweled into cabinet sides.

Hanger rails: Two located at top and bottom of cabinet back, 3 on tall cabinets, locate at top, bottom, and center of 3/4 inch particleboard.

Fixed and Adjustable Shelves and Dividers

One-inch particleboard shelves.

Exposed Locations: Vertical grade plastic laminate on both sides. Color to match cabinet exterior plastic laminate or as selected by Architect.

Semi-exposed locations: Vertical grade plastic laminate or melamine.

Front and back leading edges shall be edged with flat 1mm thick high impact PVC edging to match shelf color.

Number of adjustable shelves provided, unless indicated otherwise on the Drawings or on the Schedule

1. Low and tall cabinets

1 up to 24 inches	*4 up to 72 inches*
2 up to 36 inches	*5 up to 84 inches*
3 up to 60 inches	*6 up to 96 inches*

2. Wall hung cabinets

0 up to 24 inches	*2 up to 36 inches*
1 up to 30 inches	*3 up to 40 inches*

Adjustable dividers: 1/4 inch minimum thickness, pre-finished tempered hardboard or particleboard, smooth both faces, retained by molded plastic support clip.

Fixed dividers: Constructed of 3/4 inch particleboard, surfaced with vertical grad laminate or melamine; providing balanced construction; glued and spline doweled. PVC edged to match laminate or adjacent PVC edging.

Cabinet Doors

Hinged Doors

3/4 inch particleboard and 1 inch particle board for tall cabinets.

High-pressure plastic vertical grade laminate exterior.

Doors 48 inches and less in length shall have 2 hinges per door; doors over 48 inches in length shall have 3 hinges per door.

Corners: Square with radiused edges, 3mm PVC edging, or using standard grade laminate.

Drawers

Manufacturers standard construction of minimum components listed below; or high-density fiber board; glued and doweled or dovetail jointed; surfaced with vertical grade laminate or melamine of balanced construction. Bottoms constructed of minimum 1/4 inch tempered hardboard, surfaced to match drawer sides, inset and glued to four sides.

Drawer Face

Constructed of minimum 3/4 inch particleboard, surfaced with high-pressure vertical grade laminate exterior, screw attached to the drawer box.

1. Corners: To match doors.

2. Edging: To match doors.

3. Plastic Laminate: To match doors.

File Drawers

File drawers shall be constructed in accordance with a) and b) above. File drawers shall have front-to-back and side-to-side hanger file capability with hanger channel for letter size files integral with file drawer sides. 3/16 inch by 1/2 inch removable steel channel to span side-to-side for legal size hanging files.

PLYWOOD CABINET CONSTRUCTION (Alternate)

Cabinet Bases

Manufacturer's standard 4 inch high base construction of water repellent treated, 3/4 inch plywood. Provide additional center support for cabinets over 24 inches wide.

Base, Wall, and Tall Cabinet Boxes

Sides, bottom, and top: Constructed of glued and spline doweled 3/4 inch plywood, providing balanced construction, surfaced with cabinet liner CL20 for semi-exposed and vertical grade laminate for exposed locations.

Wall cabinet bottoms and tops: Constructed of glued and spline doweled one inch thick plywood, providing balanced construction surfaced with vertical grade laminate for exposed locations and cabinet liner CL20 for semi-exposed locations.

Back panel: Constructed of minimum 3/8 inch plywood or 1/4 inch pre-finished tempered hard board, surfaced with melamine for semi-exposed and vertical grade laminate for exposed locations, inset and glued into sides, bottom, and top.

Exposed backs: Constructed of 3/4 inch plywood, surfaced with vertical grade laminate of balanced construction for semi-exposed locations, glued and spline doweled, and mechanically attached if required.

Intermediate support rail: Minimum 3/4 inch plywood, surfaced with vertical grade laminate of balanced construction, glued and doweled into cabinet sides.

Hanger rails: Two located at top and bottom of cabinet back, 3 on tall cabinets, locate at top, bottom, and center of 3/4 inch plywood.

Fixed and Adjustable Shelves and Dividers

One-inch plywood shelves.

Exposed Locations: Vertical grade plastic laminate on both sides. Color to match cabinet exterior plastic laminate or as selected by Architect.

Semi-exposed locations: Vertical grade plastic laminate or melamine.

Front and back leading edges shall be edged with flat 1mm thick high impact PVC edging to match shelf color.

Number of adjustable shelves provided, unless indicated otherwise on the Drawings or on the Schedule

1. Low and tall cabinets

1 up to 24 inches	*4 up to 72 inches*
2 up to 36 inches	*5 up to 84 inches*
3 up to 60 inches	*6 up to 96 inches*

2. Wall hung cabinets

0 up to 24 inches	*2 up to 36 inches*
1 up to 30 inches	*3 up to 40 inches*

Adjustable dividers: 1/4 inch minimum thickness, pre-finished tempered hardboard or plywood, smooth both faces, retained by molded plastic support clip.

Fixed dividers: Constructed of 3/4 inch plywood, surfaced with vertical grad laminate or melamine; providing balanced construction; glued and spline doweled. PVC edged to match laminate or adjacent PVC edging.

Cabinet Doors

Hinged Doors

3/4 inch plywood and 1 inch plywood for tall cabinets.

High-pressure plastic vertical grade laminate exterior.

Doors 48 inches and less in length shall have 2 hinges per door; doors over 48 inches in length shall have 3 hinges per door.

Comers: Square with radiused edges, 3mm PVC edging, or use standard grade laminate.

Drawers

Manufacturers standard construction of minimum components listed below; or high-density fiber board; glued and doweled or dovetail jointed; surfaced with vertical grade laminate or melamine of balanced construction. Bottoms constructed of minimum 1/4 inch tempered hardboard, surfaced to match drawer sides, inset and glued to four sides.

Drawer Face

Constructed of minimum 3/4 inch plywood, surfaced with high-pressure vertical grade laminate exterior and interior, screw attached to the drawer box.

1. Comers: To match doors.

2. Edging: To match doors.

3. Plastic Laminate: To match doors.

File Drawers

File drawers shall be constructed in accordance with a) and b) above. File drawers shall have front-to-back and side-to-side hanger file capability with hanger channel for letter size files integral with file drawer sides. 3/16 inch by 1/2 inch removable steel channel to span side-to-side for legal size hanging files.

PLASTIC LAMINATE COUNTERTOPS

Square Edge Configurations: I inch to 1-1/8 inch thick monolithic particleboard with 1-1/4 inch edge face including top and bottom laminates.

Top and matching front edge to be high-pressure plastic laminate factory bonded.

Provide balancing sheet on opposite face.

Provide countertops for base cabinets and counter sections.

Laminate tops and shall be continuous in practical lengths. When requiring splice joints, use a combination of splines or dowels for alignment and tite-joint fasteners as required to make a uniform and gap less joint. Splices in counter top materials shall not occur where openings for sinks or other holes are required.

1. *Provide continuous top for counter type cabinets fixed in a line.*
2. *Back and end splashes shall not rest on to. Top shall butt to back and end splashes, joint shall be set in appropriate sealant.*

Provide 4 inch high scribable, square set, color matching, and mechanically attached back splash with end splashes.

1. *Back splashes are required at locations where countertops abut walls where indicated on Drawings.*
2. *Edges of back and end splashes shall be of square edge configuration.*

Sealants: Fully bed and seal splashes to tops and to other splashes with Dow Corning 786 Mildew Resistant Silicone Sealant, clear.

Additional approved manufacturers of mildew resistant silicone are as follows:

1. *General Electric*
2. *Rhone-Poulenc, Inc.*

Provide Marine grade boat plywood, 4 feet either side of sinks (Wet Areas) back splash shall also be marine grade boat plywood. Remaining areas shall be plywood.

PLASTIC LAMINATE COUNTERTOPS (Alternate)

Square Edge Configurations: I inch to 1-1/8 inch thick monolithic plywood with 1-1/4 inch edge face including top and bottom laminates.

Top and matching front edge to be high-pressure plastic laminate factory bonded.

Provide balancing sheet on opposite face.
Provide countertops for base cabinets and counter sections.

Laminate tops and shall be continuous in practical lengths. When requiring splice joints, use a combination of splines or dowels for alignment and tite-joint fasteners as required to make a uniform and gap less joint. Splices in counter top materials shall not occur where openings for sinks or other holes are required.

1. Provide continuous top for counter type cabinets fixed in a line.

Provide 4 inch high scribable, square set, color matching, and mechanically attached back splash with end splashes.

1. Back splashes are required at locations where countertops abut walls where indicated on Drawings.
2. Edges of back and end splashes shall be of square edge configuration.
3. Back and end splashes shall not rest on to. Top shall butt to back and end splashes, joint shall be set in appropriate sealant.

Sealants: Fully bed and seal splashes to tops and to other splashes with Dow Corning 786 Mildew Resistant Silicone Sealant, clear.

Additional approved manufacturers of mildew resistant silicone are as follows:

1. General Electric
2. Rhone-Poulenc, Inc.

Provide Marine grade boat plywood, 4 feet either side of sinks (Wet Areas) back splash shall also be marine grade boat plywood.

PART 3 – EXECUTION

<u>INSTALLATION</u>

Shop drawings and installation instructions furnished by the manufacturer shall be strictly adhered to. Mechanics making the installation shall be experienced in this type of work and capable of the highest quality of workmanship. Installation of casework shall conform to The Architectural Woodwork Institute (A WI) Quality Standards, Installation of Woodwork, latest edition.

Countertops shall be installed flush against wall. Provide clear sealant at the top and around the ends of countertops, end and back splashes where they meet wall surfaces.

Cut openings in countertops for sinks or other items required. Cut to size from template furnished by supplier of sinks or use the designated sinks on job.

Make use of filler sections and scribe panels to fit cabinet work into specific dimensions.
Provide maintenance instructions to Architect prior to request for final payment

Upper cabinets shall always be aligned with base cabinets unless otherwise approved by Architect.

ADJUSTMENT

Adjust door catches, drawer slides, and other moving parts after installation to provide proper operation.

End cabinets placed against comers where they tee into other cabinets or obstacles shall be provided with chain or bracket stops on the inside of the doors to prevent the door or door handles from hitting the obstruction.

CLEANING

Exposed surfaces, edges, and cabinet interior shall be cleaned, and construction and installation marks removed prior to acceptance by Owner.

Supplier of this equipment shall be responsible for the immediate removal and disposal of trash, crating, and construction debris.

All foreign matter and sawdust created by installation of cabinets shall be removed from the interior and exterior of cabinet.

SECTION THREE
DIVISION 13 - SPECIAL CONSTRUCTION

Miscellaneous

Vacuum Cleaning System: Consider Spencer system, if budget permits, possibly as an add alternate.

Clocks: Shall be plug-in type not on a master clock system.

Telephone Conduit: All telephone wiring is district property. Termination must be coordinated through the appropriate telecommunications firm.

Key-operated Switches: For continuity throughout the campus, specify only Pass & Seymour devices.

SECTION THREE
DIVISION 14 - CONVEYING SYSTEMS

14200 - ELEVATORS

PART 4 - GENERAL

4.1 DEFINITION: Elevators shall be required as a means of vertical transportation for all new two story (or greater) schools and existing two story schools undergoing Comprehensive Needs projects to meet ADA compliance.

A. Intended Use:

1. *The primary use of an elevator is for students, staff and visitors that are not able to use a stairway. A secondary use is for transport of items that are too bulky or oversized to be moved from story to story by stairway. The elevator is not intended to be a high use item and should not be used as a normal means of vertical transportation.*
2. *This elevator standard is designed and written for an indoor elevator only, where entry and exit occur within the facility. The reason for this is to protect elevator components from the Florida climate and moisture. The elevator equipment room shall also be located within the facility and in a climate-controlled environment to control heat load.*
3. *If an exterior elevator is used, as in the case of a reused prototype building, it shall be protected from the elements with the use of canopies and overhangs.*

B. Basis of Product Selection

1. *The elevator manufacturers listed in this standard have been selected on product dependability, availability, user-friendly service, experiences with past installations and design requirements established by codes and user requirements established by SDOC Facilities Operations.*

4.2 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or experienced installer approved by elevator manufacturer, who has completed elevator installations similar in material and design to the Construction Project.

B. Regulatory Requirements: Manufacturer and Contractor shall comply with applicable provisions in ASME A17.1 "Safety Code for Elevators and Escalators".

C. Florida Statutes: Chapter 399.

D. Florida Administrative Code: Chapter 61C-5.

E. Accessibility Requirements: Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG) Section 4.10 Elevators.

F. Pre-Construction Surveys/Conferences

1. The elevator manufacturer or the elevator installer shall attend the pre-construction conference and clarify components, conditions, schedules, testing and certification with the prime contractor.

4.3 INSPECTION AND CERTIFICATION

A. The elevator must be inspected and approved by an independent qualified elevator inspector (Q.E.I.) before a Certificate of Occupancy is issued for the facility.

4.4 SUBMITTALS: GENERAL INSTRUCTIONS, PRODUCT DATA, CERTIFICATES

A. Manufacturer's Product Data sheets shall be required for each item specified.

B. Shop Drawings

1. Show plans, elevations, sections and large-scale details indicating service at each landing, machine room layout and locations of equipment and signals.

C. Samples shall be specifically required for non-specified manufacturer's products submitted as a Substitution.

D. Maintenance Manual

1. Supply to the owner an operation and maintenance instructions manual that includes a parts inventory listing and emergency operation instructions and wiring diagrams. All replacement parts, to include the electronic controller, shall be available to the owner for purchase and installation after the warranty period has expired. (See Div. 1 Section 01770 – Closeout Procedures for O&M submittal requirements.)

E. Record Wiring Diagram:

1. Supply the owner with a job specific record set of the wiring diagram used for the installation of the elevator to include related connection charts and diagrams.

4.5 WARRANTY

A. Project Warranty shall be as stated in Division 1 of the Project Manual.

B. Maintenance Service

1. Routine maintenance consisting of regular examinations, adjustments and lubrication of the elevator equipment shall be provided by the installation contractor for the entire 1 year warranty period.

C. Installer's Warranty

1. The elevator contractor's warranty covers defective material and workmanship. The guarantee period shall be as stated in Division 1 of the Project Manual.

*PART 5 - **PRODUCT***

5.1 ACCEPTABLE MANUFACTURERS

A. ThyssenKrupp Elevators

B. KONE Elevators Escalators.

C. Otis Elevator Co.

5.2 COMPONENT PERFORMANCE CHARACTERISTICS:

A. System Description:

1. *Type: Twin direct acting hydraulic cylinder without well holes.*
2. *Rated Capacity and Speed: 3000 pounds @ 100 fpm.*
3. *Number of Stops: 2.*
4. *Minimum car inside dimension: 6'-8" wide x 4'-9" deep x 7'-4" beneath the suspended ceiling.*
5. *Platform Size: 7'-0" wide x 5'-6" deep.*
6. *Main Power Supply: 480 volts, 3 phase*
7. *Entrance Width and type: 3'-6"x7'-0" Single-Slide Door.*
8. *Lighting Power Supply: 120 volts, 1 Phase,*
9. *Hoistway Entrance Frame Finish: Satin Stainless Steel*
10. *Hoistway Entrance Door Finish: Satin Stainless Steel*
11. *Door Opening Time: 4.0 seconds.*
12. *Controls: Provide manufacturers microprocessor operation system. The owner shall be able to purchase the microprocessor from the manufacturer or have the microprocessor and solid state components repaired by the manufacturer. Controls shall be illuminated and vandal proof. Controls shall be **nonproprietary**.*
13. *Hall and Car Signal Fixtures: Illuminated vandal proof hall buttons shall be provided at each landing. Faceplates shall be satin finished stainless steel with vandal resistant fasteners. Provide a minimum of eight (8) keys for the car controls.*
14. *Operation System: Single elevator, Two Stops fully automatic "Simplex Selective Collective Operation" as defined in ASME A17.1.*
15. *Intercom Provisions: Elevator shall have an ADA vandal resistant phone in the elevator cab. Telephone lines, in conduit, shall be furnished from the elevator cab to the elevator equipment room.*
16. *Cab Interior finishes:*

    a. *Front return, door and transom: Satin Stainless Steel*
    b. *Cab Shell: Baked enamel painted steel.*
    c. *Removable wall panels: Wood core finish (no particle board)*
    d. *Reveals & Base: Satin Stainless Steel*
    e. *Railing: Provide handrails on sidewalls and back wall of elevator 1/2'"x1 - 1/2".*
    f. *Suspended Ceiling: Minimum height of 7'-4" with a solid ceiling panel.*

g. Interior Lighting: Indirect using 120V 1 phase fixtures. The interior lighting shall have a main lighting system connected to standard power and an auxiliary lighting system connected to the emergency generator.

h. Flooring: Flooring shall be a single piece material, Altro Safety Flooring, Designer 25 Series. (Note to A/E: Flooring furnished and installed by others.)

17. Motor: Elevator motor shall have "solid state" starting and an overload device.

18. Sills: Extruded metal.

5.3 ELEVATOR OPERATION

A. Pressing a car button or a hall/landing button will "call" the car and bring it to the designated landing. A call for either landing or within the car may be made while the car is in motion. The car shall proceed to the next recorded landing that has been programmed until the calls have been satisfied. The car shall come to rest at the last called landing.

B. Provide an emergency stop switch, an alarm button and a light switch in the elevator car control panel.

5.4 ELEVATOR DOOR

A. The door shall have a solid state, multi-beam, infrared light array door protection system.

5.5 HOISTWAY ENTRANCE:

A. Provide manufacturers standard horizontal sliding door and frame hoistway entrance complete with track systems, hardware, sills and accessories.

5.6 STANDBY POWER OPTION

A. The elevator shall be equipped for standby power operation, usually in the form of a standby generator. On operation of standby power the elevator will return to designated floor and parked with doors open.

5.7 MACHINE ROOM

A. The elevator equipment room shall be adjacent to the elevator and be climate controlled to not allow overheating of the equipment or fluids.

5.8 ALLOWABLE SUBSTITUTIONS

*A. Products other than those named in Acceptable Manufacturers and Specific Products above may be substituted when in conformance with all of the individual requirements stated in Component Performance Characteristics **and** approved by SDOC.*

5.9 BASIS OF DESIGN** type specifications shall **NOT** be used in the preparation of this Section. The Architect shall clearly specify a minimum of three named manufacturers complete with type and specific product selected. **Manufacturers utilizing proprietary controllers will not be allowed. Controllers must be easily serviceable by any elevator service vendor.

PART 6 - EXECUTION

6.1 EXAMINATION

A. Examine all elevator areas for compliance with manufacturer's requirements for installation tolerances. Verify dimensions and examine structure. Proceeding with the elevator installation acknowledges contractors acceptance of existing site and building conditions. Do not proceed with any installation if unsatisfactory work conditions exist.

B. Any dimensional discrepancies shall be recorded and given to the prime contractor for correction before installation commences.

6.2 INSTALLATION AND ENVIRONMENTAL CONDITIONS:

A. It is important that hydraulic fluids are not allowed to leak into the environment. Spill plates shall be under all pumps and equipment that store hydraulic fluids. Vibration isolation shall be used on vibrating equipment to lessen structure borne noise from entering the facility.

B. Specified items of elevator equipment shall not be delivered or installed until the building is enclosed.

C. Install cylinders plumb and accurately centered for the elevator car position and travel.

D. Provide welded connections or continuous steel members in the elevator hoistway.

E. Assure that all moving parts are lubricated as recommended by the manufacturer.

F. The elevator alignment in the shaft is very important. Coordinate the installation of the hoistway entrances and the guide-rails for an accurate alignment of the entrances with the cars. Install sills and frames after car has been installed in the shaft.

G. A leveling tolerance of ¼" should be used for travel of the car passed the landing. Set the sills flush with the finished floor of the elevator.

6.3 DEMONSTRATION

A. A manufacturer's representative shall demonstrate to the owner the proper use, operations and maintenance and emergency procedures to follow if there is a failure of the elevator.

6.4 PROTECTION

A. Do not allow use of the elevator by anyone until it has been tested and certified as explained in ASME A17.1. Do not use the elevators for construction purposes.

SECTION THREE

DIVISION 15 – MECHANICAL

HVAC Design Guidelines

All HVAC systems shall be designed in accordance with the latest version of the Standard Mechanical Code (SMC), Uniform Building Code (UBC), SREF Requirements, and the Florida Building Code Latest Edition Mechanical Section. In addition, the following guidelines are mechanical design guidelines and requirements for all School District of Osceola County projects. Requests for deviations from the guides and requirements must be made in writing to School District of Osceola County. Phase II and Phase III Documents will be reviewed and signed off by Design Review Committee (DRC) members and the appropriate maintenance representatives prior to construction. All HVAC projects will be commissioned per the Department of Energy Guidelines.

Mechanical Design Guidelines

The following Phase II submittal requirements are in addition to the requirements listed in the Florida Administrative Code 6A-2. These submittal items are for review by the School District of Osceola County and are intended to demonstrate compliance with SDOC requirements and for review of the system design as it pertains to indoor air quality concerns. The design, plans and submittal items will be reviewed by School District of Osceola County with a peer review by their continuing contract Mechanical Engineer.

1. *Provide floor plans of the proposed HVAC systems along with equipment sizing and schedules.*

2. *Indicate the quantities of outside ventilation air and how this outside air is to be introduced to the spaces, conditioned and dehumidified when the spaces are occupied and unoccupied.*

3. *Provide a proposed sequence of operation for the different applications of the air-conditioning systems within the project, i.e. classroom, gymnasium, dining, administration, etc. School District of Osceola County specifications, Sections 15950 "Energy Management and Controls System" and Section 15985 "Sequence of Operation" spec shall review Section B.*

4. *Complete a HVAC design parameter worksheet for each HVAC system type and each building type within the project.*

5. *Provide a simple psychometric analysis of air conditioner cooling performance of the system selected by the FLEET analysis during full and partial loads (75%, 50%, 25%) for each typical air handling system to show that adequate dehumidification and cooling will be provided at full and partial loads.*

General

HVAC Systems shall be selected based on life cycle cost analysis results and confirmed by the Department of Education. The Architect/Engineer shall inform the SDOC facilities staff of the probable first and maintenance costs of the various alternatives prior to life cycle cost submission.

Provide mechanical equipment in separate mechanical rooms with access from outside. Air conditioning units, conduit and piping shall not be installed on roofs. Rooms shall be designed to allow minimum of (4) four feet clear walk space around equipment. Install manufacturer recommend clearances for air handling units, boilers, chillers, VAV boxes, pumps, valves, etc.

All mechanical rooms and equipment rooms shall contain emergency lighting.

Engineer shall provide a psychometric analysis of air conditioner cooling performance of the system selected by the life cycle cost analysis during full load and partial sensible loads (75%, 50%, 25%) for each typical air handling unit to show that adequate dehumidification and cooling will be provided at full and partial loads. This information shall be provided to SDOC and Contractor for review prior to proceeding with Phase II documents.

15100 Indoor Design Parameters

Cooling temperature set points shall be adjustable between 72° to 78° F. Relative humidity shall be at 60% or below per ASHRAE Standard 55-92 during full and part load conditions. Heating temperature set points shall be adjustable between 68° to 72° F.

Duct static pressure sensor shall be located in DDC panel. Tubing shall be ran for sensor 2/3" down the length of the duct.

Cooled and heated occupied spaces shall be provided with ventilation air at the rate established by the latest revision of ASHRAE Standard 62 by the "Ventilation Rate Procedure" where acceptable air quality is achieved by providing ventilation air of the specified quality and quantity to the space.

Outside air shall be controlled by CO^2 sensors in Gym, Cafeteria, and Media Center.

Maintain positive pressure within conditioned spaces (relative. to unconditioned environments) during occupied periods. Maintain neutral or positive pressure in conditioned spaces during unoccupied periods. Pressure relief shall be by dampers, power exhaust fans are undesirable.

Provide positive air balance for all air-conditioned buildings.

Noise levels shall not exceed ASHRAE recommendations, and ARI Standard 885, procedure for estimating occupied space sound levels.

All classrooms shall be designed with individual zone controls and space thermostat. Thermostats shall be auto changeover with separate heating and cooling set points with limited set point adjustment accessible to District Staff. DDC software shall limit cooling range to 72° to 78° F cooling and 70° F heating. A minimum of one humidistat per AHU system shall be located in a typical room. Locate humidity sensors in critical spaces.

Plans and details shall include location of central workstation and all control panels and devices. In addition, plans shall Indicate control zones with room numbers and zone names as coordinated with SDOC. For example, if three AHUs and one exhaust fan are to be turned on/off at the same time, Indicate the zone by showing a dashed box around all areas served by these units. Specify that control diagrams shall be installed in respective mechanical rooms in a lockable glass and aluminum case

Time schedule shall be used to control Outside Air and all exhaust. Time schedules shall be the same for Outside Air and all exhaust.

Service space and access requirements for all equipment shall be indicated on the drawings (using dashed line) to include equipment, components and filter removal. All clearance shall be per manufacturer spec design.

Kitchens and food preparation areas shall be air conditioned separate from primary system. DX systems are preferred due to hours of operation. Dry storage areas shall be cooled and dehumidified 24 hours per day, 7 days per week using separate DX systems. Consider use of packaged heat recovery units to preheat makeup water to hot water heaters.

The Architect shall insert in the Mechanical General Conditions of the Specifications for the project the following statement: "Final payment for this Contractor's work will not be approved until Owner's independent Test and Balance Company confirms conformity to plans and specifications and all DDC control sequences are verified by the design engineer."

The construction documents shall specify that the Contractor is solely responsible for coordinating their work with the Owner's Test and Balance firm. All discrepancies drive changes, etc. reported by Engineer or Owner's Test and Balance Firm or Commissioning Authority shall be corrected by the Contractor within five-calendar day at no additional cost.

Refrigeration equipment shall utilize refrigerant R-134A, or 410A. Machines shall utilize R-134a, or 410A refrigerant. Mechanical room ventilation refrigerant detection and purge shall be designed per ANSI/ ASHRAE Standard latest edition. Alarm signal shall be tied into EMCS System.

To facilitate weekend and holiday use, Administration Buildings shall have backup DX systems for entire area. If budget is restrictive, provide as an alternate bid.
Prefer gas-heating boilers to electric heat. No steam systems. Natural gas preferred over LPG if available at site. Fuel oil is not desirable. For standardization purposes, specify Honeywell burner controls and Locinvar, Wright, Burham, or Teledyne Laars boilers, and LonMark interface to DDC.

All boilers, even under 400,000 BTU, shall be equipped with hi limit manual reset and flow control switch, where flow is critical to installed boiler. Boilers shall have an emergency cut of switch located at door entrance (inside). Boilers must have proper temp and pressure gauges on tanks, discharge, and return lines. Boiler rooms shall have sufficient lighting.

Where possible, boiler shall be located separate from chiller rooms due to high noise level. All fresh air intakes shall not be installed near outside ground, to prevent dirt and dust from being drawn into boiler fans, burners and controls. A gas detector shall be located in boiler rooms. Boilers shall have more room for proper servicing from front and rear. No piping, etc. shall be located near access panels.

Boilers, like Lochinvar type, shall not be stacked 3 high due to service being difficult. Boilers shall have isolation valves on supply and discharge. All flow to floor drains shall be carefully sloped, installed in H&V and boiler rooms so that water will not stand. New boilers and controls shall be the same make as the majority of boilers, with that type of installation.

Owner Test and Balance will be provided under a separate Owner Contract and Specification using National Standards Total System Balance by Associate Air Balance Council. Test and Balance shall be A.A.B.C. members and maintain all A.A.B.C. certifications.

All control wiring shall be installed in conduit. For accessible ceiling spaces, plenum rated cable may be used, if strapped to building structure using data rings.

15200 – Systems

Do not use horizontal fan coil or unit ventilators where possible. If unit ventilators are required due to structural reasons, do not introduce ventilation air into unit. Provide ventilation air through preconditioned outside air systems.

15300a – Direct Expansion Cooling Systems

Utilize multiple compressors with unloading capability where possible.

For multi-stage equipment utilize dual (or more) circuit split face coil with the first stage of cooling on the bottom of the coil. Do not use row split or intertwined coils.

Consider hot gas reheat where conditions require reheat for humidity control.

Where possible, utilize a separate zoned 100% outside air unit to provide conditioned, dehumidified air to the classrooms in lieu of providing raw outside air to each air handling unit. This unit will be controlled to provide air to the space at near space conditions or to supplement cooling/heating of the space. The outside air A/C unit shall be controlled by the energy management system, shall include motorized outside air dampers, and shall have minimum 30% efficiency filters. During non-occupied times, outside air unit shall close the outside air damper. Provide end switches on the outside air to ensure that dampers are open.

15300b – Chilled Water Systems

Cooling coils shall be piped counter flow to airflow.

Provide central system chilled water temperature control to provide adequate low temperature water for dehumidification. Chilled water temperature reset shall not be used unless space humidity is being monitored throughout the facility. Design shall deliver cold chilled water at part-load. Do not bypass water through an inactive chiller.

Utilize multiple chillers or multi-stage chillers after 200 tons. Provide a minimum of 25% redundancy for chiller system (i.e. if the block cooling load is 200 tons, the chiller plant shall be capable of providing at least 100 tons if any one chiller, pump, cooling tower, or refrigeration circuit is down). Air-cooled equipment is preferred if life cycle cost is comparable with other alternatives. .

Piping systems serving more than one building shall be primary-secondary with backup pumping capacity for secondary pump(s). The piping layout shall be coordinated with school master plan to facilitate future growth.

Provide service isolation shutoff valves, a separate balancing valve, Venturi flow meter (or circuit setter), strainer, drain, and automatic air vents at each coil.

Provide strainer downstream of the isolation valve at each coil with drain valve and nipple fitting.

Specify pipe-flushing velocities to remove sand and debris prior to system start-up, mains 10 f.p.s., branch piping 15 f.p.s.

For renovation, replace split-row or intertwined multi-circuited coils with split face coils with bottom coil activated first.

Isolation valves shall be ball (2-1/2" and under) or butterfly (3" or greater). Gate valves are not acceptable. Provide isolation valves at each building and main building areas.

Central systems shall be capable of providing cooling and heating to maintain acceptable temperature and humidity levels in all buildings. Four-pipe systems are preferred. No two or three pipe distribution systems are permitted.

For re-circulating systems with outside air ducted to return duct, provide motorized low-leakage dampers for the outside air intake and return air. These dampers shall be spring return and operate independent and be controlled by the energy management system and shall close when the air handling unit is shut down or when the space is not occupied. Outside air dampers shall be on a separate schedule from the equipment on/off schedule. Consider specifying a low occupancy mode of operation in control sequences. Motion detectors are not acceptable; instead CO^2 sensors shall be used to control Outside Air, on main rooms, per ASRAE Outside Air

Standard. Provide manual dampers in the outside air and the return air ducts to balance the outside air to the unit.

If a variable air volume system is utilized, the system must be designed to ensure the correct flow of ventilation air is distributed to occupied spaces at all supply airflow conditions during occupied periods.

Condensate drains shall be 1" minimum, sloped 1/4" per four feet, and shall be designed to allow individual cleanout of each line. Condensate drain trap detail and piping shall be shown on the drawings. An air gap shall be provided in the condensate drain at the exterior of the building. Condensate drywells are not desired. If possible, route condensate to storm drainage system. Condensate drains should connect to air outside perimeter of the building envelope. Condensate drains that connect to dry wells or other soil may become direct conduits for soil gas and can be a major entry point for radon.

Refrigerant piping shall be shown on the drawings. All piping below slab shall be run in a piping chase or conduit of sufficient size to allow replacement of the piping in the future. Each end of the chase shall be sealed air and watertight. Refrigerant piping above grade shall be accessible or enclosed in a suitable chase. Specify Contractor to submit refrigerant piping shop drawings. DX equipment manufacture shall certify sizes, per Carrier System Design Manual.

Ductwork shall be externally wrapped sheet metal construction with all joints sealed per SMACNA Standards. Observation of construction should include visual inspection of duct workmanship. All concealed, insulated ductwork shall be wrapped in lieu of lined, except where required for sound control. Any lined duct shall have microbial/moisture preventative coating.

Sound and vibration control of mechanical equipment shall be part of the mechanical design. Noise levels shall be carefully considered in the selection of all mechanical equipment and design of ductwork systems. No cork or neoprene absorption pads. Spring isolation on all equipment is preferred.

Water treatment service shall be included for all HVAC hydronic systems for the warranty period. The water treatment system will be periodically checked by the company currently under contract for the other facilities within the district.

Piping and ductwork located in or passing through an UL-listed wall, floor, or roof/ceiling assembly shall have the requirements of the UL listing included on the drawings. The UL-listing number shall be identified on the drawings.

New schools and major additions shall include the installation and or expansion of a DDC Energy Management and Control System. Basis of design shall be according to LonTalk protocol EIA standard 709.1: Carrier, Circon, and Irvine Mechanical, based on past performance, see LonMark spec. Check with SDOC if an existing system is on campus.

Do not use common headers or returns on the condenser side of the chilled water system. Each chiller shall be piped to its own tower. Each supply riser pipe to each tower shall have a check valve. Each tower, chiller and condenser pump shall be cross-connected with manual valves to provide redundancy.

Carbon Dioxide shall be used as fire extinguishers for range hoods. The Ansul system is preferred.

Provide lockable covers for security over thermostats and sensors in gym and common areas.

Rooftop mechanical units will not be accepted for new design work unless approved by SDOC project manager. If DX systems are considered, use split systems. There is to be no AHUs above ceilings or attics per energy code and the Maintenance Department.

Combustion heating systems should be provided with combustion air and dilution air from outside the occupied space in accordance with the Standard Gas and Mechanical Code.

The following spaces should be designed for 24-hour air conditioning and dehumidification (The use of industrial dehumidifiers is preferred for after hours dehumidification):

A. Computer Labs
B. Science Labs
C. Record Storage Rooms
D. Band Instrument Storage Room
E. Data Rooms
F. Media Centers
G. Textbook Storage Rooms

SDOC prefers chilled water systems where life cycle costs show it to be comparable with other systems. If DX, split DX systems are preferred over packaged DX units. Rooftop units are not desired.

15400 - Equipment

For standardization purposes, central station AHU design shall be based on Carrier, Trane, York and McQuay as the only acceptable manufacturers. Air handling units and fan coil units shall be double wall construction, if available. The primary condensate drain pan shall be stainless steel and sloped to drain completely on one or both sides. Heating coils shall be placed in the reheat position. Install access panels for inspection and cleaning every 10 feet in sheet metal duct to access coils, screens, heaters, flow stations, etc. The use of germicidal lamp technology should be considered.

Air handling and ductwork systems shall be protected form construction dust during the construction period. Specifications shall include provisions for system inspection and cleaning if deemed necessary at no additional cost to Owner.
Provide a minimum of 30% efficiency filter for all air handling units and fan coil units. Pleated throwaway type is preferred. Specify standard manufactured size. At least one set of filters shall be installed in all equipment during construction and replaced with a new set prior to Contractor test and balance and again prior to Owner test and balance. All outside-air shall be filtered with minimum 30% dust spot extended surface efficiency filters. All filters shall be readily accessible. Contractor shall replace all filters monthly after startup of systems until Final Completion.

Outside Air intake louvers shall have 1/2" x 1/2" minimum mesh screen.

The Architect and Engineer shall select and specify insulation systems that not only satisfy the minimum energy standards, as defined by the State Energy Efficiency Code, but also prevent condensation during periods of start-up of the system. Fiberglass pipe insulation may not be used as cold pipe insulation. Horizontal rain leaders and the bottom of all roof drains shall be insulated. Control valves, piping specialties and condensate drain lines shall be insulated.

Cooling towers shall be set at a sufficient height to ensure net positive suction pressure at pumps. Cooling towers shall be located a sufficient distance away from outside air intakes to prevent contamination of the intake air.

Centrifugal pumps are preferred. Triple duty valves are not desirable.

Install water meters on all loops. Meters shall be analog.
A two (2) year warranty, maintenance and service contract shall be included in the specifications for the complete HVAC system. The specification shall include detailed requirements of agreement.

Provide for Owner to receive manufacturer's brochures and operating instructions from Contractor, and for Mechanical Subcontractor to instruct School Maintenance technicians in operating procedures.

If electronic flow meters are used, specify Venturi type with electronic analog differential pressure sensor for measuring flow.

Smoke detectors shall be photoelectric type. Ionization type smoke detectors shall not be used.

As a minimum, humidistats shall be located in:

- *A. Book Storage*
- *B. Library*
- *C. Print Rooms*
- *D. Media Rooms*
- *E. Computer Labs*
- *F. Science Labs*
- *G. Typical classrooms*
- *H. At least one per building on campus*

** Do not install humidistats in return air ducts for after hours dehumidifier.*

Classroom thermostat set point shall be occupant adjustable (with software limits). VAV boxes shall be marked by room on all T-STATs, ceilings, and Energy Management Systems. No 277 volt single-phase motors.

All Variable Frequency Drives shall be provided by either the controls or mechanical contractor. ABB, Graham, or Baldor are acceptable manufacturers. Motors to the drives shall be the same manufacturer as the drives, with Class G insulation. Motors shall meet or exceed all MG1 requirements.

Locate returns accessible away from dust creating surfaces (chalkboards, etc.).

Supply and return air devices shall be aluminum.

All return air grilles shall be filtered with l" throwaway filters with hinged access. Contractor shall provide initial set (used during construction), balance set (used for Contractor Test and Balance) and final set (used for Owner Testing). After Owner Testing period, Owner shall replace filters during warranty period.

Ceiling mounted and above ceiling air handling units are not desirable.

Specifications shall include a statement that if any unit AHU (10 tons or greater) vibrates and is causing noise problems, the fan shall be dynamically balanced in the field to factory specifications at no additional cost to Owner.

Plans shall indicate analog pressure gauges, thermometers, and Pete's plugs on the supply and return of all chillers, boilers, and pumps.

For fuel tanks, provide a fuel tank level indicator located in the Mechanical Room and provide an alarm to BAS on fuel level.

Cooling tower design shall be based upon Marley, Baltimore, or Evapco Air Coil. Basin shall be stainless steel. Fins shall be non-corrosive material. Specify guardrails and service access ladders. Cooling tower motors shall be located outside air stream.

Underground chilled and hot water piping on larger systems shall be underground, steel welded, pre-insulated piping. All underground piping shall be steel welded, domestic pipe. Foam glass insulation is allowable for smaller systems. Install insulation on pump housing that is removeable for service.

15500 – Renovations/Equipment

Specifications shall indicate that the Contractor shall be fully responsible for refrigerant recovering, recycling, etc. for existing equipment per current EPA and ASHRAE requirements and all recovery forms shall be handed over to SDOC.

For projects where it is necessary to disconnect, relocate, or otherwise involve existing equipment, the Architect and Engineer shall ensure that the Contractor first establish the condition of the equipment by completing an Equipment Log Sheet. Engineer shall include this Log Sheet in the Specifications.

The Specifications shall clearly define the role of both the Contractor and the School Maintenance personnel during construction, start-up, and warranty period.

Coordinate any new controls with existing controls on campus. Intent is to have only one DDC control system manufacturer per campus. Coordinate requirements with the Maintenance Department prior to design.

15600 – Plumbing/Fire Protection Design Guidelines

All plumbing and fire protection systems shall be designed in accordance with the latest version of the Standard Plumbing Code (SMC), NFPA 13, Uniform Building Code (UBC) and SREF Requirements. In addition, the following guidelines are design guidelines for all SDOC projects. Request for deviations from the guides and requirements must be made in writing to School District of Osceola County.

Domestic boilers with separate storage tanks are preferred over the forced draft tank type water heaters.

For standardization and availability of equipment and parts, Bell and Gossett Pumps are preferred for pipe systems 2" and larger. Grunfos pumps are preferred for pipe systems less than 2".

All underground and under floor gas lines shall be welded and coated - no threaded joints underground or under floor. All propane installations shall follow 601 Florida Standards.

Plumbing Valves shall be ball type (2-1/2" and under) or butterfly (3" or greater). Gate valves are prohibited. No foreign-made or PVC valves and no CPVC valves over ¾". Do not specify self closing valves or valves with plastic stems.

For standardization purposes, Sloan, Regal, Zurn, Theia, or Royal flush valves shall be specified. No other fixtures are acceptable.

Fully recessed drinking fountains or other recessed & remote type fixtures are prohibited. NO floor mounted drinking fountains.

Oasis and Elkay drinking fountains are acceptable manufacturers.

No wall-hung toilets (for vandalism and cost reasons). Tile grout floor mounted water closet to floor. Caulking floor mounted fixtures to floor is prohibited.

No floor urinals.

All CPVC transition fittings (both MIP & FIP) shall be CPVC X Brass IPS.

No CPVC ballvalves over ¾" in size.

No PVC male adaptors. Transitions are to be made with PVC schedule 80 nipples only.

All air-hammer arrestors shall be Zurn Shocktrols and installed with isolation valves.

All water closets shall be flushometet or tank type. Pressure-assisted are prohibited due to cost of maintenance.

All flushvalves shall be extrernally mounted, no concealed installations.

All C.I. lavatories shall be installed with concealed-arm, chair carriers.

All hose bibs shall be Woodsford loose key.

All wall hydrants shall be Woodsford, Watts or Zurn only.

All hose bibs and wall hydrants shall have isolation valves.

All trap primers shall be non-mechanical tailpiece trap primers.

No point-of-use instant electric waters heaters.

All cleanouts must be brought to grade and provided with a concrete apron.

No kitchen sinks with stoppers and chains.

All kitchen sinks with scullery/level drains.

All kitchen sinks shall be supplied with T&S commercial fixtures.

All rest room lavs. shall be supplied with T&S commercial fixtures.

Upstream and downstream cleanouts required on all grease traps.

All lids for grease traps must be heavy-duty traffic lids.

All irrigation systems must use Schedule 40 PVC at a minimum of 12 inches deep. For beds, use poly pipe with flexible piping. Purple primer when gluing shall be used.

Shut-off valves should be liberally placed to isolate sections of the facility without disrupting the operation of other operations within the facility.

Cleanouts should be located maximum of 75'-0" on 4" and larger piping and 50'-0" for smaller piping. Wall hydrants and hose bibs should be located a maximum of 100'-0" part.

Floor drains are required in all showers, locker rooms, concession areas, toilet rooms, boiler rooms and air handler/mechanical rooms. Primer tap required on all floor drains except in kitchen areas. Approved deep seal trap can be used in lieu of trap primer in areas accepted by Owner.

No Type "M" or "K" copper piping. Only Type "L" copper piping is desired. If PVC or CPVC is to be used, use Factory U.L. fitting, no field fittings permitted. No PVC waterlines inside footer lines.

No copper waste lines to photo lab sinks or sinks subject to acid use.

Acid Waste systems shall be fused seal plastic pipe. Glass waste pipe shall not be specified.

Hot water piping shall be insulated per the Florida Energy Efficiency Code. Horizontal rain leaders and the bottom of all roof drains shall be insulated with closed cell type insulation.

Fire Protection (sprinkler) systems shall be designed by the project engineer of record with all work clearly shown on the construction drawings. The design of the system shall not be specified for the Contractor. Utilize recessed sprinkler heads with concealing cover where possible.

If the plumber provides condensate lines, lines shall be 1" minimum, sloped 11/4" per foot, and shall be designed to allow individual cleanout of each line. An air gap shall be provided in the condensate drain at the exterior of the building. Condensate drywells are not desired. Rout condensate to storm drainage system, if possible. Condensate drains should connect to air outside perimeter of the building envelope. Condensate drains that connect to dry wells or other soil may become direct conduits for soil gas and can be a major entry point for radon.

Piping and ductwork located in or passing through an UL-listed wall, floor, or roof/ceiling assembly shall have the requirements of the UL listing included on the drawings. The UL-listing number shall be identified on the drawings.

15700 - Renovations/Plumbing

For projects where it is necessary to disconnect, relocate, or otherwise involve existing equipment, the Architect and Engineer shall ensure that the Contractor first establish the condition of the equipment by completing an Equipment Log Sheet. Engineer shall include this Log Sheet in the Specifications.

Specifications shall clearly define the role of both the Contractor and the School Maintenance personnel during construction, start-up, and warranty period.

END OF SECTION

15950 - HVAC Controls

1.1 Description

This section defines the Basic Materials and Methods used in the installation of LONWORKS Control products to provide the functions necessary for control of the mechanical systems on this project.

A. Provide a Facility Management and Control System incorporating LonWorks, Direct Digital Control, equipment monitoring, and control consisting of microprocessor based plant control processors interfacing directly with sensors, actuators, and environmental delivery systems (i.e. HVAC units); electric controls and mechanical devices for all items indicated on drawings described herein including dampers, valves, panels, sensing devices; a primary communications network to allow data exchange between microprocessor based devices.

B. The system will consist of a flat, open architecture that utilizes the LonTalk protocol as the common communication protocol between all controlled and controlling devices. Where necessary, or desired, LonTalk packets may be encapsulated into TCP/IP messages to take advantage of existing infrastructure or to increase network bandwidth. Hiearchal systems consisting of master or global controllers that poll and/or control less intelligent unitary controllers on a secondary bus will not be considered.

C. The system network shall be an Echelon LON. All nodes shall communicate with each other over a twisted pair of wires, utilizing Echelon's free topology transceiver (FTT-1OA). There will be no consideration given to any System Network, which does not use an Echelon LON as the primary communications network. System controllers shall be capable of sharing standard network variable data with other LON-based devices that utilize the same transceivers.

D. System controllers shall utilize either the Echelon's 3120 or 3150 Neuron microprocessor for network communications. "Hosted" controllers that utilize a 3rd party chip coprocessor for communications are not acceptable. Controllers shall be capable of accepting control programs downloaded over the LON.

E. The system installed shall seamlessly connect devices other than HVAC throughout the building regardless of subsystem type, i.e. HVAC, lighting, and security devices should easily coexists on the same network channel with out the need for gateways. These components shall share common software for network communications, configuration, time scheduling, alarm handling, history logging, and custom programming.

F. Gateways shall not be used unless specifically authorized by the project engineer. Use of a gateway requires submittal of the documentation as required by the owner or owner's representative. It is the intent of this specification that gateways be limited to integrating legacy systems where applicable. Acceptance of Gateways is at the sole discretion of the owner and/or owner's representative.

G. System Monitoring and Supervisory Control shall be provided through the installation of GUI software applications that support either a direct driver to the LonWorks database. GUI workstations shall provide complete access to any point in the system at any time. Remote Operator interfaces and configuration tools shall be supported by the database in a client-server fashion.

H. The control system shall be able to accommodate multiple user operation. Access to the control system data should be limited only by operator password. Multiple users shall have access to all valid system data.

I. The control system shall be designed such that mechanical equipment will be able to operate under stand-alone control. In general, the operation of any controllers on the network shall not rely on any other controller for its operation. Functionality such as scheduling, trending, and alarming shall be resident in each and every controller including both programmable and configurable controllers regardless of where they reside on the network. System controllers that require a master computer, or a dedicated function module such as an alarm, schedule, trend, or data-logging module are not acceptable. 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 of the resident time clock in each controller and the resident program stored in nonvolatile memory as detailed herein. In such a case, each individual controller shall continue to trend and alarm data commensurate with the data storage capabilities of each controller until a network connection can be restored.

J. The documentation contained in this section and other contract documents pertaining to HVAC Controls is schematic in nature. The Contractor shall provide hardware and software necessary to implement the functions shown or as implied in the contract documents.

K. System configuration and monitoring shall be performed via a PC-type computer. Under no circumstances shall the PC be used as a control device for the network. It can be used for storage of data.

L. LonWorks components not supplied by the primary manufacturer shall be integrated to share common software for network communications, time scheduling, alarm handling, and history logging.

M. All system controllers shall utilize a peer-to-peer communications scheme to communicate with each other and with the PC-type monitoring computer(s).

N. Controllers shall contain non-volatile memory for storage of control programs, configuration, set points, time schedules, and historical log data. All such data shall be retained in the event of a power failure. System controllers shall have an on-board battery-backed real-time clock to ensure correct time-of-day operation following a power failure. Terminal Device Control Units controllers (VAV's, heat pumps, etc.) shall be peers on the network and be able to obtain time synchronization from plant controllers upon network power up.

O. History data logging and alarm detection shall be attained from all LonWorks controllers in the network, including third party LonWorks devices from alternate manufacturer's. This data shall be monitored in the user interface software.

P. Controllers shall use a software mechanism for network addressing and identification. It shall not be necessary to set physical network address switches on each controller.

Q System shall utilize Lonmark defined standard network and command protocol types (implicit messaging) for all system data including, but not limited to physical input and output values, input and output overrides, as well as general purpose input and output values used by the controller's control program. Systems that utilize proprietary explicit messaging or protocol converters shall not be acceptable.

1.2 Summary of Work

A. Provide LONWORKS based products that communicate on multiple channels to meet the functional specifications as indicated on the drawings and the dedicated product functional specifications and profiles specified in other sections.

B. Provide FTT-1OA LonTalk™ routers and repeaters as required to combine different communication channels onto a central field bus or as required to segment groups of Intelligent Devices and/or Control Units.

C. Provide Intelligent Devices (ID's), Programmable Control Units (PCU's), and Terminal Device Control Units (TDCU's) as herein specified and as indicated on the HVAC drawings.

D. Provide wire, raceway systems, 24 DC and/or 24 AC power supplies and final connections to nodes provided by this contract and the following Control Units.

E. The Building Management System Contractor shall provide all controls, sequences of operation, and systems monitoring as required by these specifications and by the drawings. Provide all required devices, sensors, hardware, software, wiring, controllers, etc. The Building Management System shall be configured to provide all controls, sequences of operation, and systems monitoring as required by these specifications and by the drawings. Provide all required devices, sensors, hardware software, wiring, controllers, etc.

F. The Facility Management System shall be configured to provide all controls, sequences of operation, and systems monitoring as required by these specifications and by the drawings. Provide all required devices, sensors, hardware, software, wiring, controllers, etc.

G. If required, the system shall allow the future integration of other systems (Card Access, Lighting, Intrusion Monitoring) on the network proposed in this document, and also share common software for network communications, time scheduling, alarm handling, and history logging.

1.4 Products Furnished, but not Installed under this section:

A. Control Valves
B. Temperature Sensor Wells and Sockets
C. Flow Switches
D. Flow Meters
E. Automatic Dampers
F. Air-flow Stations

1.6 Quality Assurance

A. General

1. The HVAC Control System shall be furnished, engineered, and installed by Licensed Trade Technicians. The contractor shall be an Echelon Certified Network Integrator or LonWorks Integrator. The contractor shall employ technicians who have completed Echelon factory training. The contractor shall employ technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.

B. System Integrator Qualifications

1. The system integrator must be regularly engaged in the service and installation of LonWorks based systems as specified herein, and must have been so for a minimum of three (3) years. The system integrator must be an authorized representative in good standing of the manufacturer of the proposed hardware and software components, and must have been so for a minimum of three (3) years.

2. *The system integrator shall have an office that is staffed with designers trained in integrating interoperable systems and technicians fully capable of providing LonWorks instruction and routine emergency maintenance service on all system components. The system integrator shall have in house capabilities to provide control strategies for whole building control. This includes HVAC, lighting, access, and security applications.*

3. *The system integrator shall have a service facility, staffed with qualified service personnel, capable of providing instructions and routine emergency maintenance service for networked control systems.*

4. *The system integrator shall Submit a list of no less than three (3) similar projects, which have LonWorks based Building Systems as specified herein installed by the system integrator. These projects must be on-line and functional such that the Owners/Users representative can observe the system in full operation.*

5. *The system integrator must be a certified LonWorks Integrator, or submit resumes with the proposal indicating passing certificates for Echelon Corporation's approved interoperable, or proof of equivalent training. Such proof must include summary of coursework and indicate both written and laboratory requirements of alternate training.*

C. Hardware and Software Component Manufacturer Qualifications

1. *The manufacturer of the hardware and software components must be primarily engaged in the manufacture of LonWorks based systems as specified herein, and must have been so for a minimum of seven (7) years.*

2. *The manufacturer of the hardware and software components as well as its subsidiaries must be a member in good standing of the Echelon Open Systems Alliance.*

3. *The manufacturer of the hardware and software component shall have an authorized representative capable of providing service and support as referenced in section B above, and must have done so for a minimum of three (3) years.*

4. *The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.*

5. *The manufacturer of the hardware and software components must be authorized to certify LonWorks Integrators as defined by Echelon Corporation. They also must provide for Echelon Corporation's approved LonWorks curriculum.*

6. *The manufacturer of the hardware and software components must have no less than three (3) similar projects, which have LonWorks based building systems as specified herein installed by the authorized representative referenced above. These projects must be on-line and functional such that the Owners/Users representative can observe the system in full operation.*

Acceptable manufacturers of the hardware and software components as specified herein are Circon Technology Corporation or Echelon Corporation.

A. Reference Standards

1. *Control system components shall be new and in conformance with the applicable standards for products specified, LonMark certified, and LNS Base.*

B. Products

1. *Utilize standard PC components for all assemblies. Custom hardware, operating system, and utility software are not acceptable.*

2. *All products (PCUs, TDCUs and IDs) shall contain LonWorks networking elements to allow ease of integration of devices from multiple vendors.*

3. *All materials, equipment and software shall be standard components, regularly manufactured for this and other systems and custom designed for this project. All systems and components shall be thoroughly tested.*

1.7 Submittals

A. General: Submit the following according to conditions of Contract and Division l5 Specification sections. In addition, provide the following:

1. *Product data on all components used to meet the requirements of the specifications such as enclosures, network transceivers, XIF documentation, configuration parameter options, mounting details, power supplies, etc.*

2. *Software documentation regarding the proposed PC operating system, third party utilities and application programs, and the proposed application program for the Control Units.*

3. *Logical and physical diagrams for each channel indicating each node (control devices and ID's), node address (domain, subnet and group), channel type and router specifications.*

4. Submit functional temperature control diagrams for each Mechanical system served by the HVAC Control System. Indicate and Tag each input/output served by each Control Unit or Intelligent Device.

5. Submit 8 sets of submittals for review within 3 weeks of contract award.

B. Shop Drawings

1. The controls contractor shall submit Auto CAD or Visio generated schematic drawings for the entire control system for review and approval before work shall begin. Included in the submittal drawings shall be a one-page diagram depicting the complete system architecture completed with a communications riser. Drawings shall include point-to-point wiring diagrams and must show all temperature controls, start-stop arrangement for each piece of equipment, equipment interlocks, wiring terminal numbers and any special connection information required for properly controlling the mechanical equipment. The submittal shall include a bill of material reference list as well as equipment sequences of operation.

2. The submittals shall include manufacturer's catalog data describing each item of control equipment or component provided and installed for the project.

3. System Color Graphics using the AutoCAD or Visio generated schematic drawings. Dynamic points, menus icons, commandable points, etc. should be clearly identified. Color conventions proposed for all graphics. Close-Out Documents.

C. Record Submittals

1. Submit final copies of the shop drawings outlined in above. These final submittals shall reflect all field modifications and change orders required to complete the installation. Submit the following quantities of record submittal drawings immediately following receipt of notification of substantial completion. Auto CAD drawing or VISIO files of all shop drawings on 3-1/2" floppy disks or CD ROM disks.

2. Eight (8) complete sets of documents located in a three-ring notebook and organized by subject with divider tabs shall be provided.

1.8 Operation and Maintenance Manuals

A. Submit 4 sets of operation and maintenance manual in accordance with requirements of Division 1. One set to be delivered directly to Osceola School District maintence department, marked attention Jim D`Amico.

Include the following documentation:

1. *GUI Software Users Manual.*

2. *Network Management Software User Manual specific to each tool package provided.*

3. *Maintenance Instructions: Document all maintenance and repair/ replacement procedures. Provide ordering number for each system component, and source of supply. Provide a list of recommended spare parts needed to minimize downtime.*
4. *Documentation of network variables, network node configurations, priority interrupts, node binding, address structure, etc.*
5. *Each control panel shall include a control wiring diagram of the contents of that panel. Laminate and permanently affix to the inside door of the control panel.*
6. *All software, plug-ins and tools needed to program the system shall be turned over at this time.*

1.9 Instruction of Owner Operating Personnel

A. All training shall be by the HVAC Controls Contractor and shall utilize specified manuals, as-built documentation, and the on-line help utility.

B. Operator training shall include four initial eight-hour sessions. The initial operator training program shall be to establish a basic understanding of Windows based software, functions, commands, mouse, etc. The training shall encompass as a minimum:

1. *Troubleshooting of input devices, i.e., bad sensors.*
2. *Sequence of operation review.*
3. *Sign on -sign off.*
4. *Selection of all displays and reports.*
5. *Commanding of points, keyboard and mouse mode.*
6. *Modifying English text.*
7. *Use of all dialogue boxes and menus.*
8. *System initialization.*
9. *GUI Software.*
10. *LONWORKS® Network Management Software.*

1.10 Acceptance Procedure

A. Upon completion of the installation, Contractor shall start-up the system and perform all necessary calibration and testing to ensure proper operation of the project control system.

B. Schedule a hardware demonstration and system acceptance test in the presence of the Contracting Officer and/or the Engineer. The acceptance testing is defined as demonstrating the sequence of operation as indicated in the drawings. The hardware demonstration is specified in this Section. The Contractor shall perform all tests prior to scheduling the acceptance test and hardware demonstration to insure the overall system is ready for inspection and observations.

C. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and be deemed substantially complete as defined in Division 1.

1.11 Warranty

A. The HVAC Control System shall be free from defects in workmanship and material under normal use and service. If within eighteen (18) months from the date of substantial completion, the installed equipment is found to be defective in operation, workmanship or materials, replace, repair or adjust the defect at no cost. Service shall be provided within 4 hours upon notice from Owner's designated Representative.

B. The warranty shall extend to material that is supplied and installed by the Contractor. Material supplied but not installed by the Contractor shall be covered per the above to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation.

C. All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.

1.12 Product Delivery, Storage, and Handling

A. Do not install electronic hardware in the project until non-condensing environmental conditions have been established. Products installed in violation of this request maybe requested to be replaced at no additional cost to the project.

B. Coordinate storage requirements for factory mounted terminal control units on air terminal devices, air handling units or other packaged control equipment. Do not store control units on site in non-conditioned areas for more than two weeks.

C. Factory-Mounted Components: Where control devices specified in this section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

Part 2 - Products

2.1 Central Operator's Workstation

A. General Requirement

1. A central operators workstation is already installed at the District Maintenance Department. This computer shall be updated to include any new plug-ins and software needed to connect to and service the job site. This includes, but not limited to updates for LonMaker, LNS updates, plug-ins and such. A new computer with software not compatible with LonMaker will not be accepted. The new system must be able to operate under the existing computer format.

2. A new workstation shall be provided at the school site. Location shall be determined by the school's rep. The new computer shall consist of a personal computer (PC) based workstation, with Pentium processor, 1.5 Ghz minimum clock speed, minimum 500MB of ram, CDRW drive, 60MB EIDE hard drive (or better) suitable for peripherals and applications. Operator work station shall include 17" flat panel monitor, mouse, keyboard and 10/100 Ethernet board. All software needed to commission, install, replace, reprogram, and service the system shall be included and installed on the new workstation

3. System shall support multiple Operators Work Stations.

4. The Workstation shall not function as a dedicated control device to the network. It shall be connected to the LonWorks network via standard LonWorks network connection device.

5. The contractor shall provide a hand held service tool for the system for each site. The hand held must be able to perform all service functions for all the controllers installed on campus, not just the VAV box controllers. If a hand held device is not available for the system, a laptop computer with the same requirements as listed for the above workstation, shall be provided for each site.

B. Operator Interface Software

1. The Interface software shall utilize Microsoft Windows 2000/XP based operating and utility software.

2. The graphical user interface software shall be as outlined in "User Interface Software" below.

3. *The Interface Software will not act as a control component for the network. In particular, it shall not perform the following functions:*

   a. *HVAC Global Sequence of Operation.*
   b. *Electrical Demand Limiting.*
   c. *Time of day synchronization for the network as desired by system operator.*

4. *A web appliance, such as an Echelon i-Lon 100 shall be acceptable as long as:*

   a. *The appliance is programmed to allow the user to access all user changeable points.*
   b. *The contractor shall turnover all copies of the latest plug-ins for LNS to the owner.*
   c. *The web appliance can be used for a remote network interface for LonMaker for windows.*

2.2 Plant Control Unit (PCU)

A. General Requirements

1. *Control Units shall be equipped with either the Echelon's 3120 or 3150 Neuron microprocessor for communications. There shall be intermediate device between the Neuron chip and the input and output channels. As referenced above, "Hosted" controllers that utilize a 3rd party chip for communications processing are not acceptable. The controller shall have a minimum of 32K programmable non-volatile (flash or EEPROM) memory for general data processing, power supply, input/output modules, termination blocks, and network transceivers.*

2. *System controllers shall share network variable data with other LON-based devices that utilize the same transceivers as referenced in section 1.1 paragraph Q above.*

3. *Operating system software, custom operating sequence software and application programs shall be stored in programmable, non- volatile memory.*

4. *The PCU unit shall be equipped with a dedicated software clock battery. The battery shall be capable of maintaining time of day, day of week, date, month, and year, independent of system power for a 2-week period. Include an integral calendar with automatic leap year compensation. The PCU will provide time synchronization with TDCU's when required.*

5. *PCU packaging shall be such that complete installation and checkout of field wiring can be performed prior to the installation of electronic boards. Make all board terminations facilitate troubleshooting, repair and replacement. The complete PCU including accessory devices such as relay, transducers, power supplies, etc., shall be wired and housed in an enclosure or as required by the location and local code requirements.*

6. *Provide PCU boards with (1) RJ-11 ports to provide an optional communication link.*

7. *Equip PCU's with diagnostic indicators for the following:*

    a. *Transmit.*
    b. *Receive.*
    c. *IMOK - Application Program is running correctly.*

B. Input/Output Requirements:

1. *At least 50% of the PCU Inputs shall be Universal type capable of handling current, voltage, resistance, or open and closed contacts in any mix. Analog current and voltage inputs of the following types shall be supported in the PCU.*

    a. *4-20 Ma.*
    b. *0-1 volt.*
    c. *0-5 volt.*
    d. *0-10 volt.*
    e. *2-10 volt.*
    f. *1000 ohm RTD or 10K ohm thermistor*

2. *Provide programmable intermediate ranges and linearization table for sensor types specified under the heading, "Sensors". Standard linearization tables will be available for common sensors.*

3. *Thermistor type temperature sensors shall require programmable calibration constant unique to a specific resistance group.*

4. *Digital input types supported by the cu:*

    a. *normally open contacts. (24V and 120V)*
    b. *normally closed contacts. (24V and 120V)*

5. *The PCU shall accommodate both digital and true analog outputs. Voltage (0-12V) and current (4-20 ma) outputs shall be accommodated. All analog outputs shall be proportional current or voltage type with a minimum incremental resolution of 0.5% of the full operating range of the output. Match the proportional range of the output to the full operating range of the actuating device. Use zero and maximum output voltage or current values for shutdown and close-off modes. For troubleshooting and load analysis, the value of each analog output shall be available in the database for trending and display.*

6. *The analog/digital resolution process shall be 12 bit based. The digital to analog resolution process shall be a minimum of 12 bits.*

C. Accessories: Provide the following with each Plant Control Unit

1. *Surge arrestor installed in panel and an on/off switch for panel.*
2. *Overcurrent and transient power protection.*

D. PCU Software

1. *A PCU shall operate totally standalone and independent of a central computer or master device such as a schedule module, for all specified control applications including scheduling, and trending. Software shall include a complete operating system (O.S.), communications handler, point processing, standard control algorithms, and specific control sequences.*

2. *O.S. software shall reside in programmable battery backed RAM, operate in real-time, provide prioritized task scheduling, control time programs, and scan inputs and outputs. O.S. shall also contain built in diagnostics.*

3. *Input/Output Point Processing Software shall include:*

   a. *Continuous update of input and output values and conditions. All connected points are to be updated at a minimum of one- second intervals.*
   b. *Assignment of proper engineering units and status condition identifiers to all analog and digital input and outputs.*
   c. *Analog input alarm comparison with the ability to assign two individual sets of high and low limits (warning and actual alarm) to an input or to assign a set of floating limits (alarm follows a reset schedule or control point) to the input. Each alarm shall be assigned a unique differential to prevent a point from oscillating into and out of alarm. Alarm comparisons shall be made each scan cycle.*

E. Command Software

1. *A "fixed mode" option shall be supported to allow inputs to, and outputs from DDC control programs to set to a fixed state or value. When in the "fixed mode" inputs and output shall be assigned a high residual command priority to prevent override by application programs.*

F. Run Time Totalization or Point Trending:

1. *Run time shall be accumulated based on the status of a digital output point. It shall be possible to totalize either on time or off time up to 60,000 hours with one-minute resolution. Run time counts shall be resident in non- volatile memory and have CU resident run time limits assignable through the operator's terminal.*

2. *Totalized run time or trended data shall be batch downloaded to the Workstation on a daily or weekly basis. Trended data shall reside on the User Interface database server. The automatic update of this data shall be determined by the User Interface and facility management application requirements.*

3. *Transition counter shall be provided to accumulate the number of times a device has been cycled on or off. Counter is to be non-volatile and be capable of accumulating 60,000 switching cycles. Limits shall be assignable to counts to provide maintenance alarm printouts.*

G. Custom DDC Control Loops.

1. *Custom DDC programs are to be provided to meet the control strategies as called for in the sequence of operation sections of these specifications. Each CU shall have residential in its memory and available to the programs a full library of DDC algorithms, intrinsic control operators, arithmetic, logic and relational operators for implementation of control sequences.*

    a. *Proportional Control, Proportional plus Integral (PI), and Proportional plus Integral plus Derivative (PID).*
    b. *DDC control programs shall include an assignment of initialization values to all outputs to assure that controlled devices assume a fail-safe position on initial system start-up.*

2.3 Terminal Device Control Unit (TDCU)

A. General Requirements

1. *Control units shall be equipped with 3150 or 3120 Neuron microprocessor controller, programmable non-volatile memory for general data processing, power supply, input/output modules, termination blocks, and network transceivers.*

2. *System controllers shall be capable of sharing network variable data with other LON-based devices that utilize the same transceivers.*

3. *Operating software, custom operating sequence software application programs shall be stored in programmable, non-volatile memory.*

4. *The TDCU shall synchronize time with PCU on the network upon power up of the network.*

5. *TDCU packages shall be such that complete installation and check-out of field wiring can be performed prior to the installation of electronic boards. Make all board terminations, facilitate troubleshooting, repair, and replacement. The complete CU including accessory devises such as relay, transducers, power supplies, etc., shall be wired and housed in an enclosure or as required by the location and local code requirements.*

B. *Input/Output Requirements*

1. *At least 50% of the TDCU Inputs shall be Universal type capable of handling current, voltage, resistance, or open and closed contacts in any mix. Analog current and voltage inputs shall be supported in the TDCU when appropriate for the application.*

2. *As is appropriate for the application, the Digital input types supported by the TDCU are:*

   a. *Normally open contacts. (24V)*
   b. *Normally closed contacts. (24V)*
   c. *Voltage/no Voltage.*

3. *The TDCU shall accommodate both digital and analog outputs when appropriate for the application. Voltage (0-24V) outputs shall be accommodated. All analog outputs shall be proportional or voltage type with a minimum incremental resolution of .05% of the full operating range of the output. Match the proportional range of the output to the full operating range of the actuating device. Use zero and maximum output voltage or current values for shut-down and close-off modes. For troubleshooting and load analysis, the value of each analog output shall be available in the database for trending and display.*

4. *Digital outputs shall be capable of handling maintained as well as pulsed outputs for momentary or magnetic latching circuits. It shall be possible to configure outputs for 2-mode control.*

5. *The analog/digital resolution process shall be 10 bit based. The digital to analog resolution process shall be a minimum of 8 bit.*

C. TDCU Software

1. *General: A TDCU shall operate totally standalone and independent of a central computer for all specified control applications. Software shall include a complete operating system (O.S.), communications handler, point processing, standard control algorithms, and specific control sequences.*

2. *O.S. software shall reside in programmable flash memory, operate in real-time, and provide prioritized task scheduling, control time programs, and scan inputs and outputs. O.S. shall contain built in diagnostics.*

3. *TDCU's shall have canned programs to minimize configuration and installation time.*
   Canned programs shall be able to be changed so the same hardware component can be utilized in the event the mechanical equipment is removed, and a new mechanical equipment has been added. TDCU's shall also be available in a programmable version for unique equipment sequence operation.

4. *Input/Output Point Processing Software shall include:*

   a. *Continuous update of input and output values and conditions. All connected points are updated at a minimum of one second intervals.*
   b. *Assignment of proper engineering units and status condition identifiers to all analog and digital inputs and outputs.*
   c. *Analog input alarm comparison with the ability to assign two individual sets of high and low limits (warning and actual alarm) to an input or to assign a set of floating limits (alarm follows a reset schedule or control point) to the input. Each alarm shall be assigned a unique differential to prevent a point from oscillating into and out of alarm. Alarm comparisons shall be made each scan cycle.*

5. *A "fixed mode" option shall be supported to allow inputs to and outputs from DDC control programs to set to a fixed state of value. When in the "fixed mode" inputs and outputs shall be signed a high residual command priority to prevent override by application programs.*

2.4 LON Routers, Bridges, Repeaters, and Transceivers

A. Routers, Bridges and Repeaters

1. *Equip each router and bridge with a network transceiver on each network port (inbound and outbound) as dictated by the network type (Type 1 – FTT, Type 2 – TP, Type 3 – PL, Type 4 – LP, Type 5 – RF).*

2. *The network router shall be designed to route messages from a segment, sub-net, or domain in full duplex communication mode.*

3. *Routers and bridges shall utilize LonTalk® protocol transport, network, session layers to transparently route messages bound for a node address in another sub-net or domain.*

4. *Routers, bridges and repeaters shall be fully programmable and permit a systems integrator to define message traffic, destination, and other network management functions utilizing LONWORKS®.*

5. *The routers, bridges, and repeaters shall be capable of DIN rail or panel mounting and be equipped with status LED lights for Network traffic and power.*

B. *Transceivers*

1. *Type 1 Network Transceiver, Free Topology, and Twisted Pair: Provide a transformer isolated, twisted pair transceiver capable of mounting directly on a printed circuit board. The transceiver shall meet the following specifications:*

   a. *Meets LONMARK™ INTEROPERABILITY Association Standards.*
   b. *Differential Manchester encoded signaling for polarity insensitive network wiring.*
   c. *Transformer isolated for common mode rejection.*
   d. *78kbs network bit rate up to distances of 2000m.*
   e. *Free topology supports star, home run, multidrop, and loop wiring.*
   f. *Complies with FCC and VDE requirements.*
   g. *UL recognized component.*
   h. *1.25 MB high speed network.*

2.5 Electronic Input/Output Devices

A. *Temperature Sensors and Transmitters*

1. *General Sensor & Transmitter Requirements*

   a. *Provide sensors and transmitters required as outlined in the input/output summary and sequence of operation, and as required to achieve the specified accuracy as specified herein.*
   b. *Temperature transmitters shall be equipped with individual zero and span adjustments. The zero and span adjustments shall be non-interactive to permit calibration without iterative operations. Provide a loop test signal to aid in sensor calibration.*

c. *Temperature transmitters shall be sized and constructed to be compatible with the medium to be monitored. Transmitters shall be equipped with a linearization circuit to compensate for non-linearities of the sensor and bridge and provide a true linear output signal.*

d. *Temperature sensors shall be of the resistance type and shall be either three-wire 100 ohm platinum RTD, or two-wire 1000 ohm platinum RTD.*

e. *Thermistors are acceptable provided the mathematical relationship of a thermistor with respect to resistance and temperature with the thermistor fitting constraints is contained with the cu operating software and the listed accuracy's can be obtained. Submit proof of the software mathematical equation and thermistor manufacturer fitting constants used in the thermistor mathematical/expressions. Thermistors shall be of the Thermistor (NTC) Type with a minimum of 100 ohm/ºF. resistance change versus temperature to insure good resolution and accuracy. Thermistors shall be certified to be stable ±0.24°F. over 5 years and ±0.36°F. accurate and free from drift for 5 years.*

f. *CU operating software shall be equipped with a self-calibrating feature for temperature sensors.*

g. *The following accuracy's are required and include errors associated with the sensor, lead wire and A to D conversion.*

Point Type	***Accuracy***
Outside Air	***0.50º F***
Chilled Water	***0.50º F***
Room Temperature	***1.00º F***
Hot Water/Steam	***0.75º F***
Duct Temperature	***0.50º F***
Sensors Used in Energy Water (BTU) or Process Calculations	*0.10º F*

h. *Sensors used in BTU or process calculations shall be accurate to ±0.10°F. over the process temperature range. Submit a manufacturer's calibration report indicating that the calibration certification is traceable to the National Bureau of Standards (NBS) Calibration Report Nos. 209527 / 222173.*

B. *Thermowells*

1. *When Thermowells are required, the sensor and well shall be supplied as a complete assembly including well head and greenfield fitting.*

2. *Thermowells shall be pressure rated and constructed in accordance with the system working pressure.*

3. Thermowells and sensors shall be mounted in a threadolet or ½" NPT saddle and allow easy access to the sensor for repair or replacement.

4. Thermowells shall be constructed of the following materials:

a. Chilled and Hot Water: stainless steel.
b. Steam: 316 stainless steel.
c. Brine (salt solutions): marine grade stainless steel.

C. Outside Air Sensors

1. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.

2. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate surrounding the sensor element.

3. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

D. Duct Type Sensors

1. Duct mount sensors shall mount in a hand box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. A neoprene grommet (sealtite fitting and mounting plate) shall be used on the sensor assembly to prevent air leaks.

2. Duct sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. Duct sensors probe shall be constructed of 304 stainless steel.

3. For outdoor air duct applications, use a weatherproof mounting box with weatherproof cover and gasket.

E. Averaging Duct Type Sensors

1. For ductwork greater any dimension than 48 inches and/or where air temperature stratification exists, utilize an averaging sensor with multiple sensing points. The averaging sensor shall be a 304 stainless steel tube with holes extending across the duct or plenum to be sampled. A bleed hole outside the duct or plenum causes air to enter the sample tube and exit at the bleed hole, thus bathing the sensor in average air. The averaging sensor shall be installed complete with end cap, compression fittings, gaskets, mounting flange and required accessories.

2. Provide capillary supports at the sides of the duct to support the sensing string.

F. Room Sensors

1. Room temperature for each system or VAV box shall consist of temp and set point slider or pot. At least one sensor in each building and/or each floor as necessary shall have a network jack for a laptop or hand held device to plug in.

2. Acceptable Manufacturers

a. BAPI Control Products.
b. ACI Control Products.
c. Veris Industries.
d. Mamac.
e. Or approved equal.

G. Relative Humidity Sensors/Transmitter

1. The sensor shall be a solid state, resistance type relative humidity sensor of the Bulk Polymer Design. The sensor element shall be washable and shall resist surface contaminations.

2. Humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2 wire isolated loop powered, 4-20ma, 0-10 vdc linear proportional output.

3. The humidity transmitter shall meet the following overall accuracy including lead loss and A to D conversion.

a. Room Type Sensor ±3% RH
b. Duct Type Sensor ±2% RH

4. Outside air relative humidity sensors shall be installed in a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.

5. Provide a single point humidity calibrator, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.

6. Duct type sensing probes shall be constructed of 304 stainless steel and be equipped with a neoprene grommet, bushings and mounting brackets.

7. Acceptable Manufacturers include:

a. HyCal
b. General Eastern
c. BAPI

H. Differential Pressure Transmitters and Accessories

1. General Air and Water Pressure Transmitter Requirements:

a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage and to hold calibrated accuracy when subject to a momentary 40% over-range input.

b. Pressure transmitters shall provide the option to transmit a 0 to 5V dc, 0 to 10V dc, or 4 to 20 mA output signal.

c. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device and shall be supplied with shutoff and bleed valves in the high and low sensing pick-up lines (3 valve manifolds).

d. Provide a minimum of a NEMA 1 housing for the transmitter. Locate transmitters in accessible local control panels wherever possible.

e. Low air pressure, differential pressure transmitters used for room filter monitoring shall be equipped with a LED display indicating the transmitter output signal.

f. Duct sensing pressure applications where velocity exceeds 1,500 fpm shall utilize a static pressure traverse probe.

2. Low Air Pressure Applications (0 to 0.5" WC)

a. The pressure transmitter shall be capable of transmitting a linear electronic signal proportional to the differential of the room and reference static pressure input signals with the following minimum performance specifications.

1) Span: Not greater than two times the design space DP.
2) Accuracy: Plus or minus 0.5% of F.S.
3) Dead Band: Less than 0.3% of output.
4) Repeatability: Within 0.2% of output.
5) Linearity: Plus or minus 0.2% of span.
6) Response: Less than one second for full span Input.
7) Temperature Stability: Less than 0.01% output shift per degree F. change.

b. The transmitter shall utilize variable capacitance sensor technology and be immune to shock and vibration.

c. Provide a two-year warranty for each transmitter. Replace all transmitters found to be defective at no cost to the owner during the warranty period

3. Acceptable Manufacturers are:

a. VERIS -Model PXLlOO

4. Medium to High air Pressure Applications (.05" to 10.0" WC)

a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except the performance specifications are not as severe. Provide differential pressure transmitters which meet the following performance requirements.

1) Zero & span: %F.S./Deg. F.): .041% including linearity, hysteresis, and repeatability.
2) Accuracy: 1% F.S. (best straight line)
3) Static pressure Effect: .05% F.S. (to 100 psig)
4) Thermal Effects: <±.03% F.S./Deg. F over 40°F. to 100°F. (calibrated at 700°F.)

5. Low Differential, Water Pressure Applications (0" to 20" WC)

a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20ma output in response to variation of flow meter differential pressure of water pressure sensing points.
b. The differential pressure transmitter shall have non-interactive zero and span adjustments, adjustable from the outside cover and meet the following performance specifications.

1) .01 – 20" WC input differential pressure range.
2) 4-20ma output
3) Maintain accuracy up to 20 to 1 ration turndown.
4) Reference accuracy: ±0.2% of full span.

c. Provide a two-year warranty for each transmitter. Replace all transmitters found to be defective at no cost to the owner during the warranty period

d. Acceptable Manufacturers are:

1) Tobar – Model 75DPI
2) Foxboro – Model 823 DP
3) Omega – Model PX750 – 15OD1
4) Bailey

6. Medium to High Differential Water Pressure Applications (21" WC to 100psi)

a. The differential pressure transmitter shall meet the low pressure transmitter specifications except the following.

1) Differential pressure range 21" WC to 100psi
2) Reference accuracy: ±1% of full span (includes non-linearity, hysteresis, and repeatability).
3) Warrantee: 1 Year

b. Acceptable Manufacturers

1) Dwyer
2) Mamac
3) Veris

7. Chiller Barrel Differential Pressure Switches:

a. All water cooled or air cooled chillers shall have a DP installed on all barrels, chilled water barrel, and condensate water barrel as needed.

b. Sensors shall be united electric model number J21k-254 (STK# 9545) NEMA 4 differential pressure switch. None other will be accepted.

I Electronic Valve & Damper Actuators

1. General Requirements

a. Electronic actuators shall be electric, direct-coupled type capable of being mounted over the shaft of the damper. They shall be UL listed and the manufacturer shall provide a 5- year unconditional warranty from the date of commissioning. Power consumption shall not exceed 8 watts or 15 VA of transformer sizing capacity per high torque actuator nor 2 watts or 4 VA for VAV actuators. Sound level shall not exceed 45db for high torque nor 35db for VAV actuators.

b. Electronic overload protection shall protect actuator motor from damage. If damper jams actuator shall not burnout. Internal end switch type actuators are not acceptable. Actuators may be mechanically and electrically paralleled on the same shaft to multiply the available torque. A reversing switch shall be provided to change action from direct to reverse in relation to control signal as operation requires.

c. Belimo actuators and valves shall be the only approved for all valves and actuators for all dampers.

2. a. OA and EXH actuators shall be spring return type for safety functions. Individual battery backup or capacitor return is not acceptable. With approval, a central battery backup pack NSV system similar to a UPS system may be used with a battery checking circuit to the DDC automation system.. Daily verification of battery performance shall be incorporated in the programming.

b. The control circuit shall be fully modulated using 2 – 10 volt or 4 – 10 ma signals. Accuracy and repeatability shall be within ± 1/21 of control signal. A 2 – 10 V or 4 – 20 ma signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are parallel off a master motor or to provide a feedback signal to the automation system, including damper position. Accuracy shall be within ± 2.5%.

c. Face and bypass dampers and other control dampers shall be modulating using the same control circuit detailed above, but shall not be spring return.

3. Miscellaneous Damper Actuators.

a. OA combustion and ventilation air intake and EXH damper actuators shall be two (2) position spring return closed if any water piping, coils or other equipment in the space which the damper serves needs to be protected from freezing. Otherwise drive open, drive closed type 2 position may be used. The minimum torque for any actuator shall be 50 lb/in.

b. Provide auxiliary switches on damper shaft or blade switch to prove damper has opened on all air handling equipment handling 100% outside air greater than 2.5" TSP.

4. Air Terminals

a. Air terminal actuators shall be minimum 50lb/in torque and use fully modulated floating (drive open, drive closed) 3 wire control circuit as detailed in control dampers depending on the controllers requirements.

5. Inlet Valve Actuators.

a. Inlet vane actuators shall provide at least150% of the maximum torque specified by the manufacturer as necessary to operate vanes properly. Either direct coupled or gear train with linkages are acceptable as required. The control loop for static control of the actuator shall operate slowly enough to avoid hunting and maintain stable control. See automation system specifications for details.

J. Valve Actuators

1. Control valves actuators (3 inch and smaller)

a. Actuators shall have a gear release button on all non-spring return models to allow manual setting. The actuator shall have either an insulating air gap between it and the linkage or a non-conducting thermoplastic linkage. Care shall be taken to maintain the actuator's operating temperatures and humidity within its specifications. Pipes shall be fully insulated and heat shields shall be installed if necessary. Condensation may not form on actuators and shall be prevented by a combination of insulation, air gap, or other thermal break.

b. The control circuit shall be fully modulating using 2 -10 volt or 4 -20 ma signals. Accuracy and repeatability shall be within 1/21 of control signal. A 2 -10 v or 4 -20 ma signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are paralleled off a master motor or to provide a feedback signal to the automation system indicating valve position.

c. Valve body and actuators shall be shipped fully assembled and tested at the valve factory prior to shipment.

d. Acceptable Manufacturers are BELIMO ONLY

2. Control valve actuators (4 inch and larger)

a. Control valve actuators (4 inch and larger) shall consist of a permanent split capacitor, reversible type electric motor that drives a compound epicycle gear. The electric actuator shall have visual mechanical position indication, readable from a distance of 25 feet, showing output shaft and valve position. Unit shall be mounting directly to the valves without brackets and adapters, or readily adapted to suit all other types quarter-turn valves.

b. The actuator shall have an integral terminal strip, which, through conduit entries, will ensure simple wiring to power supplies. Cable entries shall have UL recommended gland stops within the NPT hole to prevent glands from being screwed in too far and damaging cable.

c. The actuator shall be constructed to withstand high shock and vibrations without operations failure. The actuator cover shall have captive bolts to eliminate loss of bolts when removing the cover from the base. One copy of the wiring diagram shall be provided with the actuator.

d. The actuator shall have a self-locking gear train, which is permanently lubricated, at the factory. The gearing shall be run on ball and needle bearings. Actuators with 600 in/lbs. or more output torque shall have two adjustable factory calibrated mechanical torque limit switches of the single-pole, double-throw type. The motor shall be fitted with thermal overload protection. Motor rotor shaft shall run in ball bearings at each end of motor.

e. The actuator housing shall be hard anodized aluminum for full environmental protection.

f. The environmental temperature range of the actuator shall be -30°C to +60°C (-20°F to +140°F).

g. For intermittent on/off service, the actuator shall be rated at a 20% duty cycle (i.e., 12 minutes extended duty in every hour, or alternatively; one complete cycle every 2 minutes). For more frequent cycling and modulating service, an actuator shall be rated for continuous duty. The actuator rated for continuous duty shall be capable of operating 100% of the time at an ambient temperature of 40°C.

h. The actuator shall have an integral self-locking gear train. Motor brakes shall not be required to maintain desired valve position. Levers or latches shall not be required to engage or disengage the manual override. Mechanical travel stops, adjustable to 15° in each direction of 90° rotation shall be standard, as well as two adjustable travel limit switches with electrically isolated contacts. Additional adjustable switches shall be available as option.

i. Single Phase Motor: The motor shall have Class B insulation capable of withstanding locked-rotor for 25 seconds without overheating. Wiring shall also be Class B insulation. An auto-reset thermal cutout protector shall be embedded in the motor windings to limit heat rise to 80º C in a 40ºC ambient. All motors shall be capable of being replaced by simply disconnecting the wires and then removing mounting bolts. Disassembly of gears shall not be required to remove the motor.

j. Materials of Construction: The electric actuator shall have a pressure die-cast, hard-anodized aluminum base and cover. The compound gear shall be made of die-cast, hard-anodized aluminum or steel. An alloy steel worm gear shall be provided for manual override and torque limiting. Bearings for gears shall be of the ball and needle type; bronze bearings shall be used on the shafting parts. Acceptable Manufacturers are BELIMO ONLY

K. Switches

1. Differential Pressure Switches Air Side

a. All pressure sensing elements shall be corrosion resistant. Pressure sensing elements shall be bourdon tubes, bellows or diaphragm type. Units shall have tamper-proof adjustable range and differential pressure settings.

b. Pressure sensor switch contacts shall bee snap action micro-switch type. Sensor assembly shall operate automatically and reset automatically when conditions return to normal. Complete sensor assembly shall be protected against vibration at all critical movement pivots, slides and so forth.

c. Differential pressure switches shall be vented to withstand a 50% increase in working pressure without loss of calibration.

d. Acceptable Manufacturers: Mercoid, Dryer, McDonnell Miller.

2 Electrical Low Limit Thermostat (Freeze Stat)

a. Duct type, fixed 5° Fahrenheit differential, range 30° to 60° Fahrenheit. Sensing element shall be a 20 foot long capillary tube responding to the lowest temperature sensed along any 12 inches of bulb length. Switch shall be SPDT 120/240 VAC, rated for 10 amps at 120V full load. Unit shall be manually reset. Provide one low limit thermostat for each 20 square feet or fraction thereof of coil area.

b. Provide automatic reset type thermostat set at 35° Fahrenheit on each air handling unit, with a 0 to 120 second delay before fan shutdown.

c. Provide additional auto reset type thermostat for remote indication alarm set to 39° Fahrenheit.

d. Provide thermostat override on air handling units for smoke contamination in area being served.

3. Water Flow Switches

a. UL listed, Suitable for all service application conditions. Body minimum working pressure rating shall be equal or exceed service pressure. Switch electrical rating shall be 230VAC 3.7Amp, 115VAC 7.4Amp, and 125VAC. 115-230VAC AC pilot duty. Unit shall have two SPDT switches. Actuating flow rated shall be field adjustable for the specified and indicated service. Switch location shall preclude exposure to turbulent or pulsating flow conditions. Flow switch shall not cause pressure drop exceeding 2 psi maximum system flow rate.

b. Acceptable Manufacturers: McDonnell Miller FS7-4

L. Flow, Pressure and Electrical Measuring Apparatus

1. Transverse Probe Air flow Measuring Stations

a. Transverse probes shall be a dual manifold, cylindrical, type constructed of 3003 extruded aluminum with anodized finish to eliminate surface pitting and unnecessary air friction. The multiple total pressure manifold shall have sensors located along the stagnation plane of the approaching air flow and without the physical presence of forward projecting sensors in the airstream. The static pressure manifold shall incorporate dual offset static tips on opposing sides of the averaging manifold so as to be insensitive to flow angle variations of as much as ±20° in the approaching airstream.

b. The air flow transverse probe shall not induce a measurable pressure drop, nor shall the sound level within the duct be amplified by its singular or multiple presence in the airstream. Each flow measuring probe shall contain multiple total and static pressure sensors placed at equal distance along the probe length. The number of sensors on each probe and the quantity of probes utilized at each installation shall comply with the ASHRAE Standards for duct traversing.

c. Traverse probes shall be accurate to ±25% of the measured airflow range down to 0.25”wc static pressure.

d. Each flow measuring station shall be complete with its own dedicated microprocessor with a 4-line, 80 character, Alpha Numeric Display and full function keypad. The panel shall be fully programmable and display calibrated CFM directly on a LED monitor on the panel face.

e. Each station shall log airflow rates in real time and download data to its control unit (CU) via RS-232 interface.

f. Provide 24V 1 phase power to each flow measuring station.

g. Acceptable Manufacturers: Air Monitor, Ebtron.

2. Shielded Static Pressure Sensor

a. Provide for each zone where required a shielded static pressure sensor suitable for ceiling surface mounting, complete with multiple sensing ports, pressure impulse suppression chamber with minimum volume of 50 CU inches, airflow shielding, and 3/8" compression takeoff fittings, all contained in a welded stainless steel casing, with polish finish on all exposed surfaces.

b. These probes shall be capable of sensing the static pressure in the proximity of the sensor to within 1% of the actual pressure value while being subjected to a maximum airflow of 1,000 FPM from radial source.

c. The shielded static sensing devices shall be sued for both reference and space pressure sensing.

d. Pressure sensors used for outside air pressure reference purposed shall be equipped with a conduit deal for pneumatic tubing and bushings for a weather tight installation.

3. Static Pressure Traverse Probe

a. Provide multipoint traverse probes in the duct at each point where static pressure sensing is required.

b. Each duct static traverse probe shall contain multiple static pressure sensors located along the exterior surface of the cylindrical probe. Pressure sensing points shall not protrude beyond the surface of the probe.

c. The duct static traverse probe shall be of 304 stainless steel construction and (except for a ¾" dia. probe with lengths of 24" or less) be complete with threaded end support rod, sealing washer and nut, and mounting plate with gasket and static pressure signal fitting. The static traverse probe shall be capable of producing a steady nonplusing signal of static pressure without for correction factors, with an instrument accuracy of 21.

4. Venturi Flowmeter

a. Pressure drop on Venturi type flowmeters shall not exceed 0.25"wc. Each Venturi low and high pressure taps shall be equipped with nipples, valves and quick disconnect.

b. Equip each Venturi with a metal identification tag indicating the size, location, GPM and meter reading for the GPM specified.

c. Provide (1) 6" dial differential pressure meter of the proper range to determine piping system flow rate. The meter shall be property of the owner.

d. Venturi meters shall utilize flanged or screwed connections for removal purposes and shall be rated for system operating pressures.

e. The Venturi Flowmeter shall be factory calibrated to provide a minimum of flow accuracy between actual and factory flow calibration data.

5. Current Transformers

a. The current transformers shall be designed to be installed or removed without dismantling the primary bus or cables. The transformer shall be of a split core design.

b. The core and windings shall be completely encased in a UL approved thermoplastic rated 95VA. No metal parts shall be exposed other than the terminals.

c. The current transformer shall meet the following specifications:
Frequency Limits: 50 to 400Hz.
Insulation: 0.6 KV Class, 10KV BIL.
Accuracy: ±1% at 5.0 to 25.0 VA accuracy class with U.P.F. burden.

M. Current Sensing Switches

1. Current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. Current sensing switches shall consist of a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over current up to twice its trip into range.

N. Control Valves and Dampers

1. General Control Valve Requirements

a. All automatic control valves shall be linear, fully proportioning, with modulating ball, plug or V-port inner guides unless otherwise specified. The valves shall be quiet in operation and fail safe in either normally open or normally closed position in the event of control air failure or loss of electronic output signal.

b. All valves shall be capable of operating in sequence when required by the sequence of operation. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads as specified. All control valves shall be suitable for the pressure conditions, and shall close against the differential pressures involved. Valve body pressure rating and connection type (screwed or flanged) shall conform to ANSI pressure classifications appropriate for the system working pressures.

c. Acceptable Manufacturers: BELIMO ONLY

2. Hot and Cold Water Control Valves

a. Hot and cold water globe type control valves shall be single-seated type, with equal percentage flow characteristics. The valve discs shall be composition type and shall be sized using ISA methods.
b. Pressure drop through the valves shall not exceed 5 psi unless otherwise indicated.
c. Ball valves shall be equipped with 316 stainless steel trim, Teflon seals and adjustable packing gland nuts. Provide a handle for manual operation during start-up and maintenance.

3. Two Position Control Valves

a. For open/closed and/or three way diverting applications, butterfly valves are acceptable and shall be heavy duty pattern with a body rating comparable to pipe rating.
b. Provide each butterfly valve with a replaceable lining suitable suitable for temperature and service requirements.
c. Equip each butterfly valve with disc and stainless steel stem.
d. Valves used for shut-off or isolation purposes shall be bubble tight.

4. Automatic Control Dampers

a. Automatic dampers shall be multiple blade and sized for the application by the FMCS Contractor and/or as indicated on the drawings.
b. Submit a schedule of damper sizes to the Vent Contractor, with a copy to the Architect/Engineer within 15 days after being awarded the contract.
c. Dampers used for throttling air flow shall be of the opposed blade type, arranged for normally open or normally closed operation as required. The damper is to be sized so that when wide open, the pressure drop is sufficient amount of its close-odd pressure drop to shift the characteristics curve to near linear. Multi-section dampers must be provided with sufficient interconnecting hardware or jackshaft to provide unison operation of all blades in the entire assembly.
d. Damper frames and blades shall be constructed of either 16GA. Galvanized steel or 14GA. Aluminum and arranged to facilitate field assembly of several individual sections into large damper area to allow secure fastening of damper frame to the surrounding ductwork. Collar or fan housing. Maximum blade length in any section shall be 48". Additional stiffening or bracing shall be provided for any section exceeding 48" in height.
e. Damper blades shall not exceed eight (8) inches in width. All blades except for fume hood exhaust systems shall be galvanized sheet steel. Blades shall be for high velocity performance.

f. All damper bearings are to be made of nylon. Bushings that turn in the bearing are to be oil impregnated sintered metal. Dampers shall be tight closing, low leakage type synthetic elastomer deals on the blade edges and on top, bottom and sides of the frame. Dampers shall not leak in excess of 8cfm per square foot. When closing against a 4"w.g. static pressure.

g. Leakage and flow characteristics charts shall be submitted to the Architect/Engineer for review.

O. Engineer Alarm and Message Reporting System

1. General

a. Provide a means fro alarms to be broadcast either via email or to cell phone text message system (or both). This can be either thru modem or Ethernet.

2. Auto-Dial Modem

a. The auto-dial modem shall use analog phone lines and standard 56K baud phone line communications.

b. The auto-dial modem shall reside on the Lon Works Network.

c. The auto-dial modem shall place calls as follows:

1) Retry same number a programmable number of times in fixed intervals.

2) Retry successive numbers arranged in sequence by priority at fixed intervals a finite number of times.

3) The auto-dial modem software shall have password protection for User Interface security purposes.

4) The auto-dial modem shall have a minimum capacity of 8-14 digit phone numbers stored in memory .The auto-dialer shall retry a number a fixed number of times. If no connection is made in a specified number of retries, the number will be blacklisted and no longer contacted. Blacklisted numbers can be reset manually by the system operator, or the system can be programmed to allow a blacklisted number to be re-enlisted after a user-defined period of time.

d. The auto-dial modem software shall have password protection for User Interface security purposes.

3. Pager Messages

a. The telephone numbers programmed into the communications software shall be defined as pager messages.

b. The pager shall indicate the site number and alarm type on numeric pagers.

P. Electrical Control Power and Low Voltage Wiring

1. Provide interlock wiring between supply and exhaust fans, electrical wiring for relays (including power feed) for temperature and pressure indication. Provide interlock wiring between refrigeration machines, pumps and condensing equipment as required for the specific sequence of operation and the refrigeration system integral controller(s). do not provide interlock wiring if a dedicated digital output has been specified for the equipment or the sequence of operation requires independent start/stop.

2. Provide power wiring, conduit and connections for low temperature thermostats, high temperature thermostats, alarms, flow switches, actuating devices for temperature, humidity, pressure and flow indication, point resets and user disconnect switches for electric heating, appliances controlled by this Section.

3. Provide all other wiring required for the complete operation of the specified systems. No low voltage wiring can be sub-contracted out by the controls contractor.

4. Install all wiring raceway systems complying with the requirements of the National Electrical Code, and specified in Division 16 specs. All installations shall be installed in EMT.

Q System Network Communication Requirements

1. Wired network communication shall be minimum 22ga echelon approved wire. Communications wiring can not be in a conduit that is shared by any other wiring.

2. Communications between buildings shall be fiber not Ethernet communications. Fiber can either be via a new dedicated line installed by the controls contractor or the contractor may use the District's installed fiber in the IDF and MDF rooms if a spare exists. All fiber modems and routers need to conform to the LonWorks profile.

a. Acceptable Manufacturer: Control By Light Only.

3. In all communication conduits, provide one spare twisted pair to be installed, tagged and labeled at each end.

4. Communication conduits shall not be installed closer than six feet from high power transformers or run parallel within six feet of electrical high power cables. Care shall be taken to route the cable as far from interference generating devices as possible.

5. *All shields shall be ground (earth ground) at one point only, to eliminate ground loops.*

6. *There shall be no power wiring, in excess of 30 VAC rms, run in conduit with communications wiring. In cases where signal wiring is run in conduit with communication wiring, all communication wiring and signal wiring shall be run using separate twisted shielded pairs (24awg) with the shields grounded in accordance with the manufacturer's wiring practices.*

R. *Input/Output Control Wiring*

1. *General*

   a. *RTD wiring shall be two-wire or four-wire twisted, shielded, minimum number 22 gauge.*
   b. *Other analog inputs shall be a minimum of number 22 gauge, twisted, shielded.*
   c. *Binary control function wiring shall be a minimum of number l8 gauge.*

   d. *Analog output control functions shall be a minimum of number 22 gauge, twisted, shielded.*
   e. *Binary input wiring shall be a minimum of number 22 gauge.*

2. *Splices*

   a. *Splices in shielded cables shall consist of terminations and the use of shielded cable couplers, which maintain the integrity of the shielding. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties as specified herein.*

3. *Conduit and fittings*

   a. *Conduit for Control Wiring, Control Cable and Transmission Cable: Electrical metallic tubing (EMT) with compression fittings, cold rolled steel, zinc coated or zinc-coated rigid steel with threaded connections.*
   b. *Outlet Boxes (Dry Location): Sheradized or galvanized drawn steel suited to each application, in general, four inches square or octagon with suitable raised cover.*
   c. *Outlet Boxes (Exposed to Weather): Threaded hub cast aluminum or iron boxes with gasket device plate.*
   d. *Pull and Junction Boxes: Size according to number, size, and position of entering raceway as required by National Electrical Codes. Enclosure type shall be suited to location.*

4. Relays

a. Relays other than those associated with digital output cards shall be general purpose, enclosed plug-in type with S-pin octal plug and protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required.

b. Solid State Relays (SSR): Input/output isolation shall be greater than lOE9 ohms with a breakdown voltage of 1500V root mean square or greater at 60 Hz. The contact life shall be 10 x 10 E6 operations or greater. The ambient temperature range of SSRs shall be -20 to +140F. Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release time shall be for 100 milliseconds or less. Transient suppression shall be provided as an integral part of the relay.

c. Contactors: Contactors shall be of the single coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contractor shall be double-break-silver-to-silver type protected by arcing contacts. The number of contacts and rating shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices.

S. BAS Hardware Identification

1. Automatic control Valve Tags

a. For valves, etc., use metal tags with a 2-inch minimum diameter, fabricated of brass, stainless steel or aluminum. Attach tags with chain of same materials. For lubrication instructions, use linen or heavy duty shipping tag.

b. Tag valves with identifying number and system. Number valves by floor level, column location and system served.

c. Prepare lists of all tagged valves showing location, floor level, and tag number, use. Prepare separate lists for each system. Include copies in each maintenance manual.

2. Wire Tags

a. All multi-conductor cables in all pull boxes and terminal strip cabinets shall be tagged.

b. Provide wire Tags as per Division 16.

3. Conduit Tags

a. Provide tagging or labeling of conduit so that it is always readily observable which conduit was installed or used in implementation of this Work.

4. Miscellaneous Equipment Identification

a. Screwed-on, engraved black lamicoid sheet with white lettering on all control panels and remote processing panels. Lettering sizes subject to approval.

b. Inscription, subject to review and acceptance, indicating equipment, system numbers, functions and switches. For panel interior wiring, input/output modules, local control panel device identification.

T. User Interface Software

1. Basic Operators Workstation Software

a. The Operators Workstation shall be equipped with Windows 98/2000 or XP as the user terminal operating software.

b. The Operators Workstation software is installed to provide basic operator interface (i.e., non-facility management/color graphics) shall use pull down menu navigation as the basis of program execution, operating feature penetration, and local or remote site access.

c. As a minimum, the operating software shall permit the operator to perform the following tasks with a minimum knowledge of the HVAC Control System provided and basic computing skills.

1) View data (temperature, flowrate, etc.) on HV AC equipment, and/or lighting, card access, and intrusion detection equipment.

2) Navigate multiple sites.

2) Locate potentially faulty equipment through audible or visible alarms.

3) Select points to be alarmable and define the alarm state.

4) Select points to be trended over a period of time and initiate the recording of values automatically.

d. 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.

e. System Configuration. If required for the customer, the workstation software shall provide a method for advanced configuration of the system. This shall allow for future system changes or additions.

f. Online 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.

g. 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 operators access for viewing and/or changing each system application, full screen editor, and object.

h. System Diagnostics. The system shall automatically monitor the operation of network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

i. 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, and reactions for each object in the system.

1) 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, providing audible annunciation or displaying specific system graphics. Each of these actions shall be configurable by workstation and time of day.

2) Binary Alarms shall be set to alarm based on the operator specified state.

3). 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.

j. Trend Logs. The operator shall be able to define a custom trend log for any data in the system. This definition shall include interval. 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. Each trend shall accommodate up to 64 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 ASCII format for use by other industry standard word processing and spreadsheet packages.

Trend information shall also be stored on the individual CU for transmitting to the workstation. Trends shall also be established for third party LonWorks devices.

k. Alarm and Event Logs. 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. PCU's and TDCU's shall have the ability to store alarms and logs prior to transmission to the workstation. Alarms may also be established for third party LonWorks devices. Alarms shall be able to be annunciated audibly at the workstation.

l. 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.

m. Clock Synchronization. The real time clocks in the building control panels and workstations shall be synchronized on command of an operator if desired. The system shall automatically adjust for daylight savings and standard time if applicable.

n. Application Editors. Each Operator Workstation shall support full screen editing of all system applications. Provide editors for each application at Control Unit(s). The applications shall be downloaded and executed at the appropriate Control Unit(s).

1) 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 set points.

2) Provide the capability to schedule each LON object or group of objects in the system, regardless of the manufacturer. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule shall consist of the following:

a) Weekly Schedule. Provide separate schedules for each day of the week.

b) Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule for holidays or other purposes. The system operator will be presented with a calendar screen that can be browsed at least two years ahead. Exception schedules shall be dragged onto the calendar from exception day type menus on the calendar .This exception schedule shall override the standard schedule for that day. Exception schedules may be defamed up to one year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard scheduled for that day of the week.

c) Optimum Start/Stop. The scheduling application outlined above shall support an optimal start/stop algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. Provide the ability to modify the start/stop algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.

d) Provide means to allow equipment to be grouped for proper operation as specified in the sequence of operations. This shall include the coordination of airflow valves with their associated Air Handling Equipment.

3) Equipment coordination. Provide means to allow equipment to be grouped for proper operation as specified in the sequence of operation. This shall include coordination of airflow valves with their associated Air Handling Equipment.

2. Custom Application Programming Features

a. 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:

b. 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.

c. 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.

d. The programming language shall allow independently executing program tasks to be developed.

e. 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.

f. 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.

g. 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: absolute value and minimum/maximum value from a list of values.

h. 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.

i. The programming language shall have the 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 objects in the system.

j. 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.

3. Network Management

a. Provide network management software package that will permit the individual network nodes to be configured. This tool shall manage a database, all system controllers by type and revision, and shall provide a software mechanism for identifying each controller on the network. This tool shall also be capable of defining network data controllers on the network. This tool shall also be capable of defining network data connections between system controllers, known as "binding".

b. The network configuration tool shall also be capable of performing the above stated functions for other 3rd party LonWorks devices that may be added to the network.

c. The Network configuration tool shall also provide diagnostics to identify system controllers on the network, to reset controllers, and to view health and status counters within controllers.

d. 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.

e. The network configuration tool shall be able to upload network image directly from a node when that node is connected to the network. This process does not require the .XIF file from a third party device supplier.

4. Graphical User Interface Software

a. Provide a Windows 98/2000 or xp based, object oriented, graphical user interface, which shall allow the generation of custom dynamic graphics for graphical representation of system design and system parameters. The graphics editor shall allow zones of the building, mechanical systems, floor plans, etc., to be custom generated for the project.

b. Graphic Creation. The editing menu shall provide help menus for selecting graphics, choosing colors, copying previous graphics, deleting data points in the graphics. A set of standard HV AC graphics shall be provided to allow operators to select from the graphics library for graphic generation.

c. Display. Information on the color graphic display shall be dynamic and automatically updated.

d. Manual Control. A manual control option shall also be provided which allows the operator to turn points on or off, start or stop, set points to local mode or release points to automatic mode.

e. Graphic Size. The graphic definition mode of operation shall allow the creation of oversized graphics that are up to 3 video screens wide and 3 video screens high. The operator shall be able to pan and scroll around the oversized graphic to view areas of interest.

f. Object Oriented Graphics. Objects shall be provided to simplify operation and allow special functions to be performed. Custom or canned objects shall be able to modified using third party drawing tools. Objects shall be able to be rotated, scaled, filled, and moved based on a change in the process value.

g. Graphics Generation. Default system graphics shall be self-generating. A library of custom graphics shall be supplied for each control unit. In the case where a custom graphic is required (built up air handling units) the operator shall be able to specify a default graphic to a control device to generate a template so that it becomes self-generating. Graphic objects shall be able to be developed using any third party software package, such as AutoCAD, VISIO, Corel, or Designer.

h. Trending. The software shall allow analog, digital values and calculations to be graphically plotted in real-time or historical format. Refer to Database management for specific requirements on historical format requirements. The software shall be able to generate trend information for LonWorks devices not provided by the primary supplier.

i. System Documentation. All system documentation, such as wiring diagrams, points lists, and sequences of operations shall be viewable on line through the graphics browser. Any file conforming to Microsoft Active Document shall be viewable in this manner.

j. Alarm directives shall be provided through a change in color of the background of the graphic display for the alarm. Alarms shall also be provided in a separate window for ease of interpretation. Indication of an alarm state on a monitored control point shall be by a change in color of the data display. An alarm history for each individual control device shall also be available in the "tree view".

k. Navigation. The system operator shall have the option to navigate the graphics browser through designated buttons on the graphic (hyperlinks) or in a tree view similar to that of Microsoft Windows Explorer. Site names, floor plans, zones, and individual devices shall be indicated in the tree view.

l. Scheduling. The system operator shall be able to use "drag and drop' functionality in a calendar style window to drag new exception events that will change the operation of the system for the specified day. The operator shall be able to specify exception days at least 18 months in advance. The system shall also be able to provide scheduling for third party LonWorks devices not supplied by the primary manufacturer.

m. Network Diagnostics. The system operator shall be able to view and perform basic network diagnostics for each individual control device. This will allow the system user to verify faults or communications problems with the specified device.

n. Maintenance Notes. If required the system operator shall be able to type in comments regarding maintenance or other data for each individual controller.

o. 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.

p. Database Management. Trended data shall be capable of automatically being retrieved from control devices and stored on the hard drive as a data file retrievable from Excel for Windows. The spread sheet shall be configured to display the time, increment of the trended data, the engineering units, total over the listed time, average, minimum and maximum values over the listed time.

5. Optional Telephone Interface Software

a. The system user shall have the option to incorporate telephone access to the system. The telephone interface system shall override system schedules for devices from any LON manufacturer

b. If required, the telephone interface software shall generate system usage reports for each tenant and user. If required, billing reports shall be generated for tenant in the system.

6. Remote Connectivity

a. The system shall be able to connect to remote sites via standard telephone lines or Ethernet LAN.

3.0 Execution

3.1 Examination

A. Verify that systems are ready to receive work.

B. Beginning of installation means installer accepts existing conditions.

C. The project plans shall be thoroughly examined for control device and equipment locations, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

C. The contractor shall inspect the site to verify that equipment is installable as show, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

D. The Control System Contractor shall examine the drawings and specifications for other parts of the work, and if head room or space conditions appear inadequate or if any discrepancies occur between the plans and his work and the plans for the work of others, he shall report such discrepancies to the Architect/Engineer and shall obtain written instructions for any changes necessary to accommodate his work with the work of others.

3.2 General Installation Requirements

A. Install all control components in accordance with the manufacturer's instructions and recommendations.

B. f the controls contractor is responsible for providing the damper then provide mixing dampers of parallel blade construction arranged to mix streams. Provide separate minimum outside air damper section adjacent to variable outside air damper.

C. Mount control panels adjacent to associated equipment on vibration- free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide nameplates for instruments and controls inside cabinet and nameplates on cabinet face.

D. After completion of installation, test and adjust control equipment Submit data showing set points and final adjustments of controls.

E. Install equipment, piping, wiring/conduit parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

F. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

G. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

H. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.3 Electrical System Installation

A. Comply with all Division 16 Installation Requirements.

B. Install low voltage power and LON and LAN communication trunks in conduit in the following locations regardless of local building code allowances otherwise.

1. Mechanical rooms
2. Electrical rooms
3. Vertical risers (exception: fire rated continuous closet like a telephone closet).
4. Open areas where the wiring will be exposed to view to tampering.

C. Conceal conduit within finished shafts, ceilings and wall as required. Install exposed conduit parallel with or at right angles to the building walls.

D. Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used provided that:

1. *Circuits meet NEC Class 2 (current-limited) requirements. (Low- voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)*
2. *All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.*
3. *All wiring to be in data ring style hangers. No wiring shall be touching the ceiling grid.*

E. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

F. Where Class 2 wiring is run exposed, wiring to be run parallel along a surface or perpendicular to it, and NEATLY tied at 3m (10 ft.) intervals.

G. All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to-wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

H. Plug or cap all unused conduit openings and stub-ups caulking compound.

I. Route all conduit to clear beams, plates, footings and structure members. Do not route conduit through column footings or grade beams.

J. Set conduits as follows

1. *Expanding silicone fire stop material sealed watertight where conduit is run between floors and through walls of fireproof shaft.*
2. *Oakum and lead, sealed watertight penetration through outside foundation walls.*

K. Cap open ends of conduits until conductors are installed.

L Where conduit is attached to vibrating or rotating equipment, flexible metal conduit with a minimum length of la inches and maximum length of 36 inches shall be installed and anchored in such a manner that vibration and equipment noise will not be transmitted to the rigid conduit.

M. Where exposed to the elements or in damp or wet locations, waterproof flexible conduit shall be installed. Installation shall be as specified for flexible metal conduit.

N. Provide floor, wall, and ceiling plates for all conduits passing through walls, floors or ceilings. Use prime coated cast iron, split- ring type plates, except with polished chrome-plated finish in exposed finished spaces.

3.4 Sequences of Operation

A. Refer to drawings for normal operating mode sequences of operations

B. General

1. *Provide automatic control for system operation as described herein, although word "automatic" or "automatically", is not used.*
2. *Provide control devices, control software and control wiring as required for automatic operation of each sequence specified.*
3. *Manual operation is limited only where specifically described; however, provide manual override for each automatic operation.*
4. *Where manual start-up is called for, also provide scheduled automatic start-stop capabilities.*
5. *Functions called for in sequence of operations are minimum requirements and not to limit additional capabilities the DDC system can be provided with.*
6. *Provide following functions which are not specifically mentioned in each Sequence of Operation*

    a. *For each item of equipment:*

        1) *Start-Stop, manual, and scheduled.*
        2) *On-Off status of each piece of equipment.*
        3) *Run-time .*

    b. *Sequenced starting of all motors:*

        1) *At initial start-up.*
        2) *For automatic starting on emergency power after power blackout.*
        3) *Provide adjustable “dead band” of at least 5°F (3°) within which damper is at minimum position and heating coil id off.*

4) Temperature controls: Modulate terminal unit dampers to maintain cooling setpoint, between maximum and minimum air flow rate setpoints. Modulate 2-way heating coil valve for electrical heater, as applicable to maintain heating setpoints.

c. Room temperature setpoints for each unit shall be monitored and adjustable from central operator workstation.

d. Each unit shall be scheduled individually at Central Operator Workstation to allow reset of cooling and heating room temperature setpoints during selected off-hours. Full shut-off of damper shall be scheduled for each thermal unit.

e. Each unit shall have reset capability of maximum and minimum air flow rate setpoints at Central Operation Workstation.

1) All setpoints shall be adjustable.

3.5 Temperature Sensors

A. Temperature sensor assemblies shall be readily accessible and adaptable to each type of application in such manner as to allow for quick, easy replacement and servicing without special tools or skills. Strap-on mountings shall not be permitted

B. Outdoor installations shall be; of weatherproof construction or in appropriate NEMA enclosures. These installations shall be protected from solar radiation and wind effects. Protective shield shall be stainless steel.

C. Sensors shall be with enclosure where located in finished space.

D. Sensors in ducts shall be mounted in locations to sense the correct temperature of the air only and shall not be located in dead air spaces or positions obstructed by ducts, equipment, and so forth. Locations where installed shall be within the vibration and velocity limit of the sensing element. Ducts shall be securely sealed where elements or connections penetrate ducts to avoid measuring false conditions.

E. All sensors measuring temperatures in pipes larger than 2 inches in diameter or in pressure vessels shall be supplied with wells properly fabricated for the service. Wells shall be non-corrosive to the medium being measured and shall have sufficient physical strength to withstand pressures and velocities to which they are subjected. Wells shall be installed in the piping at elbows where piping is smaller than the length of the well to effect proper flow across the entire area of the well.

3.6 Flow Switch Installation

A. Install using a threadolet in steel pipe. In copper pipe use CxCxF Tee, no pipe extensions or substitutions allowed.

B. Mount a minimum of 5 pipe diameters upstream and 5 pipe diameters downstream or 2 feet whichever is greater, from fittings and other obstructions.

C. Install in accordance with manufacturer's instructions.

D. Assure correct flow direction and alignment.

E. Mount in horizontal piping – flow switch on top of pipe.

3.7 Actuators

A. Mount and link control damper actuator per manufacturer's instructions.

B. Valves – Actuators shall be mounted on valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following manufacturers recommendations.

3.8 Warning Labels

A. Affix plastic labels on each starter and equipment automatically controlled through the Control System. Label shall indicate the following.

CAUTION
This equipment is operated under automatic control and may start at any time without warning.

3.9 Identification of Hardware and Wiring

A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information.

B. Permanently label or code each point of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum 1 inch letters on nameplates.

D. Identify all other control components with permanent labels. Identifiers shall match record documents.

E. Identify room sensors relating to terminal box or valves with nameplates.

3.10 Control Units and Intelligent Devices

A. When Control Units and Terminal Device Control Units are applied, provide a minimum of (15%0 spare I/O point capacity for each point type found at each location. If input points are nor universal, (15%) of each type is required. If outputs are not universal, (15%) of each type is required. A minimum of one spare is required for each type of point used.

B. Future use of spare capacity shall require providing the field device, field wiring, point database definition, and custom software. No additional controller boards or point modules shall be required to implement use of these spare points.

3.11 Programming

A. Provide sufficient internal memory for the specified control sequences and trend logging.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.

C. Software Programming:

1. Provide programming for the system as per specifications and adhere to the strategy algorithms provided. The HVAC Control System Contractor shall also provide all other system programming necessary for the operation of the system but not specified in this document. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements reflect the language used in the sequence of operations.

D. Operator's Interface.

1. Standard Graphics. Provide graphics for each major piece of equipment and floor plan in the building. This includes each Chiller, Air Handler, VAV Terminal, Fan Coil, Cooling Tower. Etc. These standard graphics shall show all points dynamically as specified in the point list.

2. *The controls contractor shall provide all the labor necessary to install, initialize. Start-up, and trouble-shoot all operator interface software as described in this section. This included any operating software, the operator interface data base, and any third party software installation and integration required for successful operation of the operator interface.*

E. *Demonstration: A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall dedicate a minimum of 16 hours on-site with the Owner and his representatives for a complete functional demonstration of all the system requirements. This demonstration constitutes a joint acceptance inspection, and premise acceptance of the delivered system for on-line operation.*

3,12 Cleaning

A. *This contractor shall clean up all debris resulting from his or her activities daily. The contractor shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor.*

B. *At the completion of work in any area, the Contractor shall clean all of his/her work, equipment, etc., making it free from dirt and debris, etc.*

C. *At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.*

3.13 Protection

A. *The Contractor shall protect all work and material from damage by his/her work or workers, and shall be liable for all damage thus caused.*

B. *The Contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The Contractor shall protect his/her work against theft or damage, and shall carefully store material and equipment received on-site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.*

3.14 Field Quality Control

A. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. All visible piping and/or wiring runs shall be installed parallel to building lines and properly supported.

C. Contractor shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.15 Check Out, Start-Up, and Testing

A. The control system shall be properly commissioned prior to acceptance. The Contractor shall coordinate with others (including mechanical, electrical and test and balance) to properly start up and verify the operation of the system. Provide as-built documentation as detailed in Part 1 of this Section.

B. Contractor shall provide the test and balance company any software needed to complete the commissioning process.

3.16 Acceptance

A. The control systems will not be accepted as meeting the requirements of Completion until all tests described in this specification have been performed to the satisfaction of both the Engineer and Owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.

END OF SECTION 15950

SECTION 3

DIVISION 16 - ELECTRICAL

SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

GENERAL

GENERAL

Basic Requirements: The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

General Provisions: Provide all labor, materials, equipment, and incidentals required to make ready for use complete electrical systems as specified herein and shown on the drawings.

Provide and Install: The word "provide" where used on the Drawings or in the Specifications shall mean "furnish, install, mount, connect, test, complete, and make ready for operation". The word "install" where used on the Drawings or in the Specifications shall mean "mount, connect, test, complete, and make ready for operation". Perform work required by, and in accordance with, the Contract Documents.

Installation: Provide and place in satisfactory condition, ready for proper operation, raceways, wires, cables, and other material needed for all complete electrical systems required by the Contract Documents. Additional raceways and wiring shall be provided to complete the installation of the specific equipment provided. Include auxiliaries and accessories for complete and properly operating systems. Provide electrical systems and accessories to comply with the NEC, state and local codes and ordinances. It is the intent of these Specifications that the electrical systems be suitable in every way for the use intended. Material and work which is incidental to the work of this Contract shall be provided at no additional cost to the Contract.

Field Connections: Provide field connections to remote equipment and control panels provided under other Divisions of these Specifications. Provide raceway, wire, and interconnections between equipment, transmitters, local indicators, and receivers. Provide 120V and low voltage surge protection equipment in accordance with Section 16709 at equipment as required. Install field connections to "packaged" equipment provided under other Divisions of these Specifications.

SCOPE OF WORK

General: Provide labor, materials, permits, inspections and re-inspection fees, tools, equipment, transportation, insurance, temporary protection, temporary power and lighting, supervision and incidental items essential for proper installation and operation of the Electrical systems indicated in the Contract Documents. Provide materials not specifically mentioned or indicated but which are usually provided or are essential for proper installation and operation of the Electrical systems indicated in the contract documents.

Notices: Give notices, file Plans, pay fees, and obtain permits and approvals from authorities having jurisdiction. Include all fees in the Bid Price.

INTERPRETATION OF DRAWINGS

General: The Drawings are diagrammatic and are not intended to show exact locations of Raceway runs, outlet boxes, junction boxes, pull boxes, etc. The locations of equipment, appliances, fixtures, Raceways, outlets, boxes and similar devices shown on the Drawings are approximate only. Exact locations shall be determined and coordinated in the field. The right is reserved to change, without additional cost, the location of any outlet within the same room or general area before it is permanently installed. Obtain all information relevant to the placing of electrical work and in case of interference with other work, proceed as directed by the Architect.

Discrepancies: Notify the Architect of any discrepancies found during construction of the project. The Architect will provide written instructions as to how to proceed with that portion of work. If a conflict exists between the Contract Documents and an applicable code or standard, the most stringent requirement shall apply.

Wiring: Each three-phase circuit shall be run in a separate Raceway unless otherwise shown on the Drawings. Unless otherwise accepted by the Architect, Raceway shall not be installed exposed. Where circuits are shown as "home-runs" all necessary fittings, supports, and boxes shall be provided for a complete raceway installation.

Layout: Circuit layouts are not intended to show the number of fittings, or other installation details. Connections to equipment shall be made as required, and in accordance with the accepted shop and manufacturer's setting drawings.

Coordination: Coordinate final equipment locations with drawings or other disciplines. Layout before installation so that all trades may install equipment in available space. Provide coordination as required for installation in a neat and workmanlike manner.

EQUIPMENT SIZE AND HANDLING

Coordination: Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, ship the equipment in sections of specific sizes to permit the passing through the necessary areas within the structure.

Handling: Equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

RECORD DRAWINGS

Production: The Contractor shall provide two (2) sets of black or blue line on white drawings to maintain and submit record "As-Built Documents". Label each sheet of the Record Document set with "Project Record Documents" with company name of the installing contractor in stamped or printed letters. One set shall be maintained at the site and at all times be accurate, clear, and complete. These drawings shall be available at all times to the Architect's field representatives.

Recording: Record information concurrent with construction progress. Make entries within 24 hours upon receipt of information. The "As-Built" drawings shall accurately reflect installed electrical work specified or shown on the Contract Documents.

Completion: At the completion of the Work, transfer changes with a colored pencil onto the second set and submit to the Architect. The "As-Built" drawings shall be made available to the Architect to make the substantial completion punch list.

Final: Upon Contractor's completion of the Engineer's final punch list, transfer all "As-Built" conditions and all requirements by the Engineer to a reproducible set of drawings and CAD files. Submit drawings and CAD disks for review and acceptance. The Contractor shall provide updated disks which include final As-Built conditions.

ABBREVIATIONS

Abbreviations: The following abbreviations or initials may be used:

A/C	Air Conditioning
AC	Alternating Current
ABV CLG	Above Ceiling
ADA	Americans with Disabilities Act
AF	Ampere Frame
AFF	Above Finished Floor
AFG	Above Finished Grade

AHU	Air Handler Unit
AIC	Amps Interrupting Capacity
AL	Aluminum
AMP	Ampere
ANSI	American National Standards Institute
ASA	American Standards Association
AT	Ampere Trip
ATS	Automatic Transfer Switch
AUX	Auxiliary
AWG	American Wire Gauge
BC	Bare Copper
BIL	Basic Impulse Level
BMS	Building Management System
BRKR or BKR	Breaker
CAB	Cabinet
C	Conduit or Raceway
CB	Circuit Breaker
CBM	Certified Ballast Manufacturers
CCTV	Closed Circuit Television
CKT	Circuit
CLEC	Clock Equipment Cabinet
CLG	Ceiling
CO	Conduit or Raceway Only
COAX	Coaxial Cable
COND	Conductor
CONN	Connection
CPU	Central Processing Unit
CRT	Cathode Ray Terminal (Video display terminal)
CT	Current Transformer
CU	Copper
CW	Cold Water
DC	Direct Current
DDC	Direct Digital Control
DEG	Degree
DISC	Disconnect
DO	Draw Out
DN	Down
DPST	Double Pole Single Throw
EMT	Electrical Metallic Tubing
EO	Electrically Operated
EOL	End of Line Resistor
EWC	Electric Water Cooler
FAAP	Fire Alarm Annunciator Panel
FACP	Fire Alarm Control Panel
FCU	Fan Coil Unit
FLA	Full Load Amperes

FM	Factory Mutual
GF	Ground Fault
GFCI	Ground Fault Circuits Interrupter
GND	Ground
HOA	Hand-Off-Automatic
HORIZ	Horizontal
HP	Horsepower
IC	Intercom
ICU	Intensive Care Unit
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IMC	Intermediate Metallic Raceway
IN	Inches
IT	Instantaneous Trip
IPCEA	Insulated Power Cable Engineers Association
JB	Junction Box
KCMIL	Thousand Circular Mills
KV	Kilovolt
KVA	Kilo-Volt-Amps
KW	Kilowatts
LBS	Pounds
LED	Light Emitting Diode
LT	Light
LTD	Long Time Delay
LTT	Long Time Trip
LTG	Lighting
MAX	Maximum
MCB	Main Circuit Breaker
MCC	Motor Control Center
MCP	Motor Circuit Protector
MIC	Microphone
MIN	Minimum
MLO	Main Lugs Only
MTD	Mounted
MTG	Mounting
MUX	Multiplex (Transponder) Panel
MVA	Mega Volt Amps
N	Neutral
NC	Normally Closed
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIC	Not in Contract
NF	Non Fused
NL	Non Linear

NO	Number or Normally Open
#	Number
Ø	Phase
OL	Overload
OSHA	Occupational Safety and Health Administration
P	Pole
PB	Pullbox
PIV	Post Indicator Valve
PNL	Panel
PR	Pair
PWR	Power
PF	Power Factor
PRI	Primary
PT	Potential Transformer
PVC	Polyvinylchloride
REF	Refrigerator
RGC or GRC	Rigid Galvanized Raceway
RMS	Root-Mean-Square
RPM	Revolutions Per Minute
RECPT	Receptacle
SCA	Short Circuit Amps
SD	Smoke Detector
SEC	Secondary
S/N	Solid Neutral
SPKR	Speaker
SPST	Single Pole Single Throw
SST	Solid State Trip
ST	Short Time Trip
STD	Short Time Delay
SW	Switch
SWGR	Switchgear
SWBD	Switchboard
TEL	Telephone
TTB	Telephone Terminal Board
TTC	Telephone Terminal Cabinet
TVEC	Television Equipment Cabinet
TYP	Typical
UL	Underwriters Laboratories
UON	Unless Otherwise Noted
V	Volt
VFD	Variable Frequency Drive
VSD	Variable Speed Drive
W	Wire
WP	Weatherproof
XFMR	Transformer

CODES, FEES, AND STANDARDS

Application: The codes, standards and practices listed herein generally apply to the entire project and specification sections. Other codes, standards or practices that are more specific will be referenced within a particular specification.

Requirements: All materials and types of construction covered in the specifications will be required to meet or exceed applicable standards of manufacturer, testing, performance, and installation according to the requirements of UL, ANSI, NEMA, IEEE, and NEC referenced documents where indicated and the manufacturer's recommended practices. Requirements indicated on the contract documents that exceed but are not contrary to governing codes shall be followed.

Compliance and Certification: The installation shall comply with the governing state and local codes or ordinances. The completed electrical installation shall be inspected and certified by applicable agencies that it is in compliance with codes.

Applicability: The codes and standards and practices listed herein dates are furnished as the minimum latest requirements.

State of Florida.
Osceola County.

Utility Company: Comply with latest utility company regulations.

State Statutes: Florida Statutes

4A3, The State Fire Prevention Code
4A47, The Uniform Fire Safety Standards for Elevators.
State Requirements for Educational Facilities. (SREF)

Building Code: Standard Building Code.

Standards: American Society of Mechanical Engineers

ASME-A17.1 Elevator Code, plus Interpretations to Date.

Florida Americans with Disabilities Accessibility Implementation Act as described in Florida Accessibility Code for Building Construction, Department of Community Affairs.

Labels: Materials and equipment shall be new and free of defects, and shall be U.L. listed, bear the U.L. label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available or desired for certain types of equipment, test data shall be submitted to validate that equipment meets or exceeds available standards.

NFPA: National Fire Protection Association (NFPA) Standards

NFPA-13	Installation Of Sprinkler Systems.
NFPA-20	Installation Of Centrifugal Fire Pumps.
NFPA-54	National Fuel Gas Code.
NFPA-70	National Electrical Code.
NFPA-72	Installation, Maintenance And Use Of Fire Alarm Systems.
NFPA-75	Protection of Electronic Computer/Data Processing Equipment.
NFPA-90A	Installation of Air Conditioning And Ventilation Systems.
NFPA-96	Installation of Equipment For The Removal Of Smoke And Grease Laden Vapors From Commercial Cooking.
NFPA-101	Life Safety Code.

SUPERVISION OF THE WORK

Supervision: Provide one field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable sizes, type and complexity. The Superintendent shall be present at all times when work is being performed. At least one member of the Electrical Contracting Firm shall hold a State Master Certificate of Competency.

COORDINATION

General: Compare drawings and specifications with those of other trades and report any discrepancies between them to the Architect. Obtain from the Architect written instructions to make the necessary changes in any of the affected work. Work shall be installed in cooperation with other Trades installing interrelated work. Before installation, Trades shall make proper provisions to avoid interferences in a manner approved by the Architect.

Provide all required coordination and supervision where work connects to or is affected by work of others, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:

Door hardware
Roll-up doors
Roll-up grilles
Signage
Fire shutters
Elevators
Sliding or automatic doors
Mechanical Division of the Specifications

Landscape Architect drawings
Lifts
Laundry equipment
Kitchen equipment
Millwork design drawings and shop drawings

Obtain set of Contract Documents from Owner's Authorized Representative or Contractor for all areas of work noted above and include all electrical work in bid whether included in Division 16 Contract Documents or not.

Secure approved shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on approved shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.

Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner.

Adjustments: Locations of raceway and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Determine the exact routing and location of systems prior to fabrication or installation.

Priorities: Lines which pitch shall have the right of way over those which do not pitch. For example, plumbing drains shall normally have the right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.

Modifications: Offsets and changes of direction in raceway systems shall be made to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. Provide elbows, boxes, etc., as required to allow offsets and changes to suit job conditions.

Replacement: Work shall be installed in a way to permit removal (without damage to other parts) of other system components provided under this Contract requiring periodic replacement or maintenance. Raceway shall be arranged in a manner to clear the openings of swinging overhead access doors as well as ceiling tiles.

Layout: The Contract Drawings are diagrammatic only intending to show general runs and locations of raceway and equipment, and not necessarily showing required offsets, details and accessories and equipment to be connected. Work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation, which will afford maximum accessibility for operation, maintenance and headroom.

Contract Conflicts: Where discrepancies exist in the Scope of Work as to what Trade provides items such as starters, disconnects, flow switches, etc. such conflicts shall be coordinated between the divisions involved. It is the intent of the Contract Documents that all work shall be provided complete as one bid price.

Drawing Conflicts: Where drawing details, plans or specification requirements are in conflict and where sizes of the same item run are shown to be different within the contract documents, the most stringent requirement shall be included in the Contract. Systems and equipment called for in the specification or as shown on the drawings shall be provided as if it was required by both the drawings and specifications. Prior to ordering or installation of any portion of work, which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided.

It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner's Authorized Representative and Designer (and receive their approval) prior to rough-in. Locations indicated in Contract Documents are only approximate locations.

The Contract Documents describe specific sizes of switches, breakers, fuses, Raceways, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). Coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. Adjust circuit breaker, fuse, Raceway, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes shall be made at no additional cost to the Owner.

Working Clearances: Minimum working clearances about electrical equipment shall be as referenced in the applicable edition NEC Article 110, and shall include equipment installed in ceiling spaces.

COORDINATION STUDY

Specified Manufacturers: All panelboard and circuit breakers shall be of the manufacturer and type specified herein, and as indicated on the drawings or the Coordination Study. Any discrepancies or conflicts in specified equipment shall be brought to the attention of the engineer during bid, for formal clarification.

Substitutions: Alternate manufacturers listed will be considered under the following conditions:

Written approval of the Owner to consider alternate manufacturer.
Ability of alternate manufacturer to meet the requirements of the Construction Documents.
Alternate equipment selection shall provide selective overcurrent device coordination, including coordination with existing equipment.
Submission of coordination plots, showing proper selective coordination of proposed equipment for reference and review. Provide coordination plots for all distribution branches indicated on Construction Documents.

PRODUCTS

MATERIALS

Specified Method: Where several brand names, make or manufacturers are listed as acceptable each shall be regarded as equally acceptable, based on the design selection but each must meet all specification requirements. Where a manufacturer's model number is listed, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to Engineer's review and acceptance. Where manufacturers are listed, one of the listed manufacturers shall be submitted for acceptance. No substitutions are permitted.

Certification: When a product is specified to be in accordance with a trade association or government standard requested by the Engineer, Contractor shall provide a certificate that the product complies with the referenced standard. Upon request of Engineer, Contractor shall submit supporting test data to substantiate compliance.

Basis of Bid: Each bidder represents that his bid is based upon the manufacturer's, materials, and equipment described in the Contract Documents.

Space Requirements: Equipment or optional equipment shall conform to established space requirements within the project. Equipment which does not meet space requirements, shall be replaced at no additional expense to the Contract. Modifications of related systems shall be made at no additional expense to the Contract. Submit modifications to the Architect/Engineer for acceptance.

SHOP DRAWINGS

General: Shop drawings shall be submitted for every item listed within the Submittals section each individual specification section. One copy shall be submitted to the engineer prior to ordering equipment. Refer to Basis of approval paragraph.

Responsibility: It is the Contractors responsibility to provide material in accordance with the plans and specifications. Material not provided in accordance with the plans and specifications shall be removed and replaced at the Contractors expense.

Official Record: The shop drawing submittal shall become the official record of the materials to be installed. If materials are installed which do not correspond to the record submittal they shall be removed from the project without any additional cost or delays in construction completion.

Information: The shop drawing record submittal shall include the following information to the extent applicable to the particular item;

Manufacturer's name and product designation or catalog number.
Standards or specifications of ANSI, ASTM, ICEA, IEEE, ISA, NEMA, NFPA, OSHA, UL, or other organizations, including the type, size, or other designation.
Dimensioned plan, sections, and elevations showing means for mounting, Raceway connections, and grounding, and showing layout of components.
Materials and finish specifications, including paints.
List of components including manufacturer's names and catalog numbers.
Internal wiring diagram indicating connections to components and the terminals for external connections.
Manufacturer's instructions and recommendations for installation, operation, and maintenance.
Manufacturer's recommended list of spare parts.
Provide 1/2" = 1'-0" enlarged electrical room layout drawings for all electrical rooms. All equipment shall be indicated at actual size of equipment being provided. All dimensions and required working clearances shall be shown.

Preparation: Prior to submittal, shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned to Contractor unreviewed.

Basis of Review: Approval is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Contractor is responsible for quantities, dimensions, fabrication processes, and construction techniques.

Responsibility: The responsibility that dimensions are confirmed and correlated with proper coordination of other trades shall be included as part of the Contract Documents. The responsibility and the necessity of providing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings shall be included as part of the Contract Documents. The Contractor is responsible for any delays in job progress occurring directly or indirectly from late submissions or re-submissions of shop drawings, product data, or samples.

Ordering Equipment: No material shall be ordered or shop work started until the Engineer's has officially received the shop drawings record submittal and has formally released the Contractor for submittal requirements.

Brochure Requirements: Submit Technical Information Brochures at the start of construction or no later than 30 days after Award of the Contract. Each brochure shall consist of an adequately sized, hardcover, 3-ring binder for 8-1/2" X 11" sheets. Provide correct designation on outside cover and on end of brochure. When one binder is not enough to adequately catalog all data, an additional binder shall be submitted.

Brochure Contents: First sheet in the brochure shall be a photocopy of the Electrical Index pages in these specifications. Second sheet shall be a list of Project Addresses for this project. Third sheet shall list Project Information. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Electrical Schedule. Technical Information consisting of marked catalog sheets or shop drawings shall be inserted in the brochure in proper order on all items specified and shown on drawings. At the end of the brochure, provide and insert a copy of the specifications for this Division and all addenda applicable to this Division.

Contractor's Review: Review the brochures before submitting to the Engineer. No request for payment shall be considered until the brochure has been reviewed, stamped and submitted for review.

Cost: Submit cost breakdown on work in the Technical Information Brochures. The cost of material and labor for each item shall be indicated. The cost of fittings and incidentals are not required.

Title Drawings: Title drawings to include identification of project and names of Architect-Engineer, Engineer, Contractors, and/or supplier, data, number sequentially and indicate in general;

Fabrication and Erection dimensions.
Arrangements and sectional views.
Necessary details, including complete information for making connections with other work.
Kinds of materials and finishes.
Descriptive names of equipment.
Modifications and options to standard equipment required by the contract.
Leave blank area, size approximately 4 by 2-1/2 inches, near title block (for Engineer's stamp imprint).
In order to facilitate review of shop drawings, they shall be noted, indicating by cross-reference the contract drawings, notes, and specification paragraph numbers where items occur in the contract documents.
See specific sections of specifications for further requirements.

Technical Data: Submit technical data verifying that the item submitted complies with the requirements of the specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate optional equipment and changes from the standard item as called for in the specifications. Provide drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.

Same Manufacturer: In general, relays, contactors, starters, motor control centers, switchboards, panelboards, dry type transformers, disconnect switches, circuit breakers, manual motor starter switches, etc., shall be supplied and manufactured by the same manufacturer. This requirement shall apply to same type of electrical components specified in other Divisions.

EQUIPMENT, MATERIALS, AND SUPPORTS

General: Each item of equipment or material shall be manufactured by a company regularly engaged in the manufacturer of the type and size of equipment, shall be suitable for the environment in which it is to be installed, shall be approved for its purpose, environment, and application, and shall bear the UL label.

Installation Requirements: Each item of equipment or material shall be installed in accordance with instructions and recommendations of the manufacturer, however, the methods shall not be less stringent than specified herein.

Required Accessories: Provide all devices and materials, such as expansion bolts, foundation bolts, screws, channels, angles, and other attaching means, required to fasten enclosures, raceways, and other electrical equipment and materials to be mounted on structures which are existing or new.

Protection: Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by the elements. Equipment shall be stored in dry permanent shelters. If apparatus has been damaged, such damage shall be repaired at no additional cost or time extension to the Contract. If apparatus has been subject to possible injury, it shall be thoroughly cleaned, dried out and put through tests as directed by the Manufacturer and Engineer, or shall be replaced, if directed by the Engineer, at no additional cost to the Contract.

IDENTIFICATION OF EQUIPMENT

General: Electrical items shall be identified as specified in the Contract Documents. Such identification shall be in addition to the manufacturer's nameplates and shall serve to identify the item's function and the equipment or system, which it serves or controls. Refer to Identification Section of the specifications for additional information.

CONCRETE PADS

General: Provide reinforced concrete pads for floor mounted electrical equipment. Unless otherwise noted, pads shall be nominal four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches on all sides, except when equipment is flush against a wall, then the side or sides against the wall shall be flush with the equipment. Chamfer top edges 1/2". Trowel surfaces smooth. Reinforce pads with #5 reinforcing bars at 24" centers each way, unless specifically detailed on drawings.

SURFACE MOUNTED EQUIPMENT

General: Surface mounted fixtures, outlets, cabinets, panels, etc. shall have a factory-applied finish or shall be painted as accepted by Engineer. Raceways and fittings, where allowed to be installed surface mounted, shall be painted to match the finish on which it was installed. Paint shall be in accordance with other applicable sections of these specifications.

CUTTING AND PATCHING

Core Drilling: The Contractor shall be responsible for core drilling as required for work under this section, but in no case shall the Contractor cut into or weld onto any structural element of the project without the written approval of the Architect.

Cutting and Patching: Cutting, rough patching and finish patching shall be provided as specified in the contract documents. Cutting and patching shall be performed in a neat and workmanlike manner. Upon completion, the patched area shall match adjacent surfaces.

Openings and Sleeves: Locate openings required for work performed under this section. Provide sleeves, guards or other accepted methods to allow passage of items installed under this section.

Roof Penetration: Provide roofer with pitch pans, fittings, etc., required for electrical items which penetrate the roof. Roof penetrations are to be waterproofed in such a manner that roofing guarantees are fully in force. Roof penetrations shall be coordinated with other Trades to ensure that roof warranty is not invalidated.

SLEEVES AND FORMS FOR OPENINGS

Sleeves: Provide sleeves for Raceways penetrating floors, walls, partitions, etc. Locate necessary slots for electrical work and form before concrete is poured. Watertight sleeves shall be line seal type WS. Fire rated partition sleeves shall be mild steel. Sleeves shall be Schedule 40 PVC or galvanized rigid steel unless specifically noted otherwise. Size shall be one standard diameter larger than pipe being installed or of a larger diameter to below 1/4" minimum clearance.

Forms: Provide boxed out forms for Raceway penetrations only where allowed by the Architect. Fill opening after Raceway installation, with equivalent material.

OPERATING AND MAINTENANCE INSTRUCTIONS

General: Thoroughly instruct the Owner's Representative, to the complete satisfaction of the Architect and Engineer, in the proper operation of all systems and equipment provided. The Contractor shall make all arrangements, via the Architect, as to whom the instructions are to be given in the operation of the systems and the period of time in which they are to be given. The Architect shall be completely satisfied that the Owner's Representative has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by the Contractor to the Owner's Representative, then the Contractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this paragraph of the Specification has been complied with.

Submittals: Submit to the Architect for approval five (5) typed sets, bound neatly in loose-leaf binders, of instructions for the installation, operation, care and maintenance of equipment and systems, including instructions for the ordering and stocking of spare parts for equipment installed under this contract. The lists shall include part number and suggested suppliers. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.

Information Requirements: Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub index for each section shall also be provided.

Instructions: The instructions shall contain information deemed necessary by the Architect and include but not limited to the following:

Introduction:
Summary description of the Electrical Systems.
Purpose of systems.

System:

Detailed description of all systems.
Illustrations, schematics, block diagrams, catalog cuts and other exhibits.

Operations:

Complete detailed, step by step, sequential description of all phases of operation for all portions of the systems, including start up, shutdown and balancing. Include posted instruction charts.

Maintenance:

Parts list and part numbers.
Maintenance and replacement charts and the Manufacturer's recommendations for preventive maintenance.
Trouble shooting charts for systems and components.
Instructions for testing each type of part.
Recommended list of on-hand spare parts.
Complete calibration instructions for all parts and entire systems.
General and miscellaneous maintenance notes.

Manufacturer's Literature:

Complete listing for all parts.
Names, addresses and telephone numbers.
Care and operation.
All pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.
Internal wiring diagrams and Engineering data sheets for all items and/or equipment furnished under each Contract.
Guarantee and warranty data.

SERVICE AND METERING

Company: The utility company serving this project will be referred to as the Utility Company herein.

Service: Make arrangements with the power company for obtaining a complete service. Pay charges and provide labor and material for the service. Service shall be obtained at 277/480 volts from the Utility Company. Provide underground cables and Raceways for incoming services from the utility's overhead service drop to distribution equipment. Provide Utility Company approved meter socket and empty Raceway (per utility co. specs.) from transformer secondary bushings to meter location.

A. Fees: Contact the Utility Company to determine if any fees, charges or costs will be due the Company, as required for temporary power, permanent power, installations, hook-ups, etc. This fee, charge or cost shall be included in the bid price.

B. Payment: Pay for required licenses, fees and inspections. Include costs in the proposed construction cost submission. These costs shall include but not be limited to applicable taxes, permits, necessary notices, certificates and costs required to obtain same.

C. Codes: Install a complete system in accordance with the latest edition of the National Electrical Code and the latest regulations of governing local, State, County and other applicable codes, including the Utility Company requirements.

D. Provide transformer pad per Utility Company requirements.

TEMPORARY LIGHT AND POWER

Capacity: Provide capacity from new temporary service. Make arrangements with the Owner for temporary service and pay all related expenses. Temporary light and power shall be provided constantly during the project dependent upon Owner's safety requirements.

Capacity: Make arrangements with the Owner for existing temporary service and pay all related expenses. Temporary light and power shall be provided constantly during the project dependent upon Owner's safety requirements.

Lighting: Temporary light shall be based on one 200 watt lamp covering each 1,000 square foot of floor area in the building. Each room 100 square foot and over shall have a minimum of one 100-watt lamp with guards. Provide power for motors up to 3/4 horsepower only. Provisions are to be made for electric welders, if required.

Outlets: Provide outlets located at convenient points so that extension cords of not over fifty (50) feet will reach work requiring artificial light or power.

Other Connections: Contractors of other trades shall furnish their own cords and sockets, as may be required for their work and shall also pay for cost of temporary wiring of construction offices and shanties used by them.

New Fixtures: Permanently installed lighting fixtures may be used for temporary lighting at the Contractor's option with the provision that cool white lamps for fluorescent, clear lamps for incandescent and marked temporary for other types shall be installed. At job completion, lamps shall be replaced with permanent lamps specified.

Wiring: Temporary electrical work shall be furnished and installed in conformity with the National Electrical Code and in accordance with the requirements of the local ordinances and shall be maintained in a workmanlike manner throughout their entire construction period and shall be removed after installation of the permanent electrical systems. Extension cords shall be GFCI protected or shall be fed from GFCI circuit breakers.

Payment: The Contractor will pay for the cost of energy consumed by all trades. Any temporary wiring of a special nature for light and power required other than mentioned above shall be paid for by the Contractor using same.

EXECUTION

WORKMANSHIP

General: The installation of materials and equipment shall be performed in a neat, workmanlike and timely manner by an adequate number of craftsmen knowledgeable of the requirements of the Contract Documents. They shall be skilled in the methods and craftsmanship needed to produce a quality level of workmanship. Personnel who install materials and equipment shall be qualified by training and experience to perform their assigned tasks.

Acceptable Workmanship: Acceptable workmanship is characterized by first-quality appearance and function, conforming to applicable standards of building system construction, and exhibiting a high degree of quality and proficiency which is judged by the Architect as equivalent or better than that ordinarily produced by qualified industry tradesmen.

Performance: Personnel shall not be used in the performance of the installation of material and equipment who, in the opinion of the Architect, are deemed to be careless or unqualified to perform the assigned tasks. Material and equipment installations not in compliance with the Contract Documents, or installed with substandard workmanship and not acceptable to the Architect, shall be removed and reinstalled by qualified craftsmen, at no change in the contract price.

PROTECTION AND CLEAN UP

Protection and Restoration: Suitably protect equipment provided under this Division during construction. Restore damaged surfaces and items to "like new" condition before a request for substantial completion inspection.

Handling: Materials shall be properly protected and Raceway openings shall be temporarily closed by the Contractor to prevent obstruction and damage. Post notice prohibiting the use of systems provided under this Contract, prior to completion of work and acceptance of systems by the Owner's representative. The Contractor shall take precautions to protect his materials from damage and theft.

Safeguards: The Contractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or systems provided under this contract.

Cleanup: Keep the job site free from debris and rubbish. Remove debris and rubbish from the site and leave premises in clean condition on a daily basis.

SYSTEMS GUARANTEE

General: Provide a one-year guarantee. This guarantee shall be by the Contractor to the Owner for any defective workmanship or material, which has been provided under this Contract at no cost to the Owner for a period of one year from the date of substantial completion of the System. The guarantee shall include lamps, for ninety days after date of Substantial Completion of the System. Explain the provisions of guarantee to the Owner at the "Demonstration of Completed System".

FINAL OBSERVATION

General: Work shall be completed, and forms and other information shall be submitted for acceptance one week prior to the request for final observation of the installation.

SPECIAL CONSIDERATIONS

Comply with special requirements imposed at site by Owner. This may include badging of employees, prohibition of smoking, special working hours, or special working conditions.

END OF SECTION

CERTIFICATE OF COMPLETED DEMONSTRATION MEMO

Note to Contractor: Do not submit this form at the time Technical Information Brochure is submitted. Submit five copies of information listed below for checking at least one week before scheduled completion of the building. After information has been accepted and inserted in each brochure, give the Owner a Demonstration of the Completed Electrical Systems and have the Owner sign five copies of this form. Provide one signed copy for each brochure. After this has been done, a written request for a final inspection of the System shall be made.

Re: _____
(Name of Project)

_____
(Division Number and Name)

This memo is for the information of all concerned that the Owner has been given a Demonstration of the Completed Electrical Systems on the work covered under this Division. This conference consisted of the system operation, a tour on which all major items of equipment were pointed out, and the following items were given to the Owner;

(a) Owner's copy of Technical Information Brochure containing approved submittal sheets on all items, including the following; (To be inserted in the Technical Information Brochure after the correct tab).
    (1) Maintenance Information published by manufacturer on equipment items.
    (2) Printed Warranties by manufacturers on equipment items.
    (3) Performance verification information as recorded by the Contractor.
    (4) Check-out Memo on equipment by manufacturer's representative.
    (5) Written operating instructions on any specialized items.
    (6) Explanation of the one-year guarantee on the system.

(b) "As-Built" conditions as described in the record drawing specifications.
(c) A demonstration of the System in Operation and of the maintenance procedures which shall be required.

_____
(Name of General Contractor)

By: _____
(Authorized Signature, Title & Date)

_____
(Name of SubContractor)

By: _____
(Authorized Signature, Title & Date)

Brochure, Instruction, Prints, Demonstration & Instruction in Operation Received:

_____
(Name of Owner)

By: _____
(Authorized Signature, Title, Date)

cc: Owner, Architect, Engineer, Contractor, Sub Contractor and General Contractor
(List names as stated in cc: above)

SECTION 16020
TESTS AND PERFORMANCE VERIFICATION

GENERAL

RELATED DOCUMENTS

General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

DESCRIPTION

Time: Perform verification work as required to show that the System is operating correctly in accordance with contract documents and manufacturers literature. All verification shall be done after 3-day full operational period.

Submission: Submit check out memos and completed testing results of all systems, cable, equipment, devices, etc., for acceptance prior to being energized or utilized.

QUALITY ASSURANCE

Compliance: Testing shall comply to the following standards;

NEMA
ASTM
NETA
ANSI C2
ICEA
NFPA

QUALIFICATIONS OF TESTING FIRM

Qualification: The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, supplier, and installers of equipment or systems evaluated by the testing firm.

Experience: The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

Accreditation: The testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or be a Full Member company of the International Electrical Testing Association.

Certification: The lead, on-site, technical person shall be currently certified by the International Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

Personnel: The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.

Proof of Qualifications: The testing firm shall submit proof of the above qualifications when requested.

Suggested Companies: NETA certified pre-qualified testing firms for this project are;

Electro Test Inc. (941) 693-7100 Fax: (941) 693-7772
Industrial Electrical Testing, Inc. (904) 260-8378 Fax: (904) 260-0737
Electric Power Systems (407) 578-6424 Fax: (407) 578-6408

TESTS

EQUIPMENT

Instruments: Supply all instruments required to read and record data. Calibration date shall be submitted on test reports. All instruments shall be certified per NETA standards.

Adjustments: Adjust system to operate at the required performance levels and within all tolerances as required by NETA Standards.

APPLICATIONS

Switchboards, Panelboards and Mechanical Equipment Feeders: After feeders are in place, but before being connected to devices and equipment, test for shorts, opens, and for intentional and unintentional grounds.

Cables 600 Volts or Less: Cables 600 volts or less in size #1/0 and larger shall be meggered using an industry approved "megger" with 1000V internal generating voltage. Readings shall be recorded and submitted to the Engineer for acceptance prior to energizing same. If values are less than recommended NETA values notify Engineer. Submit 5 copies of tabulated megger test values for all cables.

Ratings 250V or Less: Cables 250V or less in size #1/0 and larger shall be meggered using an industry approved "megger" with 500V internal generating voltage. Readings shall be recorded and submitted to the Engineer, for acceptance prior to energizing same. Submit (5) copies of tabulated megger test values for all cables.

Transformers (75) KVA and larger. Perform Insulation resistance test and turns ratio test. Submit five (5) copies to Engineer at substantial completion.

MOTORS

Procedure: Test run each motor, (5 HP) and larger. Tabulate and submit 5 copies of the Test Information at substantial completion for final inspection. Refer to form at the end of this Section.

Provisions: With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. The condition shall be corrected when measured values deviate plus or minus 10% from the nameplate ratings.

Insulation: Test the insulation resistance's of all motor windings to ground with an appropriate test instrument as recommended by the motor manufacturer, before applying line voltage to the motors. If these values are less than the manufacturer's recommended values, notify the contractor providing the motor for correction before initial start up.

Power Factor: Check power factor of all motors (5 HP) and larger while driving it's intended load, and at all operating speeds.

GROUNDS

Electrode Ground: The resistance of electrodes (main service, generators, transformer, etc.) shall not exceed 10 ohms and shall be measured before equipment is placed in operation. Testing shall be performed on all grounding electrode installations. Testing of main ground shall be (3) point method in accordance with IEEE No. 81 Section 9.04 Standard.9. (2) point method for distribution equipment. Testing to be completed before service energized. Submit all ground test readings to the Engineer in tabulated format at substantial completion.

Electrode Ground: The resistance of electrodes (main service, generators, transformer, etc.) shall not exceed 5 ohms and shall be measured by The Contractor before equipment is placed in operation. Testing shall be performed on all grounding electrode installations. Testing shall be 2 point method in accordance with IEEE Standard 81. Submit all ground test readings to the Engineer in tabulated format at substantial completion.

DRY TYPE TRANSFORMERS

Required Factory Tests: Required factory tests shall be as follows;

Ratio
Polarity
Losses
No load
Full load
Resistance Measurements

Impedance
Temperature
Impulse Strength
Sound Level
Exciting Current
Low-frequency Dielectric Strength
ANSI Point and Curve

Submission: Submit test results with shop drawings.

EMERGENCY SYSTEM

General: Submit emergency system tests in accordance with NFPA 110. Refer to emergency section of the specification for additional information.

EXECUTION

SUBMITTALS

Cable Test Report: Submit Cable Test Report in Triplicate.

Transformer Test Report: Indicate comparative data of ANSI and NEMA Standards. Indicate all characteristic values as specified herein. Certified copies of tests on electrically duplicate units are acceptable.

Check Out Memos: Complete all information on forms at the end of this specification, project information, and certificate of completed demonstration memo. Submit data for examination and acceptance prior to final inspection request.

Tabulated Data: Submit data on 8-1/2 x 11 inch sheets with names of the personnel who performed the test.

Final: Submit accepted memos before a request for final inspection.

QUANTITIES

Quantity: Submit 5 copies of the check out memo on each major item of equipment. Insert accepted memos in each brochure with the performance verification information and submittal data.

END OF SECTION

FACILITY NAME:_____ PROJECT NAME:

DATE: _____TESTED BY:

MAXIMUM TEST INTERVALS: NAME:
COMPANY:

WET LOCATIONS - 12 MOS.

GROUND TEST REPORT

TYPE METER USED AND EXTERNAL NETWORK IF USED:

NOTE: MAXIMUM READINGS PERMITTED - 20 MV NEW CONSTRUCTION
40 MV CRITICAL EXISTING CONSTRUCTION
500 MV GENERAL CARE EXISTING CONSTRUCTION
0.1 OHM NEW CONSTRUCTION
0.2 OHM QUIET GROUNDS AND EXISTING

Room No.	AREA TYPE / Description	VOLTAGE MEASUREMENT			IMPEDANCE MEASUREMENT		REMARKS- IF VOLTAGE READINGS MORE THAN 20MV IN EXISTING CONST. NOTE TESTS & INVESTIGATION REQUIRED.
		NO. OF RECEPTS.	NO. OF OTHER	MAX. READING IN MILIVOLTS	NO. OF RECEPTS.	MAX READING IN OHMS	

PROJECT
NAME:_____

MOTOR TEST INFORMATION

Name of Checker:_____

Date Checked:_____

(a) Name and identifying mark of motor _____

(b) Manufacturer _____

(c) Model Number _____

(d) Serial Number _____

(e) RPM _____

(f) Frame Size _____

(g) Code Letter _____

(h) Horsepower _____

(i) Nameplate Voltage and Phase _____

(j) Nameplate Amps _____

(k) Actual Voltage _____

(l) Actual Amps _____

(m) Starter Manufacturer _____

(n) Starter Size _____

(o) Heater Size, Catalog No. and Amp Rating _____

(p) Manufacturer of dual-element fuse _____

(q) Amp rating of fuse _____

(r) Power Factor at _____ Speed _____
(For variable speed motors provide
recording chart over operating range)

TABULATED DATA

VOLTAGE AND AMPERAGE READINGS

SWITCHGEAR OR PANELBOARD

FULL LOAD AMPERAGE READINGS:

DATE

TIME

PHASE A.

B.

C.

N.

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

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

_____ENGINEERS REPRESENTATIVE

_____CONTRACTORS REPRESENTATIVE

SECTION 16030
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.2 DESCRIPTION

A. Extent: Electrical identification work as required by the Contract Documents or other specifications.

B. Types: Electrical identification work specified in the Contract Documents include the following;

1. Electrical power, control and communication conductors.
2. Operational instructions and warnings.
3. Danger signs.
4. Conduits, boxes, etc.
5. Distribution Equipment.
6. Cabinets.
7. Equipment/system identification signs and tags.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacturer of electrical identification products of types required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.

C. UL Compliance: Comply with applicable requirements of UL Standard 969, "Marking and Labeling Systems", pertaining to electrical identification systems.

D. ANSI Compliance: Comply with applicable requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems", and ANSI Standard Z53.1 "Color Designation."

E. NEMA Compliance: Comply with applicable requirements of NEMA Standard No's. WC-1 and WC-2 pertaining to identification of power and control conductors.

F. ADA Compliance: All signage shall meet ADA standards. Identification for maintenance purposes shall be as specified herein.

1.4 SUBMITTALS

A. General: Submit shop drawings of all identification materials to be used for this project. Submit one sample of each item with the shop drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SUPPLIERS OR MANUFACTURERS

A. General: Subject to compliance with requirements, manufacturers offering electrical identification products which may be incorporated in the work include, but not limited to, the following;

1. Alarm Supply Co, Inc.
2. Direct Safety Co.
3. Ideal Industries, Inc.
4. LEM Products, Inc.

5. Markal Company
6. National Band and Tag Co.
7. Panduit Corp.
8. Seton Name Plate Co.
9. Thomas and Betts Co.
10. Carlton Industries, Inc.

2.2 LANGUAGE

A. General: Provide all products in this section in English.

2.3 ELECTRICAL IDENTIFICATION MATERIALS

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than one single type is specified for an application, selection shall be at the installer's option, however, provide a single selection for each application.

B. Conduit System Markers: Color doe fittings every 10-feet on conduit system.

C. Baked Enamel Danger Signs: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20 gauge steel; of standard red, black and white graphics; 14 x 10 inch size except where 10 x 7 inch is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, and subsequent directive e.g. HIGH VOLTAGE, KEEP OUT; BURIED CABLE, DO NOT DIG; LIVE PARTS, DO NOT TOUCH SWITCH.

D. Engraved Plastic Laminate Nameplates: Provide engraving phenolic plastic laminate, in sizes and thicknesses indicated, engraved with 1/16 inch thick lines with square standard pica lettering and wording as specified herein, black face and white core plies (letter color) for 120/208 volt systems, bright Osceola and white for 277/480 volt and red and white for fire alarm and where noted in the specifications. Punch for mechanical fastening, except where adhesive mounting is necessary because of substrate. Material thickness shall be 1/16 inch. Provide beveled edge in order to eliminate sharp corners. Provide self-tapping stainless steel round head screws. Provide contact type permanent adhesive where screws cannot or shall not penetrate the substrate. Adhesive nameplate shall be permanently installed. Titles shall be 1/2 inch high and all other lettering shall be 1/4 inch high.

E. Underground Type Plastic Line Marker: Manufacturer's standard permanent, bright colored, continuous printed, metal backed plastic tape, intended for direct burial service; not less than 6 inches wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service or type of buried cable.

F. Junction Box Identification: Provide neat indelible felt tip, stenciled marking on junction box and pullbox covers. Letter sizes shall be 1-inch high minimum. Provide non-stenciled markings inside the junction box and on the exterior edge to match the cover markings.

G. Identify lighting or power circuits in indelible black felt tip on junction box and pull box covers.

2.4 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations, and other designations used in electrical identification work, with corresponding designations specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by the manufacturer and as required for proper identification and operation/maintenance of the electrical system equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

B. Size: System identification labeling consists of providing minimum 1/2 inch high stenciled black letters for raceway systems.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Installation: Install electrical identification products as indicated, in accordance with manufacturer's written instructions, as required by the NEC and as specified herein.

B. Coordination: Where identification is to be applied to surfaces which require a field finish application, install identification after completion of such application. Painting of conduit fittings will be acceptable.

C. Regulations: Comply with governing regulations and requests of governing authorities for the identification of electrical work.

D. Hazards: Identify all rooms, spaces, and equipment which house potential electrical hazards, and label with appropriate signage or indicators.

3.2 RACEWAY SYSTEM IDENTIFICATION

A. Color Coding: All electrical conduit shall be identified by color-coding. Apply color-coded identification on electrical conduit in a neat and workmanlike manner.

B. Identification: Identify all raceways provided or utilized as part of this project as follows;

1. Apply 10 feet on center along the raceway system and at each side of walls or floors, and at branches from mains.

2. Identify the following services;

	Service	Label
a.	Low Voltage	120/208 Voltage
b.	High Voltage	277/480 Voltage
c.	Fire Alarm	Fire Alarm
d.	Alarm Monitoring	Alarm

3. Spot Painting on Rough-in;

a. Conduit, raceways, boxes, backboxes, panelboards, etc. shall be spot painted. Conduit shall be identified within 6 inches of the box or enclosure. The entire box and coverplate shall be painted.

b. Use following colors for color bands and for color coding;

System		Color
1)	Normal and Equipment Power	Krylon Black (120/208)
2)	Lighting	Krylon Yellow (277/480)
3)	Fire Alarm	Krylon Red
4)	Equipment Power	Krylon Brown (277/480)
5)	Clean Power	Krylon White (120/208)

3.3 CABLE/CONDUCTOR IDENTIFICATION

A. General: Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where conductors of more than one circuit or communication (such as color coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for the project's electrical work.

B. Color Coding: Color code all power and lighting cable. Use wire colored by integral pigmentation, making the wire 100 percent colored. Where not practicable or available (in larger conductor sizes), color code the wire by using colored plastic tape, painting the ends accessible at junction or pull boxes, or other method acceptable to the Engineer. Use the following chart as applicable;

CONDUCTOR	120/208 VOLTS
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Equip.Ground	Green

CONDUCTOR	277/480 VOLTS
Phase A	Brown
Phase B	Osceola
Phase C	Yellow
Neutral	Gray
Equip.Ground	Green

3.4 OPERATIONAL IDENTIFICATION AND WARNINGS

A. General: Provide identification and warning wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems. Provide identification and warning identification if necessary for signage to help prevent misuse of electrical facilities by unauthorized personnel.

B. Plasticized signs: Install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes.

C. Locations: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified as constituting dangers for persons in or about the project.

D. High Voltage: Install danger signs wherever it is practicable, for persons to come into contact with electrical power of voltages higher than 277 volts to ground.

E. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

F. Electrical Equipment Rooms: Provide warning signage at the entrance to each such room; identify the hazard, and direct non-qualified personnel to stay away.

G. Equipment Identification:

1. Nameplates: Install an engraved phenolic plastic laminate nameplate on each unit of electrical equipment in the building, including central or master unit of each electrical system unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text. Provide text matching terminology and numbering of the contract documents and shop drawings.

    a. Normal system shall be 1/2 inch high white lettering in a black field.
    b. Emergency system shall be 1/2 inch high white lettering in a red field for life safety, Osceola for critical and green for equipment branch.

2. Locations: Provide nameplates for each unit of the following categories of electrical work;

    a. Switchboard, panelboards, electrical cabinets, and enclosures.
        1) Provide a nameplate inside, outside and above the door (if equipped with one) listing its designation, voltage, source and circuit number.
    b. Access panel/doors to electrical facilities.
    c. Major electrical switchgear and switchboards.
    d. Motor Control Centers.
    e. Power Transfer Equipment.
    f. Transformers.
    g. Motor starters.
    h. Disconnect switches.
    i. Enclosed circuit breakers.
    j. Communication Control Panels, Terminal Cabinets and Equipment Cabinets.
    k. Telephone Switching Equipment
    l. Remote Annunciators
    m. Terminal Boards
    n. Install an engraved nameplate on the main electrical switchboard or on a plaque located in the Main Electrical Room indicating the name and cities of the home office of both of the Electrical Engineer and the Electrical Contractor.
    o. Other similar equipment as designated by the Engineer.

3. Viewing: Install nameplates at locations indicated and where not otherwise indicated at a location for the best convenience of viewing without interference with operation and maintenance of equipment.

    a. Secure to substrate with rigid fasteners. Utilize adhesive where fasteners cannot penetrate substrate.

4. Names: The names or wording used for a particular machine shall be the same as the one used on all motor starters, disconnects and remote button stations nameplates for that machine.

END OF SECTION

SECTION 16110
RACEWAYS AND CONDUIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION

A. General: Provide all supports, hangers and inserts required to mount conduit, pullboxes and other equipment provided under this Division.

B. Support: All items shall be supported from the structural portion of the building. Supports and hangers shall be of a type approved by Underwriters' Laboratories. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels. Do not install any devices supported by ceiling tiles.

C. Installation: The Contractor shall lay out and provide his work in advance of the laying of floors or walls, and shall provide all sleeves that may be required for openings through floors, walls, etc. Where plans call for conduit to be run exposed, provide all inserts and clamps for the supporting of conduit.

D. Systems: Provide conduit system of empty raceways including terminal cabinets, backboards and outlets as described and specified herein.

1.3 QUALITY ASSURANCE

A. Qualifications: Manufacturers shall be regularly engaged in the manufacture of conduit systems and fittings of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years in the USA.

B. Compliance: Materials shall comply with the latest edition of the following standards as they apply to the different raceway types specified herein;

1. ANSI:

a. ANSI C80.1: Rigid Steel Conduit (RSC)
b. ANSI C80.3: Electrical Metallic Tubing (EMT)

2. UL:

   a. UL 1: Flexible Metal Conduit
   b. UL 6: Rigid Steel Conduit (RSC)
   c. UL 360: Liquid-Tight Flexible Metal Conduit
   d. UL 514: Fittings for Metal Conduit
   e. UL 651: Nonmetallic Conduit (PVC)
   f. UL 797: Electrical Metallic Tubing (EMT)
   g. UL 886: Fittings for Hazardous Locations

3. NEMA:

   a. NEMA TC2: Rigid Nonmetallic Conduit (PVC)

4. Federal Specifications:

   a. WW-C-581: Rigid Steel Conduit (RSC)
   b. WW-C-563: Electrical Metallic Conduit (EMT)
   c. WW-C-566: Flexible Steel Conduit
   d. WC-1094A: Nonmetallic Rigid Conduit (PVC)
   e. WC-582A Conduit, Raceway, Metal and Fittings; surface

1.4 SUBMITTALS

A. Products: Submit manufacturer's product data, including technical information on each type of raceway system;

   1. All conduit
   2. Conduit fittings
   3. Plastic (PVC) solvent
   4. Black mastic coating for conduit
   5. Insulating and grounding bushings for conduit
   6. Galvanizing and protective coatings for conduit

B. Compliance: Product data shall show compliance with this section of the specifications, including U.L. label, manufacturer and manufacturer's written installation instructions.

1.5 CONDUIT

A. General: Provide a complete and continuous system of raceways to maintain a protected path for wires and cables to distribute electric power, and low voltage systems throughout the project, utilizing U.L. listed and labeled materials.

B. Accessories: Provide conduit accessories of types, sizes, and materials, as specified herein complying with manufacturers published product information, which match and mate conduit and tubing.

C. Interior Minimum Size: Minimum conduit size for light and power systems shall be 3/4 inch conduit for all power and lighting circuitry homeruns from panelboard to outlet box at first power consuming devices. The remainder of circuitry may be in 1/2 inch conduit, if it contains no more than 4 conductors per conduit (excluding the equipment grounding conductor), and phase conductors no larger than #12 AWG. Switchlegs may be 1/2inch conduit unless otherwise noted on drawings. Lighting fixture whips shall be 3/8-inch flexible conduit.

D. Site Underground Conduit: Unless otherwise noted, minimum underground raceways shall be 1 inch conduit. Homeruns from the branch circuit overcurrent device, through any control devices to the first exterior junction box or consumption device shall be 1-inch minimum.

E. System Conduit: Provide end bushings on all conduits.

F. Pull Strings: Provide pull strings in all empty raceways. Pull strings shall be nylon and shall be impervious to moisture. Pull strings installed in one inch and smaller conduits shall have a tensile strength of not less than 30 lbs. Pull strings installed in conduits larger than 1 inch shall a tensile strength not less than 200 lbs.

G. Conduit Bends: The use of NEC Table 346.10 Exception is not allowed.

1.6 LOCATIONS

A. Materials Above Grade: The following conduit types are to be installed above grade where specifically noted herein;

1. Electrical metallic tubing (thin wall)

2. Flexible metal conduit

3. Liquid-tight flexible metal conduit

4. Heavy wall Schedule 40 PVC

5. Galvanized rigid steel conduit

B. Materials Below Grade: The following conduit types are to be installed below grade where specifically noted herein;

1. Rigid galvanized conduit (heavy wall)

C. Materials on Roofs: The following conduit types are to be installed on roofs where specifically noted herein;

1. Rigid steel conduit

1.7 SURFACE RACEWAY

A. General: Provide surface mounted raceway where specifically indicated on the drawings. Raceway shall be metallic and one-piece type. Where wiring channels are specifically specified, they shall be two-piece type.

PART 2 - PRODUCTS

2.1 ELECTRICAL METALLIC TUBING

A. Fittings: Provide compression insulated throat type fittings.

B. Locknuts: Provide locknuts for securing conduit to enclosures with sharp edges for digging into metal, and ridged outside circumference for proper fastening.

2.2 BUSHINGS

A. Bushings: Bushings shall be provided on all terminations, mounted on the ends of all EMT connectors 1-1/4 inches and larger and within all equipment.

B. Construction: Bushings shall have a flared bottom and ribbed sides, with smooth insides to prevent damage to cable insulation.

C. Insulating Ring: Mold a phenolic insulating ring into sizes 1-1/4 inches and larger.

D. Grounding: Provide a screw type grounding terminal on all sizes.

2.3 RIGID METAL CONDUIT

A. Conduit: Conduit ends shall have precision cut hi-torque threads. One end of the conduit shall have a coupling and the other shall be covered with a color-coded plastic thread protector. Conduit shall be manufactured in 10 foot lengths.

B. Fittings: Fittings shall be cut groove steel. Cast fittings are not acceptable.

2.4 FLEXIBLE STEEL CONDUIT

A. Conduit and Standards: A continuous length, spirally wound steel strip, zinc-coated, each convolution interlocked with following convolution into a helix form. Product shall meet Federal Specification WW-C-566 and UL 1242.

B. Fittings: Provide conduit fittings for use with flexible steel conduit of the threadless hinged clamp type, and a male threaded end provided with a locknut.

1. Straight terminal connectors shall be one piece body, female end with clamp and deep slotted machine screw for securing conduit.
2. 45 and 90 degree terminal angle connectors shall be 2 piece body, with removable upper section, female end with clamp and deep slotted machine screw for securing conduit.

C. MC Cable is permitted as follows:

1. For lighting and receptacle circuits.
2. Al homeruns shall be in conduit to the first box or room where circuit is located. Remainder shall be in MC Cable.
3. Provide Caddy Clip supports in studs for cable. Caddy Clip #FB Series in all other studs to support cable and eliminate rattle.
4. For lighting whip support, utilize Caddy clip #4234 Series.
5. Plastic or steel tie wire will not be acceptable for support of MC cable.

2.5 LIQUID-TIGHT FLEXIBLE STEEL CONDUIT

A. Conduit: Plastic jacketed (PVC) liquid-tight flexible steel conduit with copper bonding conductor, and steel material galvanized inside and outside.

B. Fittings: Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings with insulated throat.

2.6 HEAVY WALL PVC CONDUIT (SCHEDULE 40)

A. Conduit: Schedule 40, 90 degrees C. UL rated, PVC conduit shall be composed of High Impact PVC (polyvinyl chloride C-2000 Compound), and shall conform to industry standards, and be UL listed in accordance with Article 347 of National Electrical Code for underground and exposed use. Materials must have tensile strength of 55 PSI, at 70 degrees F., flexural strength of 11,000 psi, compression strength of 8600 psi. Manufacturer shall have five years extruding PVC experience.

2.7 SUPPORTING DEVICES

A. Hangers: Hangers shall be made of durable materials suitable for the application involved. Where excessive corrosive conditions are encountered, hanger assemblies shall be protected after fabrication by galvanizing, or approved suitable preservative methods.

B. Materials: Insert anchors shall be installed on concrete or brick construction, with hex head machine screws. Recessed head screws shall be used in wood construction. An electric or hand drill shall be used for drilling holes for all inserts in concrete or similar construction. Installed inserts, brick, shall be near center of brick, not near edge or in joint. Drilled and tapped, and round head machine screws shall be used where steel members occur. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Gunpowder set anchors are not permitted.

C. Exterior: Supporting devices for exterior use shall be 316 stainless steel unless otherwise noted on drawings.

D. PVC Coated Conduit: Supporting devices for PVC coated conduit shall be as manufactured by the PVC coated conduit manufacturer and shall match in color and appearance.

2.8 WIREWAYS

A. General: Wireway shall be sized as shown on drawings, NEMA 1, lay-in type. Wireway sides and bottom shall contain no knock-outs. The Contractor shall punch holes required. The cover shall be hinge type with quarter turn fasteners to hold cover shut. Covers and bodies shall be 16 gauge steel. Wireway shall be as manufactured by Hoffman Engineering Company, Square "D" or Steel City.

2.9 MANHOLES

A. Concrete Strength: The design of concrete mixture shall be the responsibility of the contractor as set forth under ASTM Standard C-94 for ready-mixed concrete. The concrete produced shall have a concrete strength at 28 days which shall be not less that 2500 PSI.

B. Concrete Slump: The slump when tested in accordance with ASTM Standard C-143, shall be not more than 3 inches for vibrated concrete and 4 inches for non-vibrated concrete. Ready-mixed concrete shall be mixed and delivered to the project in accordance with ASTM Standard C-94, using Alternative No. 2 for the mix design. With each load of concrete delivered, the producer shall provide in duplicate before unloading at the site, delivery tickets of certification as required by ASTM C-94.

C. Mixing Option: At contractor's option, concrete may be mixed by volume at the project site in an accepted type batch mixer in the manner specified for stationary mixers in ASTM Standard C-94. The portions of cement, aggregate and water shall be selected to provide the characteristics indicated below for the compressive strength specified. Conformance with the strength requirements shall be as determined in accordance with ASTM Standard C-39.

D. Precast Option: Manholes may be of the precast type if accepted, submit drawings, calculations and necessary detail to determine acceptability.

E. Brick: Brick used where indicated shall be sewer and manhole brick conforming to ASTM C-32, Grade MS.

F. Mixture: Mortar shall be mixed in proportions of 1-part Portland Cement, -1/4-part hydrated lime and between 2-1/4 and 3 parts sand by volume. (At contractor's option, mortar may be mixed in the proportions of 1 part Portland Cement and between 4-1/2 and 6 parts of sand by volume).

G. Structural: Reinforcing bars shall be deformed and comply with either of the following ASTM Standards: Billet Steel Bars A-615 or Rail Steel Bars A-616.

H. Forming: Material for concrete forms shall be smooth boards exterior grade plywood or metal.

I. Drainage: Drainage Pipe and Fittings shall be cast-iron, extra strength. Drains shall be plain pattern in accordance with Specification WM-P-541.

J. Covers: Metal Frames, Covers and Gratings, except as indicated or specified otherwise, shall conform to Specification RR-F-621, and shall be of cast iron. Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Steel covers shall be rolled steel floor plate having an accepted anti-slip surface. Steel gratings shall be of welded construction and conform to the applicable requirements of Specification RR-G-661, Type 1.

K. Accessories: Pulling-in irons shall be steel bars bent in the form indicated, and cast in the walls and floors. In the floor, they shall be centered above or below, and opposite the conduits entering the manhole. Pulling-in irons shall be projected into the manhole approximately 4 inches. Irons shall be zinc-coated after fabrication in accordance with Specifications MIL-Z-17871. Cable Racks, including hooks and insulators, shall be installed in manhole and shall be sufficient to accommodate the present and future cables and shall be spaced not more than 18 inches apart horizontally. The wall bracket shall be Channel or T-Section steel. The hooks shall be of steel or malleable iron and shall be of the removable type. Insulators shall be dry-process glazed porcelain. The metal portion of racks shall be zinc-coated after fabrication in accordance with Specification MIL-Z-17871.

2.10 SURFACE RACEWAY

A. General: Provide a surface raceway system with raceway, boxes and appropriate fittings. Raceway shall be Wiremold V500 or equal.

B. Wiring Channel: Metal raceway where specifically indicated on the contract drawings shall be Wiremold G4000 series, unless otherwise noted.

C. Devices: Provide 20 ampere duplex receptacles 36 inches center-to-center unless otherwise noted.

PART 3 - EXECUTION

3.1 CONDUITS

A. Provide as a minimum 3/4 inch conduit from each of the following device locations to ceiling space. Terminate in ceiling cavity. Provide insulated bushings at ends of all conduits.

1. Security

3.2 IDENTIFICATION OF BOXES

A. Tags: During installation of pull strings all pull strings shall be marked with vinyl tags indicating where the opposite end may be found.

3.3 BLANK PLATES

A. Plates: Unless otherwise noted all outlet boxes shall receive blank plates matching the finish of plates on electrical devices in the same room.

3.4 RACEWAY INSTALLATION

A. Support: All raceways shall be run in a neat and workmanlike manner and shall be properly supported and in accordance with the latest edition of the NEC. Supporting conduit and boxes with wire is not acceptable. Exposed raceways where allowed, shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry. All conduits shall be securely fastened in place with at least one support per eight foot section. Support within one foot of changes in direction. All required hangers, supports and fastenings shall be provided at each elbow and at no more than one foot from the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits shall not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.

B. Hanger Installation: Where 2 or more conduits 1 inch or larger run parallel trapeze hangers may be used consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or approved clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.

C. Sealant: Provide a closed cell silicone foam sealant rated to provide a rating equal to the wall, ceiling, or floor assembly rating. Provide seals for the exterior of conduit penetrations consisting of a cast-in-place sleeve with a compressible rubber gasket between the conduit and the sleeve. Provide seals for the interior of the conduit penetrations consisting of gland type sealing bushing or closed cell silicone foam. Provide duct seal inside an appropriate seal-off fitting to seal the interior of the conduit system from water seepage or hazardous gases.

D. Routing: Conduits shall be run parallel to building walls wherever possible, exposed or concealed as specified, and shall be grouped in workmanlike fashion. Crisscrossing of conduits shall be minimized.

E. Location: All raceways except those from surface-mounted switches, outlet boxes or panels shall be run concealed from view. Surface mounted devices and equipment shall be specifically noted on the contract drawings. It is the intent that all raceways shall be run concealed unless specifically noted.

F. Protection: All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction until wires are pulled in and covers are in place. No conductors shall be pulled into raceways until the raceway system is complete.

G. Coordination: All raceways shall be kept clear of mechanical equipment and plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.

H. Masonry Installation: All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.

I. Arrangement: All raceways shall be run connecting outlet to circuits generally as shown on the drawings. Provide circuit connection arrangement shown. Actual final arrangement shall be in accordance with the record drawings section as specified herein.

J. Grounding: All branch circuit and feeder raceways shall have a copper system ground conductor within the conduit throughout the entire length of the circuit. All conduit shall be electrically continuous to establish redundant grounding.

K. Empty Raceways: Raceways which do not have conductors provided under this Division of the specifications shall be left with an acceptable nylon pullcord in raceway.

L. Manufacturer: Rigid Metallic Conduit, Electrical Metallic Tubing, Flexible Steel Conduit, Liquid-Tight Flexible Conduit, and PVC Conduit shall be manufactured within the United States, and each shall be as manufactured by one manufacturer.

M. Roof Installation: Conduit installations on roofs shall be kept to a bare minimum. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Supports shall be fastened to roof using roofing adhesive as specified in other sections of this specification.

N. Firewall Installation: Provide pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC Article 300 where required.

O. Dissimilar Metals: Avoid the use of dissimilar metals to reduce the possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.

P. Sealoff Fittings: Provide conduit sealoffs wherever the raceway system enters a hazardous or wet area or areas of drastic temperature change such as coolers, freezers, etc. as required.

Q. Identification: Provide appropriate identification as required by codes and as indicated on the drawings and in accordance with the methods specified herein.

R. Conduit: Conduits shall be anchored down to prevent floating while pouring in concrete.

3.5 SITE UNDERGROUND CONDUIT INSTALLATION

A. General: All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with Section 300-5 of the NEC except that the minimum cover for any conduit or duct bank shall be two feet, unless otherwise indicated.

B. Stubs: Spare conduit stubs shall be capped and accurately dimensioned on as-built drawings.

C. Separation: All conduit run underground, or stubbed above floor shall be separated with plastic interlocking spacers manufactured specifically for this purpose, or shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel.

D. Coating: Rigid metallic conduit installed underground shall be coated with waterproofing black mastic before installation, and all joints shall be recoated after installation.

E. Provide PVC conduit seperators at 10 foot intervals along conduit run to maintain spacing and arrangement; install prior to backfilling. Carlon high impact spacers with horizontal and vertical locking intervals.

3.6 RIGID METALLIC CONDUIT

A. Locknuts: Rigid steel box connections shall be made with double locknuts and bushings. Turn down on threads to solidly connect raceway to box or enclosure.

B. Bushings: Grounded insulated bushings shall be used on all rigid steel conduits terminating in panels, wire gutters, or cabinets . Bushing shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.

3.7 PVC CONDUIT

A. Floor Penetrations Exposed: Where PVC penetrates a floor in an exposed location from underground or in slab, a black mastic coated steel conduit elbow shall be used.

B. Location: No PVC shall be allowed anywhere except underground or in slab, with the exception that PVC conduit may be used in non-fire rated poured block walls and poured in place columns. No PVC elbows will be allowed anywhere on this project.

C. Floor Penetrations in Block: PVC may also be used for penetrations of floor into concrete block or hollow walls up to first outlet box provided outlet box is at a maximum height of 48 inches above finished floor.

D. Ground Conductor Installation: All individual bare copper ground conductors (i.e. service, transformer, or lightning protection grounds) shall be installed in PVC conduit.

E. Joints: PVC joints shall be solvent welded. Threads shall not be permitted on PVC conduit and fittings, except for rigid steel to PVC couplings. Installation of PVC conduit shall be in accordance with manufacturer's recommendations.

F. Restrict Support: PVC conduit shall not be used to support fixture or equipment.

G. Bonds: Field bends shall be made with an approved hotbox. Heating with flame and hand held dryers are prohibited.

H. Where PVC conduit is located under a concrete slab, install conduit 12” below concrete slab. Where long sweep elbows are required conduit may need to be deeper.

3.8 FLEXIBLE CONNECTIONS

A. Vibrating Equipment Connection: All connections to motors or other vibrating equipment (except dry type transformers) or at other locations where required shall be made with not less than 12 inches of flexible liquid-tight steel conduit, using special type of connectors with strain relief fittings at both terminations of conduit, Kellems Type 074-09 Series or accepted substitution.

B. Normal Type: Flex connectors shall have insulated throat and shall be T & B 3100 Series or accepted substitution.

C. Angle Type: Use angle connectors wherever necessary to relieve angle strain on flex conduit.

D. Transformer Connection: Connections to dry type transformers shall be made with flexible conduit.

3.9 ELECTRICAL METALLIC TUBING

A. Location: Install Electrical Metallic Tubing (thin wall) inside buildings, above the ground floor where not subject to mechanical injury.

B. Handling: All cut ends shall be reamed to remove rough edges.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.2 WIRES AND CABLES

A. Description: Provide a complete and continuous system of conductors as specified herein. All conductors shall be in accordance with the latest edition of the NEC.

1.3 QUALITY ASSURANCE

A. Qualifications: Manufacturers shall be regularly engaged in the manufacture of wire systems and fittings of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years in the USA.

B. Compliance: Materials shall comply with the following standards as they apply to the different wire types specified herein.

1. UL:

    a. 44 - Rubber insulated wire and cables.
    b. 83 - Thermoplastic insulated wires.
    c. 486-A-80 - Wire connectors and soldering lugs for use with copper.
    d. 486B - Splicing wire connectors
    e. 493 - Thermoplastic insulated underground feeder and branch circuit cables.

2. NFPA:

    a. 70 NEC

1.4 SUBMITTALS

A. General: Submit product data on all different types of conductors specified.

PART 2 - PRODUCTS

2.1 GENERAL

A. Conductors: Branch circuit and feeder conductors for electric power shall be copper type. Utilize THHN/THWN insulation for branch circuits and THWN/XHHW insulation for feeders, unless specifically noted otherwise. Conductors #10 AWG and smaller shall be solid, #8 AWG and larger shall be stranded. No aluminum wiring shall be permitted. All wire shall be sized as shown on the drawings. If no size is shown, wire shall be #12 AWG, except that branch "homeruns" over 50 ft. in length shall be #10 AWG for 120/208V circuits. Wire in vicinity of heat-producing equipment shall be type XHHW insulation. All wiring shall be manufactured in the USA and of 98 percent resistivity. #14 AWG minimum size conductors shall be used for fire alarm system.

B. Taps and Splices: All copper taps and splices in #8 AWG or smaller wire shall be fastened together by means of "wirenut" connectors (Ideal or accepted substitution). All taps and splices in wire larger than #8 AWG shall be made with compression type connectors and taped to provide insulation equal to wire. All taps and splices in manholes or in ground pull box shall be made with compression type connectors and covered with Raychem heavywall cable sleeves (type CTE or WCS) with type "S" sealant coating. Provide sleeve kits as per manufacturer's installation instructions.

C. Color Coding, General: All power feeders and branch circuits #8 AWG and smaller shall be installed with color-coded wire with the same color used for a system throughout the building. Power feeders above #8 AWG shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape shall cover the conductor insulation within the box or panel in such a manner so as to allow standard markings to be readily observed.

D. Colors: Unless otherwise accepted, color-code shall be as indicated in the Identification section of the specifications. All switchlegs, other voltage system wiring, control and interlock wiring shall be color-coded other than those listed in the Identification Section of these specifications.

E. Submittals: Submit cut sheets on all major types of wires and cables including splicing tape, and terminating/splicing lugs or connectors and cable sleeves.

2.2 MANUFACTURERS

A. General: Branch circuit and feeder conductors shall be manufactured by one of the following: General Cable Co., Anaconda, Pirelli or Rome Cable Corporation.

PART 3 - EXECUTION

3.1 EXECUTION

A. General: All wiring shall be installed in conduit (power, low voltage and control wiring), unless otherwise indicated or specified under other Sections of this specification. All wiring shall be installed per the latest edition of the NEC.

B. Connections: Conductors #10 and #12 AWG shall be connected with pre-insulated spring connectors incased in a steel shell and rated at not less than 105 degrees C. A minimum of 3/8 inch skirt shall cover the bare wires. The connector shall meet with UL approval for fixture and pressure work, and shall be "Scotch Lok" Type Y, R and B electrical spring connectors as manufactured by the 3M Company or approved equal.

C. Connector Manufacturers: Lugs and wire connectors shall be one of the following: Burndy Corporation, Thomas & Betts, Co., Appleton or ILSCO.

D. Equipment Installations: Neatly form, train and tie the cables in panelboards, cabinets, wireways, switches and equipment assemblies.

END OF SECTION

SECTION 16130
OUTLET BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.2 DESCRIPTION

A. General: Outlet boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.

B. Ceiling Size: Ceiling outlet boxes shall be 4 inch octagonal or 4 inch square by 1-1/2 inches deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.

C. Wall Size: Switch, wall receptacle, telephone and other wall outlet boxes in drywall shall be 4 inch square by 1-1/2 inches deep. For exposed masonry, provide one piece 4 inch square by 1-1/2 inches deep wall boxes with appropriate 4 inches square cut tile wall covers Steel City series #52-C-49/52-C-52 or accepted substitution. For furred-out block walls, provide 4 inch square box with required extension for block depth and required extension for drywall depth.

1.3 QUALITY ASSURANCE

A. Qualifications: Manufacturers shall be regularly engaged in the manufacture of conduit systems and fittings of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years in the USA.

B. Compliance: Materials shall comply with the following standards as they apply to the different raceway types specified herein.

1. UL-50 & UL-514
2. NEC 70

1.4 FLOOR OUTLETS

A. General: Provide floor outlet boxes as shown on the plans. Installation shall be in accordance with the National Electrical Code, and shall be complete with service fittings as indicated. Equipment shall be listed by Underwriters' Laboratories, Inc.

1.5 SPECIAL PURPOSE OUTLETS

A. Location: Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications.

1.6 SUBMITTALS

A. Submittals: Submit product data on all different types of outlet boxes and associated trim/plaster rings.

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE BOXES

A. General: Provide standard galvanized one-piece steel outlet boxes at all concealed outlets for electric lights, switches, convenience receptacles, telephone outlets, etc. Acceptable manufacturers shall be T&B, Steel City, Raco. Surface outlet boxes and conduit bodies shall be the heavy cast aluminum or iron with external raised hubs - Appleton, Crouse Hinds or Steel City or accepted substitution. Trim rings shall also be of one piece construction.

2.2 FLOOR OUTLET BOXES

A. Standards: Outlets in slab on grade shall conform to Federal Specifications No. WC-526b, Type 1, with threaded conduit hubs.

B. Carpet Locations: In carpeted areas, brass carpet flanges shall be installed to protect carpet edges where flush floor boxes are installed.

C. Construction: All assemblies shall be designed and installed to maintain grounding continuity, fireproofing and watertight integrity. Connections to boxes in slabs on grade shall be made tight or sealed to prevent entrance of moisture. Boxes shall be cast iron construction.

D. Accessories: Box trim, service fittings and accessories shall be brass and as required to provide a complete installation.

E. Manufacturer: Approved manufacturer is Walker, Raco, Steel City or Hubbell.

PART 3 - EXECUTION

3.1 INSTALLATION OF OUTLET BOXES

A. Installation: All flush outlets shall be mounted so that covers and plates shall finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth ring or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8 inch of finish wall surface.

B. Stud Walls: Outlet boxes mounted in metal stud walls, shall be supported to studs with 2 screws inside of outlet box to a horizontal stud brace between vertical studs.

C. Blank Covers: All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.

3.2 MOUNTING HEIGHT

A. Mounting Height: Height of wall outlets to center or bottom of box above finished floor shall be as follows, unless specifically noted otherwise. Verify all heights with the Architectural plans and shop drawings for installation. The following dimensions are a guide only. Specific heights required by governing institutions and laws shall apply.

Switches & Dimmers	46 inches to centerline
Receptacles	1 foot 6 inches to centerline
Branch Panelboards	6 foot 6 inches top of panel trim
Fire Alarm Pull Station	46 inches to centerline

B. Counter Tops: Bottoms of outlets above counter tops or base cabinets shall be minimum 2 inches above counter top or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Contractor to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural plans, prior to rough-in, regardless of height shown on documents.

C. Wall Outlets: Height of wall-mounted fixtures shall be as shown on the drawings or as required by Architectural plans and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.

3.3 FLOOR OUTLET BOXES

A. Adjustment: Where floor or fill depth is 3 inches or more, adjustable boxes with maximum vertical and angular adjustment for after concrete pour shall be used. After pour is complete, boxes shall be set and readjusted to provide a smooth surface conforming to the elevation and slope of the surrounding finished floor.

END OF SECTION

SECTION 16140
WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.2 DESCRIPTION

A. General: Provide factory fabricated wiring devices in type, color and electrical rating for the service indicated to provide convenient access to the electrical system for portable and permanent connections, and control of fixed outlets.

B. Ratings: Voltage and ampere rating of switches and receptacles shall be marked on the device, and shall conform to Voltage and Ampacity of system to which applied.

C. Hardware: Devices consist of all the necessary hardware to complete an installation and provide a margin of safety by inaccessibility of live electrical components.

1.3 WALL DIMMING CONTROLS

A. General: Incandescent - Provide dimming controls as indicated on drawings, and as specified herein to provide complete method of controlling the artificial illumination intensity portion of the project. Provide dimmers, controls, interfaces, and ancillary equipment to make a complete dimming system. Devices shall be terminal connected. Do not "back-stab" devices. Devices are to be slide.

B. General: Fluorescent - Provide dimming controls as indicated on drawings, and as specified herein to provide complete method of controlling the artificial illumination intensity portion of the project indicated. Provide dimmers, controls, interfaces, and ancillary equipment, dimming ballast, magnetic or electronic for use with specific control, to make a complete dimming system.

C. Standards: Voltage and ampere rating of dimmer controls shall be marked on dimmer, and shall conform to voltage of system to which applied.

1. WD-2-1970 for dimmers.
2. ANSI/IEEE Standard C62.41-
   a. Test withstand voltage surges of up to 6000 Volts and current surges of up to 200 Amps for dimmers without damage.
3. Nema WD-1
4. UL 20

1.4 DIMMING CONTROLS QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of wiring devices, of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years. Fully test all dimmers for proper operation prior to shipment from the factory. Equipment shall be as that manufactured by Lutron Electronics Co., Hubbell Manufacturing Co., Leviton Manufacturing.

B. Installer: A firm with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for the project.

C. Warranty: Provide a minimum one-year warranty from time of installation acceptance.

1.5 RECEPTACLES AND SWITCHES QUALITY ASSURANCE

A. Manufacturers: Manufacturers shall be companies regularly engaged in manufacture of wiring devices, of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years. Acceptable manufacturers are Pass & Seymour, Hubbell, and Leviton Manufacturing.

B. Installer: A firm with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for the project.

C. Compliance: Comply with the latest edition of the following standards;

1. NEMA WD1, WD3 and WD5
2. UL 5, 20 and 231
3. UL 1449
4. ANSI/IEEE Standard C62.41-1980 (Formerly IEEE 587)
   a. Test withstand voltage surges of up to 6000 volts and current surges of up to 200 amperes without damage.

D. Warranty: Provide a minimum one-year warranty from time of final acceptance.

1.6 SUBMITTALS

A. Wiring Devices: Submit manufacturer's product data on all wiring devices listed on the drawings including;

1. Colors
2. Dimensions
3. U.L. Label
4. Finish
5. Voltage
6. Wiring diagrams
7. Application information

B. Coverplates and Identification: Submit type of identification used for coverplates to comply with the Identification Section as specified herein. Screws to match coverplate color.

1.7 SEQUENCING AND SCHEDULING

A. Coordination: Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of all wiring devices.

PART 2 - PRODUCTS

2.1 WALL DIMMERS

A. Color: Unless otherwise noted, standard device and matching faceplate color shall be as specified in other sections. Match colors with other devices, particularly when multi-gang application requires devices by other manufacturers.

B. Dimensions: Profile projection off the wall of dimmer shall not exceed 0.295 inches beyond the surface of the wall. Dimmers in excess of 1500 watts shall not exceed 0.627 inches. Dimmer shall not exceed 2-3/4 inches in width for units 1000 watts or less and 4-1/2 inches for 1500 watt units. The height of all wattage units shall not exceed 4 1/2 inches. Depth of dimmer within backbox shall not exceed the following;

1. 1-5/16 inches for units 1000 watts and lower.
2. 1-5/8 inches for 1500 watt units.
3. Selected low voltage and 2-location dimmers may exceed the above depth, but shall in no case exceed 1-11/16 inches.
4. All dimmers within the same room or vicinity shall be of the same profile projection. Varying depths or projections shall not be tolerated.

C. Mounting: Dimmers shall be mounted individually in a single gang standard switchbox, and be gangable without removing side sections (fins) or derating each unit's capacity.

D. Operation: No auxiliary dimmers cabinets, control modules, or interfaces shall be required for operation at single location incandescent dimming of 2000 watts or less systems. 3-way dimmers shall be 3-way not one master and one slave.

E. Rating: All devices shall be capable of operating at rated capacity indicated on the drawings without affecting rated lifetime.

F. Temperature: Dimmers shall be capable of operating in an ambient temperature of 0 to 40 degrees C. (30 to 104 degrees F.)

G. Static Discharge: Dimmers shall not be susceptible to damage or loss of memory due to static discharge.

H. Short Circuit Test: Dimmers shall meet the UL 20 short circuit test requirement for snap switches.

I. Filtering: Dimmers shall utilize an LC filtering network to minimize interference with properly installed radio, audio, and video equipment. Provide heavy duty toroidal choke to suppress RFI interference.

J. Type: Dimmers shall be slide type.

2.2 LINEAR SLIDER DIMMERS

A. Operation: Linear Slider Preset Systems Operation shall provide a continuous linear slider movement, which controls lighting intensity in direct proportion to the movement of the slider. Provide a smooth and continuous Square Law Dimming curve. Slider shall be of the dual wiping type, with a smooth movement, and an even pressure requirement for movement along the entire length of the slider. Encase the slider within the dimmer enclosure to prevent accumulation of dust on the control movement.

B. Power-Failure Memory: When power is interrupted and subsequently returned, the lights shall come back on to the same levels set prior to the power interruption. Restoration to some other default or pre-set point is not acceptable, unless specifically noted elsewhere.

C. Regulation: Regulate voltage so that a 10 percent variation in the line voltage shall cause no more than a 5 percent variation in the load voltage when the dimmer is operating at 40 volts (5 percent light output).

D. Full-On Bypass: Dimmer shall contain latching contacts to bypass dimming circuitry when placed in the full on position to achieve 100 percent lighting output.

E. Manufacturer: Manufacturer shall be Pass & Seymour, Leviton or Hubbell.

2.3 FLUORESCENT DIMMING

A. Lamps: Dimmers shall be rated at 277 volts to control 40 lamps of the same current rating, but may be of different lengths.

B. Operation: Dimming operation and performance shall be as follows;

1. Dimming range from 100 to 1 percent light output
2. One and two-lamp fixture packs shall track evenly, with no perceptible difference in light levels for the same type lamps.
3. Different lengths of lamps shall track evenly, with no perceptible difference in light levels for the same type of lamps.

4. Fixture packs shall be inaudible with no apparent humming or buzzing at any point in the dimming range.
5. Use standard lamps for dimming applications. Do not use energy-saving krypton-fill gas lamps. Where applicable, use knife-edge lamp sockets.

    a. Burn fluorescent lamps for 100 hours to "season lamps" before acceptance by the owner.
    b. Warrantee does not become effective until after system is "seasoned" by 100 hour burning time.

6. Electrical noise shall be suppressed to a level that shall not interfere with the normal operation of other properly designed and installed electrical equipment.
7. Minimum light levels shall be user-adjustable in order to compensate for different loading of each dimmer.
8. Use and interface control where necessary for preset systems, or for two location dimming of fluorescent fixtures.

2.4 DIMMER FACEPLATES

A. Features: Faceplate shall snap on to device with no visible means of attachment. Heat fins shall not be visible on front of device.

B. Multigang: Using 2 or more dimmers and/or other wiring devices together. Include mounting frame for proper device alignment and faceplate attachment. Dimmers ganged with other devices in a common location shall be included under a single faceplate of the size and shape to accept all devices located in the ganged mounting. Utilize similar shaped wiring devices to dimmer configuration to keep alignment and appearance uniform.

C. Materials: Color and finish to be selected by the Architect/Engineer unless otherwise noted on the plans, or in these specifications.

2.5 CONVENIENCE RECEPTACLES

A. Twenty Ampere Receptacles: Provide commercial specification grade single or duplex receptacles, 2-pole, 3-wire grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 20 ampere, 120 volts, with metal plaster ears, side wiring, NEMA configuration 5-20R unless otherwise indicated.

B. Color: Devices connected to the normal system shall be grey in color, unless otherwise noted.

C. Device Type: Unless otherwise noted, in all public areas, provide all receptacles as the duplex modular type. Provide standard devices in non-public areas such as storage rooms, janitor's closet, penthouses & mechanical spaces, and electrical rooms.

D. Construction: Heavy duty nylon face and wraparound mounting strap, locked into and on the body, utilizing heavy-gauge brass ground contacts riveted to strap. Include automatic self-grounding spring to assure ground continuity between mounting strap and metal wall box. T-slot one piece copper alloy contact wipes which interface with plug blades inserted at 3 points. Line terminals shall be screw terminals and accept #14 to #10 AWG copper conductors.

E. Ground Fault Circuit Interrupter: Provide commercial specification grade, duplex, ground fault circuit interrupter receptacles, grounding type, UL rated Class A, Group 1, 20 ampere ratings, 125 volts, 60 Hz; with solid state ground fault sensing and signalling; with 5 milliampere ground fault trip level; equipped with 20 ampere receptacle configuration, NEMA 5-20R. Device shall contain test and reset pushbuttons, with a visual display of the tripped position. All outside receptacles (weatherproof) shall be duplex G.F.C.I. type. Interrupter shall resist tripping from the effects of radio frequency (RF) signals from 10 to 450 MHz.

2.6 SWITCHES

A. Toggle Switches: Provide specification grade, fast-make positive-break, flush single-pole, three and four way, silent operation toggle switches, 20 ampere, 120 volt AC or 277 volt AC as required, with mounting yoke insulated from mechanism, equipped with plaster ears, and side-wired screw terminals. Switches connected to the normal system shall be grey; red for emergency system.

B. Two Pole Switches: Provide two pole switches where drawings indicate the switching of 208 volt systems consisting of two phase conductors.

C. Security Key Switches: Provide key switches where drawings indicate, where a degree of security requires limited access to control of the lighting system.

D. Pilot Light Handle: Handle glows when switch is on. Handle color shall be clear, unless otherwise indicated.

E. Thermal Switch: Provide fractional horsepower switch with melting alloy type overload relay, with number of poles to coordinate with the equipment being controlled. Surface or flush mounted cover, as required, equipped with padlocking device and pilot light. Provide overload relay heaters for each pole of the switch, sized per the manufacturer's instruction, and adjust heater size to permit normal operation of the motor.

F. Color: Devices connected to the normal system shall be grey in color, unless otherwise noted.

2.7 PLUGS AND CONNECTORS

A. Standard: Comply with NEMA Standards Pub. No. WD1.

2.8 WIRING DEVICE ACCESSORIES

A. Multigang: Provide all necessary hardware and frames to properly mount various devices in combinations.

B. Exterior Device Covers: Provide "Weatherproof" duplex with stainless steel hinged cover. Device opening shall be standard or modular, to be compatible with the device provided for elsewhere in these specifications.

C. Color: Unless otherwise noted, provide colored faceplates to match devices listed elsewhere in these specifications.

2.9 PRODUCT DESIGN SELECTION

A. Standard Commercial Specification Grade Receptacles: Provide standard commercial specification grade receptacles as follows;

Description	Leviton	Hubbell	P & S
20 amp Simplex	#5801	#5351	#5351
20 amp Duplex	#CR20	#CR20	#5342
20 amp Duplex GFCI	#6898	#GF-5352	#2091-S
20 amp Duplex Isolated Gnd.	#5362-IG	#IG-5362	#IG-6300

B. Premium Standard Specification Grade Switches: Provide premium standard specification grade switches as follows;

Description	Leviton	Hubbell	P & S
20 amp Single	#1221-2	#1221	#20AC1
20 amp 3-way	#1223-2	#1223	#20AC3
20 amp 4-way	#1224-2	#1224	#20AC4
20 amp Single-Locking	#1221-2L	#1221-L	#20AC1-L
20 amp 3-way-Locking	#1223-2L	#1223-L	#20AC3-L
20 amp 4-way-Locking	#1224-2L	#1224-L	#20AC4-L
20 amp Single-Pilot	#1221-2PL	#1221-PL	#20AC1-CPL
20 amp 3-way-Pilot	#1223-2PL	#1223-PL	#20AC3-CPL

C. Dimmers: Provide dimmers as follows *per wattage requirements:

Description	Lutron	Leviton	Hubbell
Linear Slide	Nova T Star	80,000 series	AS series
Fluorescent	Nova T Star	86,000 series	AS series
Rotary	Centurion	60,000 series	AR series

D. Motor Starter Switches: Provide motor starter type switches as follows;

Description	Square D
Manual motor starter switch with overloads	Class 2510
Manual motor starter switch with overloads and pilot light	Class 2510

E. Device Covers: Provide device covers as follows;

Description	Leviton	Hubbell	P & S
Stainless steel coverplate	#302 S/S	#302	#302
Weatherproof stainless steel coverplate	----	----	WP-8
Weatherproof stainless steel coverplate locking type	----	----	SP-26L

F. Multi-outlet Assembly: Provide a multi-outlet assembly with 20 ampere single devices at 24 inches on center. Assembly shall be Wiremold 2400 Series.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES

A. General: Provide wiring devices, in accordance with manufacturer's written instructions, applicable requirements of NEC and National Electrical Contractors Associations "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve intended function.

B. Completion: Delay installation of devices until wiring and wall finish is completed.

C. Support: Devices shall be securely supported to box, not supported to device plate. Device shall trim out flush with front of plate. Do not support the device by loosening device mounting screws and attaching the coverplate for leveling.

D. Adjustment: Provide receptacles and switches only in electrical boxes which are clean, free from excess building materials, debris, etc. Adjust devices to plumb when tightened, and in position to receive faceplate. Devices shall not be leveled by using the mounting screws, outlet boxes shall be flush to wall finish prevent leveling problems. Tighten devices and provide securely, so that there shall be no movement during usage.

E. Position: Position ground pin at the top of the device in vertical application, unless otherwise noted.

F. Wiring: Provide screw terminal connections using a single conductor only. Do not "back-stab" devices. Provide single whips for all multiple conductor connections within each box.

3.2 WALL DIMMER INSTALLATION

A. General: Provide dimmers in accordance with manufacturer's written application, wiring, and installation instructions. Applicable requirements of NEC and National Electrical Contractors Associations "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve intended function.

B. Mounting: Provide dimmers only in electrical boxes which are clean and free from excess building materials, debris, etc. Adjust dimmers to plumb when tightened, and in position to receive faceplate. Tighten dimmers so that there shall be no movement during usage.

C. Cover Plates: Provide dimmers and cover plates in true vertical or horizontal alignment as applicable. Plates shall be properly secured by means of screws which have heads with finish matching the plate. Secure plates so as to maintain a snug fit against dimmer surfaces, with no gaps.

D. Position: Position ground pin at the top of the device in vertical application, unless otherwise noted. Slider to be in off position before connection to system.

3.3 APPLICATION OF COVER PLATES

A. Mounting: Provide coverplates in true vertical or horizontal alignment as applicable. Plates shall be properly secured by means of screws which have heads with finish matching the plate. Secure plates so as to maintain a snug fit against wall surfaces with no gaps.

B. Replacement: Replace all coverplates which are warped, cracked, chipped, or whose color does not match the balance of the installation. Replace screws whose threads do not allow the drawing up tight of the coverplate to the device.

3.4 CLEANING

A. Soiled Devices: Clean devices soiled prior to acceptance inspection, to remove all debris and foreign materials, such as paint, varnish, drywall compound, etc.

B. Solutions: Do not use liquid cleaning solutions, etc. on the face of the devices without written direction from the Engineer/Architect.

3.5 TESTING

A. Ground testing: Provide ground testing procedures as specified herein. Prior to energizing circuitry, test wiring devices for electrical continuity, and for short circuits.

B. Polarity: Subsequent to energization, test wiring devices for proper polarity, and to demonstrate operations as required in this and other sections of this Specification.

C. Recording: Record all tests as required in other sections of this specification.

END OF SECTION

SECTION 16425
DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.2 DESCRIPTION

A. Description of System: Provide factory-assembled, metal-enclosed switchboard for service entrance from line terminals to outgoing feeder terminals, complete, installed, and tested in place.

B. Description of System: Provide factory-assembled, metal-enclosed switchboard for distribution and control of power from line terminals to outgoing feeder terminals, complete, installed, and tested in place.

C. General: Switchboard shall include all main and branch protective devices, related equipment as required or as listed on drawings, with all necessary interconnections, instrumentation, control wiring, etc.

1.3 DISTRIBUTION SWITCHBOARDS QUALITY ASSURANCE

A. ANSI: The latest edition of the Reference Standards for the American National Standards Institute shall apply as follows;

1. ANSI Y32.2 - Graphic Symbols for Electrical and Electronic Diagrams.
2. ANSI Z55.1 - (R1973) Gray finishes for Industrial Apparatus and Equipment.
3. ANSI C57.13 - Instrument transformers

B. NEMA: National Electrical Manufacturers Association shall apply as follows;

1. NEMA PB2, Dead front Switchboards.
2. NEMA AB1, for molded case circuit breakers and switches.
3. NEMA MS1 for enclosed switches.

C. NFPA: The latest edition of the National Fire Protection Association shall apply as follows;

1. NFPA 70, National Electrical Code (NEC).
2. Refer to Section 16010 for additional references.

D. UL: The latest edition of the Underwriters' Laboratories, Incorporated shall apply as follows;

1. UL Electrical Construction Materials List Switchboards-dead front type (384 W4) WEVZ.
2. UL 891-Dead front switchboards.
3. UL 50 Cabinets and boxes.
4. UL 38 Enclosed and dead front switches.
5. UL 489 Molded case circuit breakers.
6. UL 891 Dead front switchboards.
7. UL 943 Ground fault circuit interrupters.
8. UL 977 Fused power circuit breakers

E. Source Quality Control: Tests to meet NEMA PB2 requirements.

F. Design Tests: Rated Continuous current test, short circuit current test, Enclosure test, Dielectric test.

G. Production Tests: Perform tests on completed switchboard assembly.

H. Type: Dielectric tests, Mechanical operation test, Grounding tests, Control wiring tests, Electrical operation tests.

1.4 SUBMITTALS - DISTRIBUTION SWITCHBOARDS

A. General: Submit layouts showing concrete pad dimensions, conduit entrance and available space, bus duct connections, electrical rating, nameplate nomenclature, single-line diagram (in accordance with ANSI Y32.2) indicating all connections and control.

B. Shop Drawings: Shop Drawings shall be submitted for each switchboard and shall clearly indicate all of the following information;

1. Enclosure elevations, studs and details.
2. Complete Construction Information
3. U.L. Label
4. Each overcurrent device amperage rating, circuit number and position/location in the switchboard.
5. Electrical characteristics
6. Dimensions, (width, depth, height, weight)
7. Switchboard classification
8. Frame size, rating and interrupting capacity of each breaker, and of total assembly.
9. Horsepower rating at rated voltage of fused switches and/or breakers.

10. Size and type of fuses being provided.
11. Ranges of all meters (all meters shall be analog).
12. Type of labeling for each overcurrent device and load (Provide at least one sample with shop drawing).
13. Main switchboard nameplate indicating project name; Architect, Engineer and Contractor.
14. Product data for switchboard mounted transformers; transfer switches; main fused "bolt-loc" switches; power breaker; or other specialties clearly and/or separately called out in the contract documents.
15. Bus bar size, type arrangement and spacing (Phase, neutral and ground bar).
16. Transparency log paper time current curves for protective relays, current and potential transformer excitation and saturation curves, and fuses.
17. Protective relay instruction books.
18. Shipping sections.
19. Lug sizes for cables on all switches or breakers.
20. Incoming lug sizes.

C. Product Data: Manufacturer's written recommendations for storage, protection, handling, installation instructions and field test requirements. Record all field tests, itemize data and submit at end of project with project manual.

D. Test Reports: Reports of production and field tests.

E. Operations and Maintenance Data: Provide and comply with manufacturer's instructions for tightening bus connections, performing cleaning, operating and maintaining switchboard.

1.5 QUALITY ASSURANCE

A. Standards: The switchboard shall comply with the latest edition of the following standards;

1. American National Standards Institute (ANSI):
   a. ANSI Y32.2, Graphic Symbols for Electrical and Electronic Diagrams.
   b. ANSI Z55.1 Gray Finishes for Industrial Apparatus and Equipment.
   c. Measurement of Sound Pressure Levels of AC Power Circuit Breaker, ANSI/IEEE C37.082.
   d. Low-Voltage AC Power Circuit Breakers Used in Enclosures, ANSI/IEEE C37.13.
   e. ANSI C37.16 Preferred Ratings, Related Requirements and Application Recommendations for Low Voltage AC Power Circuit Breakers and AC Power Circuit Protectors.
   f. ANSI C37.17 Trap Devices for AC and General Purpose DC Low-Voltage Power Circuit Breakers.
   g. ANSI C37.20 Switchgear Assemblies.

h. Test Procedures for Low Voltage AC Power Circuit Breakers Used in Enclosures, ANSI C37.50.
i. Conformance Testing of Metal-Enclosed Low-Voltage AC Power Circuit Breaker Switchgear Assemblies, ANSI C37.51.

2. National Electrical Manufacturers Association (NEMA):

a. NEMA PB2 - Tests.

3. National Fire Protection Association (NFPA).

a. NFPA 70 National Electric Code (NEC).

4. Underwriters Laboratories (UL)

a. (384 W4) WEVZ Switchboards
b. 891 Dead Front Switchboards

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handling: Only lift switchboard using eyes, yokes, and skids provided by manufacturer.

B. Storage: Do not store indoor switchboard exposed to weather.

C. Protection: Physically protect switchboard against all damage. Cover switchboard with suitable material to avoid damage to finish.

PART 2 - PRODUCTS

2.1 DISTRIBUTION SWITCHBOARDS

A. General: Switchboards shall be deadfront with front accessibility required. The switchboard frame shall be of formed code gauge steel rigidly bolted together to support all coverplates, bussing and component devices during shipment and installation. Steel base channels shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit. All front covers shall be screwed on and removable and all doors shall be hinged with removable hinge pins. Top and bottom conduit areas shall be clearly indicated on shop drawings. Switchboards shall be freestanding and completely self supporting structures, 90 inches high.

B. Provide distribution switchboards as manufactured by Square "D", General Electric, Siemens, or Cutler Hammer.

2.2 FINISH

A. Preparation: All steel surfaces shall be chemically cleaned and treated to provide a bond between paint and metal surfaces to help prevent the entrance of moisture and formation of rust under the paint film.

B. Color: The switchboard exterior shall be finished in indoor light grey No. 61, ANSI Z55.1.

C. Coating: Apply corrosion-protective undercoating and allow to dry prior to final coat. Touch up any scratches prior to calling for final inspection.

2.3 BUSSING AND TERMINATIONS

A. Bus bars: Buses shall be plated copper sized on the basis of not more than 1000 ampere per square inch current density. Bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise. The bus structure shall be braced and rated to withstand mechanical forces exerted during short circuit current conditions when connected directly to a power source having a minimum 50,000 rms symmetrical amperes. A ground bus shall be provided and factory secured to each vertical section of switchgear.

B. Bus Supports: All bus supports, connections and joints shall be bolted with hex-head bolts and Belleville washers to minimize maintenance requirements.

C. Accessibility: Bus connections shall be front accessible. Each switchboard end section shall include all provisions for the addition of future sections.

D. Space Provisions: Where space for future is called for on drawings, provide all necessary hardware and bus, except device connecting straps.

E. Ratings: Switchboard through bus shall have continuous current rating of 100 percent of main device frame size.

F. Terminations: All line and load termination points shall be suitable for the quantity and size of terminated conductors as indicated on the drawings and shall be suitable for each type of conductor material. Terminations shall be front accessible.

G. Hardware: All hardware shall be manufactured from high tensile strength steel and have a suitable protective finish.

H. Bus Duct Connections: When bus duct stubs are required, they shall be suitable for direct connection from the switchboard to the bus duct without any cabling connections.

2.4 ACCESSORIES

A. General: Switchboard shall be provided with adequate lifting means from the factory, and shall be capable of being rolled or moved into installation position and bolted directly to its concrete base (housekeeping pad) without the use of floor sills.

2.5 CONTROL WIRING

A. General: All control wiring conductors shall have heat shrink identification labels on each end of termination. Terminations shall be made to screw terminal strips using accepted conductor terminals. All points of terminal strips shall be labeled to match conductor labeling.

2.6 MAIN SECTION

A. General: The service disconnect devices shall be as specified herein and shall be totally front accessible and front connectable. Main device shall be provided with ground fault protection. Main circuit breaker shall be solid-state with adjustable settings for long-time, short time, instantaneous, long-time delay and short time delay.

B. Analog Instruments and Equipment: The following instruments and associated equipment shall be provided;

1. Ammeter (0-1200 amperes) (0-2000 amperes) (0-3000 amperes)
2. Voltmeter (0-240 volt) (0-600 volt)
3. Ammeter and voltmeter transfer switches
4. Current and potential transformers
5. Fuses and assemblies
6. Power factor meter
7. Kilowatt - hour meter, with demand register.
8. All required interconnecting wiring
9. All instruments shall be 4-1/2 inch square, with plus or minus 1 percent accuracy, analog, and shall be mounted in the entrance section of the switchboard.
10. The compartment shall be (barriered) (unbarriered) and covered with a (formed steel cover plate) (single-hinged door) (double-hinged door) with sealing provisions, a (voltmeter) (ammeter) (power factor meter) (wattmeter) (watthour meter) shall be mounted in the door and supplied with current and potential transformers and instrument transfer switches where required. All front plates used for mounting meters, instrument transfer switches or other front mounted devices shall be hinged with all wiring installed.

C. Ground Fault Protection: Ground fault protection system shall be provided consisting of the following;

1. A ground sensor on line side of main switch encircling all phase and neutral conductors connected to an adjustable solid state ground relay switch which initiates automatic shunt tripping of the main and/or branch circuit interrupting devices.

2. System shall be adjustable from 200 to 1200 primary amperes, and time current characteristics shall provide 6 cycle operation at about ten times setting.

3. Relay output shall operate at 120 volts A.C. fused source from main bus. Provide all terminal blocks, transformer, auto-reset fuses, interconnecting wiring, etc.

4. Submit relay curves and all main/branch breakers for coordination study.

D. Phase Protection: A phase protection system shall be provided as follows;

1. System shall provide loss of phase, phase reversal, low voltage and phase unbalance protection.

2. System shall consist of solid state controller, DPDT relay, terminal blocks, audio and visual failure indicator with local silence switch, adjustable trip delay (1 to 5 seconds) adjustable sensitivity, auto-reset fuses and all interconnecting wiring.

3. Unit shall be mounted in NEMA 1 enclosure adjacent to or mounted on side of main section of switchboard.

4. System shall control shunt trip mechanisms on switchboard circuit breakers were equipped with such features.

5. The phase protector system shall be capable of protecting the electrical power system if loss of power shall occur, regardless of phase, as an interruptable source of power.

6. Unit voltage shall match voltage system of main board. Provide additional relay operated, by phase protection system, as required if tripping more than one breaker.

7. Phase protection system unit shall be Time Mark #259 for system voltage.

8. Submit phase protection system layout with shop drawing.

2.7 DISTRIBUTION SECTIONS

A. General: Group mounted molded case circuit breakers, fusible switches, or integrally fused circuit breakers shall be totally front accessible. The branch protective devices are to be mounted in the switchboard to permit easy installation, maintenance and testing without reaching over any line side bussing. The circuit breakers shall be removable by the disconnection of only the load side cable terminations and all line and load side connections shall be individual to each circuit breaker. No common mounting brackets or electrical bus connectors shall be acceptable. Each circuit breaker is to be provided with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate, as well as exercise the circuit breaker operating mechanisms.

B. Solid State Circuit Breakers: All breakers 600 amperes and above shall be solid-state with adjustable settings for long-time, short-time, instantaneous, long-time delay and short-time delay.

C. All circuit breakers in the switchboard shall be fully rated. No series rating is allowed.

PART 3 - EXECUTION

3.1 INSPECTION

A. Preparation: Examine area to receive switchboard to assure that there is adequate clearance to meet NEC requirements and normal maintenance issues for switchboard installation. Check that housekeeping pads (concrete base) are level and free of irregularities. Start work only after any unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Compliance: Provide switchboard complete in accordance with manufacturer's written instructions, NEC, and all applicable codes.

B. Mounting: Mount switchboard on 4 inch housekeeping pad (concrete base). Pad shall extend 4 inches beyond switchboard edge on all sides with all equipment installed.

C. Mats: Provide continuous rubber insulating mat on floor in front of switchboard. Mat shall extend for the entire length of switchboard plus two feet beyond each side. Mat to be minimum 4 feet wide and 1/2 inch thick. Mat shall lie flat on floor without the use of any adhesive or fastener. Entire edge of mat shall be chamfered. Submit manufacturers data sheet and sample of mat with shop drawings.

3.3 FIELD QUALITY CONTROL

A. General: Provide field tests prior to energization as follows;

1. Megger check and record all data, of phase to phase and phase to ground insulation levels.
2. Continuity.
3. Short Circuit.
4. Proper phase relationship.

B. Provisions: Perform tests according to switchboard manufacturer's instructions.

3.4 ADJUSTMENT AND CLEANING

A. Adjustments: Adjust operating mechanisms for free mechanical movement.

B. Connections: Tighten bus connections and mechanical fasteners.

C. Finish: Touch-up scratched or marred surfaces to match original finish.

3.5 CHECK-OUT MEMO

A. General: Submit check-out memo from switchboard representative.

CHECK-OUT MEMO

NOTE TO CONTRACTOR: Do not submit this form at the time Technical Information Brochure is submitted. This form shall be completed and submitted before Instruction in Operation to Owner or a request for final inspection.

Name of equipment checked:_____

Name of manufacturer of equipment:_____

Re: _____
(Name of Project)

1. The equipment furnished by us has been checked on the Job by us. We have reviewed (where applicable) the performance verification information submitted to us by the Contractor.

2. The equipment is properly installed, except for items noted below.*

3. The equipment is operating satisfactorily, except for items noted below.*

4. The written operating and maintenance information (where applicable) has been presented to the Contractor, and gone over with him in detail. Five (5) copies of all applicable operating and maintenance information and parts lists have been furnished to him for insertion in each of the Equipment Brochures.

Checked by: _____
(Printed Name of Manufacturer's Representative)

_____
(Address and Phone No. of Representative)

_____
(Signature and Title of Person Making Check)

_____
(Date Checked)

cc: Owner, Architect, Engineer, Contractor and Subcontractor

*Exceptions noted at time of check were as follows:

SECTION 16450 GROUNDING

GENERAL

RELATED DOCUMENTS

General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section

GROUNDING ELECTRODES

General: Provide a grounding electrode system, as described in NEC 250, as specified herein and as indicated on plans.

Ground Field / Ground Rods: The ground field shall consist of three 20 ft long vertically driven ground rods arranged in a triangular pattern spaced 20 feet apart. Additional ground rods shall be added as necessary to achieve the desired resistance.

Main Metallic Water Pipe: The building's main metallic underground water piping shall be utilized as a grounding electrode, provided the metal pipe is installed in direct contact with the earth for a minimum of 10 feet. Bond the main metallic water service within 5 ft. of the entrance of the water pipe into the building.

Building Steel: The building steel shall be utilized as a grounding electrode, provided the steel is in direct contact with the earth or is otherwise effectively grounded.

Rebar: In concrete buildings, provide bond to rebar in concrete.

Resistance: Grounding electrode resistance shall not exceed 10 ohms. Overall resistance of the entire grounding electrode system shall not exceed 5 ohms. Provide additional grounding electrodes as required to meet this value. Refer to Section 16020 for testing requirements.

GROUNDING ELECTRODE CONDUCTOR

Grounding Electrode Conductor: A main grounding electrode conductor, bare copper, sized per NEC, shall be run in PVC conduit from main service equipment to the grounding electrodes. This conductor shall also be bonded to the following:

Telecommunications service ground within 20' of the electrical service
Gas and other interior metal piping – refer to NEC.

SEPARATELY DERIVED GROUNDING SYSTEMS

Description: Provide a separately derived grounding system where indicated herein and as required by the National Electrical Code. Bond neutral and ground busses together.

Services: Provide a separately derived grounding system for all building electrical services and step-down transformers.

Multiple Buildings: Multiple buildings fed from the same electrical service shall be provided with separate grounding electrode systems, as required by the NEC and specified herein.

BONDING AND EQUIPMENT GROUNDING

Description of System: In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated copper system grounding conductor in accordance with specific rules of Article 250 of the NEC Equipment grounding conductors through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.

Equipment Grounding Conductors: All raceways shall have an insulated copper system ground conductor run throughout the entire length of circuit installed within conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill when determining conduit sizes, even though not included or shown on drawings.

Redundant Grounding: In general all branch circuits shall be provided with a redundant grounding system through the use of grounding conductors and metallic conduit.

Bonding: In addition to connections to grounding electrodes, the main service ground shall be bonded to the lightning protection system and other underground metal piping.

Light Poles: All exterior light poles shall have their enclosures grounded directly to a separate driven ground at the light pole in addition to the building ground connection, via the circuit equipment ground conductor.

Bushings: Provide insulated grounding bushings on all metallic feeder conduits terminated within panelboards, switchboards or enclosed overcurrent devices. Provide insulated grounding bushings on all branch circuit conduits where concentric knockouts are used.

Connection to Other Systems: Provide all required grounding and bonding connections as specified herein and as required by the National Electrical Code.

SUBMITTALS

General: Submit product data on ground rods, ground wire, ground connectors, ground bars, and data on exothermic welds.

QUALITY ASSURANCE

Compliance: The entire ground system shall meet or exceed the minimum requirements NEC 250 and IEEE Std. 142 (green book).

PRODUCTS

GROUNDING ELECTRODE AND BONDING CONDUCTORS

General: Except as specified in C below, provide UL and NEC approved types of copper with THWN, THHN, or XHHW with green insulation or green tape on black insulation the entire length of conductor not in conduit.

Size: Grounding electrode conductors shall be sized as specified herein and on the drawings, but in no case shall be smaller than required by NEC 250.

Insulation: Conductors above ground shall be insulated, conductors run below grade shall be bare.

GROUNDING ELECTRODES

A. Ground Rods: Provide copperclad steel, 5/8 inch diameter by 20 feet long vertically driven ground rods. Use of multiple 10 feet sectional ground rods is acceptable.

CONNECTIONS

Bonding: One piece mechanical lugs or wire terminals, properly sized and approved by the local authority having jurisdiction shall be used to bond ground wires together or to junction boxes and panel cabinets.

Underground: All connections and bonds made underground and to building steel shall be exothermic weld type-connections.

INSPECTION WELLS

Location: Provide inspection wells for all ground rods covered by concrete, paving, or other permanent materials that prevent access to ground rods.

Description: Inspection well shall be provided with circular, flush traffic rated, grade mounted, twist lock traffic cover with the word "ground" (or similar) on the cover. Inspection test well shall allow clear access to the ground rod and exothermic weld connection of conductor to ground rod. Clearly mark ground rod locations on as-built drawings.

GROUND BAR

Location: Provide a ground bar connected to the main service ground via a #4/0 grounding conductor in all electrical rooms with step-down transformers.

Description: Ground bar shall be 12" x 2" x ¼" (minimum) copper bus mounted to wall 24" AFF via insulated standoffs. All connections to ground bar shall be made via approved mechanical connections.

Interconnection: In addition to the main service ground, all ground bars shall be interconnected to each other via #4/0 insulated grounding conductor. Each ground bar shall also be bonded to local metallic water piping and building steel via #6 insulated grounding conductor.

INSTALLATION

EXTERIOR

Connection: The main grounding electrode conductor shall be exothermically welded to ground rods and other main system electrodes.

INTERIOR

Installation: Equipment grounding conductors shall be installed as follows:

Where installed in metal conduit, both conductor and conduit shall be bonded at each end.

Have connections accessible for inspection and made with approved solderless connectors brazed (or bolted) to the equipment or structure to be grounded.

Shall in NO case be a current carrying conductor.

Have green insulation, except that grounding electrode conductors may be bare.

Water Meter: Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe.

Bushings: Bond all grounding bushings to the equipment ground bus of the panel or switchboard, or overcurrent device in which it is located. Bond shall be made via an insulated bonding conductor of same size as equipment ground conductor run in the circuit.

TESTING

Testing: Provide testing as required in other sections of this specification, including but not limited to sections 16010 and 16020.

Reports: Submit impedance test reports for all separately derived services to the Engineer prior to project completion.

CONNECTIONS

Preparation: All contact surfaces shall be thoroughly cleaned before connections are made, to ensure good metal to metal contact.

END OF SECTION

SECTION 16460 TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Section 16010, apply to work specified in this section.

1.2 DRY-TYPE TRANSFORMERS

A. General: Dry type transformers shall be factory assembled, metal enclosed, provided complete with mounting brackets as required.

B. Provide dry type transformers as manufactured by Square "D", General Electric, Siemens, or Cutler Hammer.

1.3 SUBMITTALS

A. Shop Drawings: Shop drawings shall be submitted showing dimensions, wiring diagrams, taps and nameplate nomenclature.

B. Product Data: Product data shall be submitted showing compliance with this section of the specification, manufacturer's written recommendation for storage and protection, and installation instructions.

1.4 PRODUCT STORAGE AND HANDLING

A. Protection: Physically protect transformers against damage as recommended by manufacturer.

B. Storage: A waterproof covering shall be kept around all transformers until they are ready to be energized.

1.5 SUBMITTALS

A. General: Provide shop drawings and product data on transformer showing compliance with these specifications including:

1. Pad dimensions with openings required.

2. Complete dimensions and drawings on transformer.

3. Coolant properties.

4. Incoming compartment equipment

5. Accessories.

PART 2 - PRODUCTS

2.1 CONSTRUCTION - DRY TYPE TRANSFORMERS

A. Listing: Dry type transformers shall be U.L. listed and certified to meet NEMA ST-1 with convection cooling and ST20.

B. Testing: Transformers shall be tested and rated for sound level in accordance with ASA-C89.1-1961.

C. Insulation: Class H insulation shall be employed for transformers above 30 KVA with maximum temperature rise of 150 degrees C. over 40 degrees C. Class F insulation shall be employed for transformers up to and including 30 KVA with a maximum temperature rise of 115 degrees C. over 40 degrees C.

D. Windings: Three phase units shall be wound delta-wye. Each three phase transformer shall have three separate sets of coils. No Scott T connections, open delta, or two coil arrangements shall be permitted.

E. Taps: Voltages shall be compatible with the application. Taps shall be provided two at plus 2-1/2 percent increments and two minus 2-1/2 percent increments from rated voltage.

F. BIL: Basic impulse level shall be 90 KV.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting: Transformers shall be mounted where accessible. No units may be mounted behind partitions, above ceilings, etc. Each transformer shall be mounted on 3 inch concrete base extending 3 inches outside all sides.

B. Noise Isolation: Flexible conduits shall be used to isolate noise.

C. Grounding:

1. Grounding and bonding shall be per NEC. Provide #4/0 AWG conductor run in 1 inch conduit; loop conductor from transformer to transformer and ground at main service ground.

2. Provide ground to building steel and size ground per NEC 250.94.

END OF SECTION

SECTION 16470 PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.2 DESCRIPTION

Description: Provide panelboards with main breaker or main lugs where shown on the drawings, of a dead front, distributed phase sequence design. Panelboards shall be equipped with thermal-magnetic molded case circuit breakers with frame and trip ratings as indicated in the schedules.

1.3 QUALITY ASSURANCE

ANSI: the latest edition of the Reference Standards for the American National Standards Institute shall apply as follows;

ANSI Y32.2 - Graphic Symbols for Electrical and Electronic Diagrams.
ANSI Z55.1 Gray finishes for Industrial Apparatus and Equipment.

NEMA: National Electrical Manufacturers Association shall apply as follows;

NEMA PB1 Panelboards
NEMA PB1-57 Gutter space

NFPA: The latest edition of the National Fire Protection Association shall apply as follows;

NFPA 70, National Electrical Code (NEC).

UL: The latest edition of the Underwriters' Laboratories, Incorporated shall apply as follows;

UL Electrical Construction Materials List, panelboards-dead front type.
UL 67 Panelboard wiring gutter space, bus heat rise test.
UL 50 Cabinets - Rigidity and gauge of steel.

Listing: Panelboards shall be listed by Underwriters Laboratories and bear the UL or other nationally recognized testing laboratory label. Where required, panelboards shall be listed for use as service entrance equipment.

1.4 SUBMITTALS

Shop drawings:

Product data shall be submitted on:

Panel
Cabinet
Bus
Construction
Dimensions

Shop drawings shall be submitted for every panel, and shall clearly indicate all of the following information:

U.L. Label
Each circuit breaker amperage rating, circuit number and position/location in panel
Electrical characteristics of panel
Main bus rating
Main device rating
Mounting type
Dimensions, (width, depth, height, weight)
Bus material
Interrupting capacity of minimum rated breaker
Panelboard classification
Submit coordination curves on log-log paper for all breakers, fuses, transformers, etc.
If dimensions for equipment proposed in submitted shop drawings are different than was shown on drawings, contractor shall submit sketches showing layout of proposed equipment.

Coordination Study: The Contractor shall expect an additional 10 working days for panelboard and switchboard review to allow the Engineer to design the coordination study.

1.5 OVERCURRENT PROTECTIVE DEVICES - DESCRIPTION

Description of System: Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment. Provide overcurrent protection for all wiring and equipment in accordance with the NEC, all federal, state and local codes as required and/or as shown on the drawings.

1.6 OVERCURRENT PROTECTIVE DEVICES - SUBMITTALS

Shop drawings and product data: Shop drawings shall clearly indicate;

Frame sizes and interrupting capacity of all circuit breakers.

Horsepower ratings of rated voltage of fused switches and/or circuit breakers.

Size and type of fuses being provided.

Device is U.L. Listed, and bears the U.L. Label.

Device complies with these specifications, drawings, and applicable standards of NEMA, IEEE, ANSI, and ASA.

PART 2 - PRODUCTS

2.1 PANELBOARDS

Equipment: The panelboard bus assembly shall be enclosed in a steel cabinet and shall be surface or flush mounted as shown in the schedules. The box shall be fabricated from galvanized steel with standard baked enamel finish. Panelboard front shall include a door and shall have a flush, cylinder tumbler-type lock with catch and spring-loaded stainless steel door pull. All panelboard locks shall be keyed alike. All panel cabinets shall be a minimum of 20 inches wide. Fronts shall have adjustable indicating trim clamps which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Panel front shall not be removable with door in the locked position.

Bus: Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule. Bus shall be insulated and bus bar connections to the branch circuit breakers shall be of the "distributed phase" or phase sequence type. All current carrying parts of the bus structure shall be tin plated copper. A full size insulated neutral bus bar shall be provided. Provide system grounding tin plated copper bus bar bonded to the panelboard cabinet for connection of system grounding conductors. This bar shall be mechanically and electrically isolated from the neutral bar except where panelboard is used as service entrance equipment.

Molded Case Circuit Breakers: All panelboard branch circuit breakers shall be bolt-on thermal-magnetic molded case type. Breakers shall be 1, 2 or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multi-pole circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and active handle indication. Handles shall have "ON", "OFF", and "TRIPPED" positions. Bolt-on circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware.

Solid State Circuit Breakers: Provide solid state circuit breakers for all breakers 400 amperes and above. Breakers shall have adjustable settings for long time pickup, long time delay, short-time pickup and short time delay.

120/208 Rating: 120/208 volt circuit breakers shall have interrupting ratings a minimum of 10,000 rms symmetrical amperes at 240 volts AC maximum.

277/480 Rating: 277/480 volt circuit breakers shall have interrupting ratings a minimum of 14,000 rms symmetrical amperes minimum at 277 volts AC (single pole) or 480Y/277 volts AC 2 and 3 pole.

Switching Type: Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.

Directories: Provide (2) two typed panelboard directory for each panelboard and indicate the actual circuit number used, room name and type of load. Room names shall be the actual name or room number used not necessarily as shown on the drawing. Panel directories shall include all room numbers and names. Where panel schedules are indicated on the drawings as "receptacles or "lighting", etc., it shall be the responsibility of the Contractor to include the specific area served.

Bracing: Panelboard as a complete unit shall be braced for a minimum short circuit rating equal to or greater than the lowest breaker symmetrical interrupting capacity as shown on the schedule. However, all panelboards shall be fully rated. No series ratings are allowed.

Grounding: All panelboard cabinets shall have a system grounding bar bonded to the panelboard cabinet for connection of system grounding conductors. This bar shall be mechanically and electrically isolated from the neutral bar.

Stubs: Provide four 3/4 inch conduits from all flush mounted panels to adjacent accessible ceiling space and mark "for future use". Provide pull cord in all empty conduits and provide plastic end bushing.

Design Selection:

120/208V		480/277V
Square "D", NQOD Cutler-Hammer: Pow-R-Line 1 General Electric: A-Series Siemans: S1 Series		Square "D", NF Series Cutler-Hammer: Pow-R-Line 2 General Electric: A-Series Siemans: SL/SE Series
600A	thru	1200A
Square "D": I-Line Cutler-Hammer: Pow-R-Line 4 General Electric: Spectra Series Siemans: S4/S5 Series		Square "D": I-line Cutler-Hammer: Pow-R-Line 4 General Electric: Spectra Series Siemans: S4/S5 Series

2.2 OVERCURRENT PROTECTIVE DEVICES - INTEGRALLY FUSED CIRCUIT BREAKRS

General: The integrally fused molded case circuit breaker shall be provided as shown on the drawings and shall consist of a molded housing in which is combined (1) a standard molded case circuit breaker providing overload-short circuit protection within its interrupting capacity and ON-OFF switching function and (2) current limiters internally mounted on the load side of the circuit breaker of such ratings that their time current limiting characteristics shall coordinate with the time current tripping characteristics of the circuit breaker elements. This coordination to result in interruption by the circuit breaker alone of fault level currents up to the IC of the circuit breaker and interruption by the current limiter in conjunction with the circuit breaker of fault level currents above the interrupting capacity of the circuit breaker.

Current Limiter: A removable cover shall be provided over the current limiter section of the integrally fused circuit breaker. The current limiter housing covers shall be interlocked with the breaker tripping mechanism such that the breaker shall trip upon removal of the cover. This cover shall be so interlocked with the breaker that the circuit breaker cannot be turned to the ON position with the cover removed. Current limiters shall have a spring loaded plunger which, when the limiter blows, is released to actuate the circuit breaker common trip bar mechanism opening all breaker poles simultaneously.

Interlocks: The limiters shall be individually interlocked with the breaker element tripping mechanism so that no limiter can be inserted until the breaker is in the OFF position. The circuit breaker and limiters are to be interlocked so that the circuit breaker cannot be closed if a limiter is either missing or has blown.

Fuse Limiters: Fuse limiters shall be individually removable from the molded case housing.

Molded Case Circuit Breaker: The molded case circuit breaker shall be ambient temperature compensating. The circuit breaker shall be provided with thermal magnetic trip rated at amperes continuous current as shown on drawings.

Integrally Fused Circuit Breaker: The integrally fused circuit breaker shall be capable of interrupting available short circuit currents up to 200,000 RMS symmetrical amperes at voltage up to 600 VAC.

Standards: Ratings, clearances and performance of the integrally fused circuit breaker shall be in accordance with applicable standards of NEMA, IEEE and ASA.

Shunt Trip: The breaker shall be capable of being shunt-tripped by a remote switching device and shall have external terminals for this function. Shunt-trip mechanism shall be provided on breaker as called for on drawings. Coil voltage of shunt-trip mechanism shall match remote device voltage.

2.3 OVERCURRENT PROTECTIVE DEVICES - CURRENT LIMITING BREAKERS

Current Limiting: These breakers shall be molded case with inherent current limiting ability. They shall limit available fault of up to 100,000 rms symmetrical amperes to less then 10,000 amperes.

PART 3 - EXECUTION

3.1 INSPECTION

General: Examine area to receive panelboard and assure that there is adequate clearances to meet NEC requirements and normal maintenance issues.

Correction: Start work only after any unsatisfactory conditions have been corrected.

3.2 INSTALLATION

General: Provide panelboards in complete accordance with manufacturer's written instructions and all applicable codes.

Support: Panelboards shall be rigidly supported and installed per manufacturers recommended supporting instructions, with beams provided if necessary, to suit actual site conditions. Panels shall not be directly mounted to masonry walls. Use kindorf or similar channel.

Storage and Delivery: Panelboards shall be delivered to the site during that phase of panelboard installation in order to avoid storing panels on site where damage may occur. Replace any damaged parts prior to energizing panel. Cover panelboard to avoid damage to finish.

Mounting: Do not mount equipment directly to masonry or concrete walls. Provide two uni-strut spacers between wall and panelboard.

Operations and Maintenance Data: Manufacturer's instructions for tightening bus connections, cleaning, operation and maintenance.

3.3 QUALITY CONTROL

General: Field test prior to energization;

Megger check, and record all data, of phase to phase and phase to ground insulation levels.

Continuity.

Proper phase relationship.

3.4 CHECK-OUT MEMO

General: Submit check-out memo from panelboard representative.

END OF SECTION

SECTION 16480 MOTOR CONTROLS AND RELATED EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.2 QUALITY ASSURANCE FOR MOTOR CONTROLS

A. Compliance: Materials shall comply with the latest edition of the following standards as they apply to the different motor control types.

B. ANSI: The latest edition of the Reference Standards for the American National Standards Institute shall apply as follows;

1. American National Standard Institute (ANSI);
   a. ANSI Y32.2, Graphic Symbols for Electrical and Electronic Diagrams.
   b. ANSI Z55.1 (R1973) Gray finishes for Industrial Apparatus and Equipment.

C. NEMA: National Electrical Manufacturers Association shall apply as follows;

1. NEMA ICS-1, 2, 3, 4, 5, 6, controls and systems.

D. NFPA: The latest edition of the National Fire Protection Association shall apply as follows;

1. NFPA 70, National Electric Code (NEC).

E. UL: The latest edition of the Underwriters' Laboratories, Incorporated shall apply as follows;

1. UL Electrical Construction Materials List, motor controllers motor-control centers.

1.3 INSTALLATION OF MOTOR CONTROL EQUIPMENT

A. Responsibility: Unless specifically noted otherwise, motor starters for all equipment requiring them shall be installed as part of this Division in conformance with other Sections of the specifications. Mechanical equipment which has packaged starters, shall be supplied with the mechanical equipment.

B. Manufacturer: All starters shall be of the same manufacturer Square "D", General Electric, Siemens, or Cutler Hammer.

1.4 DESCRIPTION OF SYSTEM FOR MOTOR CONTROLS

A. General: All control, power and interlock wiring required for proper operation of equipment furnished as part of other Divisions and requiring raceways shall be provided under this Division. All control, power and interlock wiring shall be in conduit and shall be color-coded.

1.5 DESCRIPTION OF SYSTEM FOR MOTOR CONTROLS

A. Description: Motor controls shall be factory-assembled, metal-enclosed motor control units for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.

B. Provisions: Motor Control Units shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, instrumentation, and control wiring.

1.6 SUBMITTALS FOR MOTOR CONTROLS

A. Products: Submit manufacturer's product data, including technical information on each type of motor control as follows;

1. Motor Control Centers:
   a. Layouts showing concrete pad dimensions, conduit entrance and available space, bus duct connections, electrical ratings, nameplate nomenclature, and single-line diagrams in accordance with ANSI Y32.2 indicating connections and controls with numbered terminals.
   b. Shop Drawings shall clearly indicate:
      1) Frame sizes and Interrupting Capacity of each starter/motor circuit protector unit and total assembly.
      2) Horsepower ratings at rated voltage of starter/motor circuit protector unit.
      3) Type of labels and labeling for every device and what it feeds.
      4) Nameplate giving name of project; Architect, Engineer and The Contractor.
      5) Bus bar size, arrangement and spacing.

2. Individually mounted AC Magnetic Starters:
   a. Shop Drawings shall clearly indicate:
      1) Frame sizes and Interrupting Capacity of starter and/or disconnect unit.
      2) Horsepower rating at rated voltage of starter and/or disconnect unit.
      3) Electrical ratings.

4) Single line diagram for power and control connections with numbered terminals and all required accessories.
5) All required accessories.

3. Motor Control Centers and Individually Mounted Starter:
   a. Manufacturer's written recommendation for storage and protection, installation instructions and field test requirements.

B. Test Reports: Provide reports of all production and field tests. Tests shall include rated continuous and short circuit currents, dielectric, grounding, operation and control.

C. Operations and Maintenance Data: Provide manufacturer's instructions for tightening bus connections, performing cleaning, and operating and maintaining motor control unit.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING FOR MOTOR CONTROLS

A. Lifting: Lift motor control center using eyes, yokes, and skids provided by manufacturer.

B. Storage: Do not store indoor motor control units exposed to weather.

C. Protection: Physically protect motor control units against damage from work of other trades. Cover motor control units with suitable material to avoid damage to finish.

1.8 DESCRIPTION OF DISCONNECTS

A. General: All disconnect switches shall be heavy-duty type, unless specifically noted otherwise. Switches shall be fusible or non-fusible and sized as noted on the drawings.

B. Ratings: Switches shall be 240 volt rated on systems up to and including 120/208V and 600V rated on higher voltage systems. Provide NEMA 1 enclosures, unless otherwise noted. All switches for motors shall be dual horsepower rated. All switches mounted outdoors shall be NEMA Type 3R.

C. Lugs: Provide lugs on disconnect switches as required to accept conductors specified on drawings.

D. Manufacturers: Same as Motor Control Equipment 1.03B.

1.9 SUBMITTALS FOR DISCONNECTS

A. Products: Submit product data on all types of disconnects provided as part of the contract documents.

1.10 DESCRIPTION OF OVERCURRENT PROTECTIVE DEVICES

A. Description of System: Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment. Provide overcurrent protection for all wiring and equipment in accordance with the NEC, all federal, state and local codes as required and/or as shown on the drawings. Should there be disagreement over the size of or application of, an overcurrent protection device called for on the drawings, it shall be brought to the attention of the Engineer immediately.

1.11 SUBMITTALS FOR OVERCURRENT PROTECTIVE DEVICES

A. Products: Submit manufacturer's product data for all overcurrent devcies required as part of the contract documents.

B. Shop Drawings: Shop drawings shall clearly indicate;

1. Frame sizes and interrupting capacity of all circuit breakers.
2. Horsepower ratings of rated voltage of fused switches and/or circuit breakers.
3. Size and type of fuses being provided.
4. Device is U.L. Listed, and bears the U.L. Label.
5. Device complies with these specifications, drawings, and applicable standards of NEMA, IEEE, ANSI, and ASA.

PART 2 - PRODUCTS

2.1 INDIVIDUALLY MOUNTED AC MAGNETIC STARTERS

A. Combination Starter and Disconnect: Combination starters and disconnect switches shall be a combination across-the-line magnetic type starter with motor circuit protection (magnetic only breaker) disconnect, rated in accordance with NEMA Standards, sizes and horsepower rating. Final magnetic setting of MCP shall be field set and recorded. Unit shall be mounted on NEMA I enclosures, unless otherwise noted.

B. Individual Starter Without Disconnect: Individually mounted starters shall be across-the-line magnetic type rated in accordance with NEMA Standards, sizes, and horsepower ratings. Unit shall be mounted on NEMA I enclosure, unless otherwise noted.

C. General: Starters shall be equipped with double break silver alloy contacts. All contacts shall be replaceable from front without removing starter from enclosure. Overload relays shall be provided in each phase, and shall be melted alloy or bimetallic type. Thermal units shall be of the one-piece construction and interchangeable.

D. Accessories: Starters shall be equipped with auxiliary contacts, as required for proper control functions, minimum of two normally open auxiliary contacts, in addition to the normally open auxiliary seal-in interlock and shall be suitable for the addition of at least two additional external electrical interlocks, one normally open and one normally closed. All starters shall have green "run" pilot light, "Hand-Off-Auto" selector switch, and nameplate. Control voltage shall be as required. Starters shall contain fused control transformers to provide correct control voltage.

E. Power Monitor: All motors shall include three-phase power monitor as manufactured by Time Mark Corporation (Model #A258B, for 480V, 3 phase systems) (Model #258B for 208V/240V, 3 phase systems) (Model #B258B for 120V systems) providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage of (340-480 VAC)(160-240 VAC)(85-125 VAC).

2.2 CIRCUIT BREAKER OVERCURRENT PROTECTIVE DEVICES

A. General: Circuit breakers for applications other than panelboards shall be bolt-on type. All circuit breakers shall be molded-case, quick-make, quick-break, thermal magnetic type, and shall be U.L. listed and rated for voltage and class of service to which applied. Double and triple pole breakers shall be of the common trip, single handle type. Circuit breakers shall have minimum rating of 10,000 AIC at 240V and 14,000 AIC at 480V, unless required by other sections of the contract documents. Circuit breakers shall be fully rated. Series rating is not allowed.

2.3 OVERCURRENT PROTECTIVE DEVICES - CURRENT LIMITING BREAKERS

A. General: Current limiting breakers shall be provided as called for on the drawings.

B. Molded Case Breakers: These breakers shall be molded case with inherent current limiting ability. They shall limit available fault of up to 100,000 rms symmetrical amperes to less then 10,000 amperes.

PART 3 - EXECUTION

3.1 INSPECTION

A. Coordination: Examine area to receive motor-control units to assure adequate clearance for motor control unit installation.

B. Provision: Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General: Provide motor control units in accordance with manufacturer's written instructions, and the NEC.

3.3 FIELD QUALITY ASSURANCE

A. Testing: Perform tests according to motor control unit manufacturer's instructions. Field tests prior to energization as follows;

1. Megger check of phase to phase to ground insulation levels.
2. Continuity.
3. Short Circuit.

3.4 ADJUSTMENT AND CLEANING

A. General: Adjust operating mechanisms for free mechanical movement.

B. Connections: Tighten bus connections and mechanical fasteners.

C. Finish: Touch-up scratched or marred surfaces to match original finish.

3.5 CHECK-OUT MEMO

A. General: Submit check-out memo from motor control center representative.

END OF SECTION

SECTION 16490 AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION

A. General: Provide automatic transfer switches of the size, number of poles, amperage, voltage and withstand ratings as shown on the contract drawings and as specified herein.

B. Description: Using a Nema 1 enclosure, the switches shall automatically transfer the load to the generator during normal power outages. The switches shall be fully rated, electrically operated, mechanically held unit with both electrical and mechanical interlocks to prevent simultaneous energizing of both sides.

1.3 QUALITY ASSURANCE

A. Manufacturer Requirements: Firms regularly engaged in manufacture of automatic transfer switches, of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Manufacturers: Subject to compliance with the requirements of this specification, provide an automatic transfer switch manufactured by one of the following:

Manufacturer

a. Russelectric, Inc.
b. Automatic Switch Company
c. Zenith Company

C. Standards: Comply With The Following Standards:

1. UL-1008

a. As a precondition for acceptance, transfer switch, complete with timers relays and accessories shall be listed by Underwriters Laboratories, Inc. in their Electrical Construction Materials Catalog, and accepted for use on emergency systems.

b. When conducting temperature rise tests to Paragraph 99 of UL-1008 the manufacturer shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.

c. Produce UL 1008 closing and withstand ratings for 3 cycles at 480 volts. certified test reports from an independent testing laboratory to verify the identical samples have been subject to three phase short circuit current at voltage indicated on drawings, for a minimum of 3 cycles duration, without contact damage or contact welding and without the use of current limiting fuse protection. Oscillograph traces are to be supplied to verify that the test parameters have been met.

1.4 SUBMITTALS

A. Shop Drawings: Provide all equipment cabinet dimensions and wiring diagrams as required.

B. Product Data: Provide all applicable options, accessories, and interrupting or withstanding current ratings. Provide all electrical characteristics and data as required to show compliance with these specifications.

C. Testing: Provide test results from UL 1008 as listed above.

1.5 PRODUCT HANDLING

A. Equipment Storage: The Contractor shall store items provided under this specifications until time of installation. Such storage shall meet the requirements of the system supplier and be accepted by the Engineer. The stored equipment shall not be delivered to the site until it is to be installed.

B. Protection: Use all means necessary to protect the materials of this section before, during and after installation and to protect the installed work and materials from the activities of all other trades.

C. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Engineer and at no cost to the Owner.

PART 2 - PRODUCT

2.1 GENERAL

A. Type: Provide 4 pole automatic transfer switches as shown on plans, with full load current and voltage rating as shown, 60 Hz normal and emergency.

B. Load Types: The transfer switch shall be capable of switching all classes of load, and shall be rated for continuous duty when installed in a nonventilated enclosure that is constructed in accordance with Underwriters Laboratories, Inc., Standard UL-1008.

C. Accessories: All relays, timers, control wiring and accessories to be front accessible.

2.2 COMPONENTS

A. Features: Provide the following transfer switch features;

1. The transfer switch shall be double throw, actuated by a single electrical operator momentarily energized; and mechanically connected to the transfer mechanism by a simple over center type linkage with a total transfer time not to exceed 1/6 of a second.

2. The mechanism shall be a high speed actuator, capable of transferring successfully in either direction with 70 percent of rated voltage applied to the switch terminals.

3. Circuit breaker switches are not acceptable.

4. Mechanical interlocking of transfer switches to prevent unintended interconnection of the normal and alternate sources of power.

5. A means of safe manual operation of the transfer switch.

B. Main Contacts: The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be fully rated, arc quenching, mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnet, or springs and shall be renewable silver-tungsten alloy protected by arcing contacts, with magnetic blowouts on each pole. Contacts shall be able to withstand high fault current levels without contact damage or separation. Parallel main contacts are not acceptable.

C. Exercise Timer: Include an exerciser with the transfer switches for exercising the generator in loaded or unloaded condition, up to every 168 hours for a period adjustable from a minimum of 20 minute intervals to 24 hours.

D. Engine Start Delay: Time delay to override momentary normal source power outages to delay engine start signal and transfer switch operation. Adjustable 0.5 to 3 seconds, factory set at 3 seconds.

E. Load Test Switch: Load test switch to simulate normal power failure. (Maintained type).

F. Contact Failure indicators: Contact to close on failure of normal source to interface with data acquisition panel. Contact to open on failure of normal source to initiate customer functions.

G. Pilot lights: Green push to test pilot light on the cabinet door to indicate the main switch in normal position. Red push to test pilot light on the cabinet door to indicate the main switch in emergency position.

H. Auxiliary Contacts: Provide an auxiliary contact closed in normal position. Provide an auxiliary contact closed in emergency position.

I. Additional Contacts: Two sets of relay contacts shall be provided to open and close upon loss of the normal power supply.

2.3 OPERATION

A. Low Voltage: Provide engine starting contacts in transfer switches to start the generating plant if any ungrounded phase of the normal source drops below 70 percent of rated voltage, after a non-adjustable time delay period of 1 to 3 seconds, to allow for momentary dips.

B. Transfer: The transfer switch shall transfer to emergency as soon as the generator source voltage and frequency have reached 90 percent of rated values.

C. Stabilization; After restoration of normal power on all phases to 90 to 95 percent of rated voltage, adjustable time delay period of 2 to 25 minutes shall delay transfer to normal power until it has had time to stabilize. If the emergency power source shall fail during the time delay period, the time delay shall be by-passed, and the switch shall return immediately to the normal source.

D. Generator No-Load Operation: Whenever the switch has retransferred to normal, the engine-generator shall be allowed to operate at no load for a fixed period of time (5 minutes) to allow it to cool before shut-down.

E. Test Switch: The transfer switch shall include a test switch to simulate normal power failure with actual load transfer.

PART 3 - EXECUTION

3.1 CONNECTIONS

A. Tightening Connectors: Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds. 486A and 486B.

END OF SECTION

SECTION 16500 LIGHTING

PART1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.2 DESCRIPTION

A. Description of System: Light fixtures provided under this Division shall be provided complete with lamps and all necessary trim and mounting hardware, and installed as shown on the drawings. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures. Lamps shall be included in the system guarantee for a period of 90 days after final acceptance of the building. All fixtures and associated products shall be UL listed for the application intended.

1.3 SUBMITTALS

A. Shop Drawings: Shop drawings shall be submitted for all fixtures ballasts, lamps, special accessories, etc. Submittals for fixtures that require modifications either as specified or as required to fit this projects' architectural field conditions (i.e. luminous ceiling, wall/slot fixtures, special fixtures) shall also be provided.

Shop drawings shall be complete showing all dimensions and installation instructions required for this project's architectural/field conditions.

Shop drawings for exterior post/pole mounted light fixtures shall be provided and shall clearly indicate handhole and lightning protection ground lug mounted to post/pole at handhole inside post/pole. Submit information on pole mounting, concrete base, etc.

B. Product Data: Product data shall be submitted for all light fixtures showing:

dimensions
U.L. Label
fusing
metal gauge
lens/louver thickness
finish
voltage
lamps
9. ballasts

C. Product data shall be submitted showing manufacturer's written recommendations for storage and protection, and installation instructions.

1.4 PRODUCT STORAGE AND HANDLING

A. Protection: Physically protect fixtures against damage as recommended by manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

A. Fusing: All fluorescent fixtures provided under this Division ballasts shall be individually fused with a renewable fuse in an external GLR holder. All fluorescent ballasts shall be CBM-ETL accepted, and shall be of the automatic thermal resetting type Class P. Provide ten extra renewable fuses to the Owner.

B. Testing: All fixtures shall adhere to UL Test Standard No. 1571 and Section 410-65(c) of the National Electrical Code.

C. Mounting: The contractor shall provide fixture trims and supports as required to match type of ceiling system. No ceiling fixture shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type. Fixtures shall be supported independent of the suspended ceiling system. Provide closed link jack chain at all four corners of fixtures utilizing a trapeze inverted "Y" connection. Provide individual supports at all four corners when trapeze connections conflict with mechanical work.

D. Exterior Poles: All exterior post/pole mounted light fixtures shall have handhole near base. Hand hole shall provide easy access to light fixture fusing and lightning protection ground lug. Lightning protection ground lug shall be provided inside post/pole, electrically in contact with pole, for connection to ground rod. Provide ground wire from ground lug to ground rod, concealing ground wire through post/pole base. Anchor bolts shall be galvanized.

E. Labels: All light fixtures and ballasts shall be UL listed. All light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and U.L. labels. All labels hall be concealed within the body of the fixture. No manufacturers name or logo shall appear on the exterior of any light fixtures unless accepted in writing by the engineer.

F. Exterior Fixtures: All lighting fixtures mounted outdoors subject to dampness and insects shall have gasketing material between lens door and frame to completely seal interior of fixture. Knockouts and holes in fixtures housing shall be closed and sealed. All fixtures shall be complete with lamps, shielding, brackets, concrete bases, anchor bolts and all necessary fittings and accessories for a complete installation.

2.2 ELECTRONIC BALLAST

A. General: Ballast shall be electronic type, high power factor and shall be covered by a three-year warranty against defects. Warranty shall include payment for normal labor costs of replacements of inoperative in-warranty ballasts. Ballast shall be rated for voltage system to which applied. The electronic ballast shall incorporate the following min. features:

1. Solid state ballast shall be compatible for use with F-32(32W), F-25(25W) and F-17(17W) straight biax-type lamps.
2. Ballast shall be high frequency (20-62.5 KHz) and operate without detectable flicker.
3. Ballast shall be constant current rated 95 percent power factor.
4. Ballast shall have a thermo-setting, non-toxic, fire retardant partial filler to serve as a conformal coating and protective insulator against both internal and external damage.
5. Ballast shall have internal regulation of power consumption and light output under input line voltage fluctuations.
6. Ballast shall be minimum "A" sound rated and operate quiet.
7. Ballast case temperature shall not exceed 90 degrees C.
8. Ballast shall contain MOV transient surge protection.
9. Ballast shall not cause RFI interference.
10. Ballast shall have total harmonic distortion of less than 20 percent.
11. Ballasts (including compact fluorescent ballasts) shall be Instant Start Type

B. Suggested Manufacturers: All ballasts shall be compatible to lamps provided. Ballasts shall be provided by one of the following manufacturers. No substitutions are allowed:

1. Universal Liughting Technologies Triad
2. Advance Mark VII
3. Osram Sylvania Quicktronic
4. Motorola

2.3 - HID BALLASTS

A. General: High intensity discharge ballasts shall be constant wattage auto transformer, high power factor type with renewable type KTK fuses in HEB holders. Voltages shall comply with system to which applied. Provide ten extra renewable fuses to the Owner.

B. Suggested Acceptable Manufacturers: Valmont, Advance, MagneTek.

C. Indoor HID Ballasts: Ballasts shall be encapsulated in standard fluorescent type ballasts cases for quiet operation. Ballasts shall be high power factor. Sound rating shall be minimum "B".

D. Suggested Ballasts: All ballasts shall be compatible with lamps provided. Ballast shall be manufactured by one of the following:

1. Valmont
2. Advance
3. Universal Lighting Technologies

2.4 T-8 FLUORESCENT LAMPS

A. General: Provide lamps as follows:

1. 2 foot lamps, T-8, 17 watts, 3500 degrees K, 80 minimum CRI, 1350 minimum initial lumens, 20,000 average life.

2. 3 foot lamps, T-8, 25 watts, 3500 degrees K, 80 minimum CRI, 2150 minimum initial lumens, 20,000 average life.

3. 4 foot lamps, T-8, 32 watts, 3500 degrees K, 80 minimum CRI, 2850 minimum initial lumens, 20,000 average life.

B. Design Selection: OSRAM-Sylvania, GE, or Philips.

2.5 COMPACT FLUORESCENT

A. Lamps shall be 3500 degrees K, CRI of 82 minimum. Lamps 13 watts and below shall be rated minimum 10,000 hours life. Lamps 18 watts and above shall be rated minimum 20,000 hours life. Refer to light fixtures schedule for wattage of lamps.

B. Design Selection:

1. OSRAM-Sylvania
2. GE
3. Philips

2.6 INCANDESCENT LAMPS

A. General: Incandescent lamps shall be rated 130 volts. Average minimum rated lamp life shall be 2500 hours.

2.7 EXTERIOR POLES

A. Exterior Poles: All exterior post/pole mounted light fixtures shall have handhole near base. Hand hole shall provide easy access to light fixture fusing and lightning protection ground lug. Lightning protection ground lug shall be provided inside post/pole, electrically in contact with pole, for connection to ground rod. Provide ground wire from ground lug to ground rod, concealing ground wire through post/pole base. Anchor bolts shall be galvanized.

B. Wind Rating: All poles shall be rated for 120 mph winds, plus 1.3 gust factor with the E.P.A. of fixtures mounted on the pole.

C. Poles shall be direct buried or secured to concrete bases, as indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sealing: Ducseal shall be installed to seal all conduits entering exterior light fixtures from underground.

B. Instructions: Install all fixtures in accordance with manufacturer's written instructions and NEC.

C. Suspended Installation: Pendant mounted fluorescent fixtures installed in exposed ceiling areas are to be suspended from structure with all-thread rods and 1-1/2 x 1-1/2 inch Kindorf channels, full length of fixture/row. Mount outlet box at structure with flexible connection to fixture.

D. Coordination: Coordinate fixtures installed in mechanical rooms with piping and ductwork prior to installation and relocate fixtures as required to provide proper illumination and access.

E. All ballasts shall be securely mounted to eliminate resonate humming.

3.2 LAMPS

A. Lamps: Provide two extra lamps for every HID lamp type. Provide ten extra lamps for every incandescent lamp type. Provide ten extra lamps for every fluorescent lamp type.
B. Lamps shall be “burned in” for a period of 30 days prior to substantial completion of the project. All lamps requiring replacement (flickering, burn out, etc.) during this period through 90 days after Owner Acceptance shall be done so at no additional cost.

3.3 CLEAN-UP

A. Luminaires: Prior to the Owner move-in, the Contractor shall clean all fixtures and remove any dust or dirt. Wash lens and glassware using cleaner such as "Windex" and dry with absorbent cloth. Clean plastic per manufacturer's recommendations; do not wipe. Clean "Alzak" aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove fingerprints and smudges.

END OF SECTION

SECTION 16501
SPORTS LIGHTING LUMINARIES & EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. Section 16010, Basic Electrical Requirements - Electrical of this specification applies to all work in this section.

B. Provide all labor, material, equipment and services to perform all operations required for the complete installation and related work as required in all contract documents.

C. Work under this section includes the basic construction materials for the erection and installation of a complete sports lighting facility for this project.

D. These drawings and specifications were prepared with the following equipment manufacturers as being identified and capable of meeting the performance requirements described herein and are approved to bid this project:

1. Musco Sports Lighting Sports Cluster-2
2. Qualite International Series
3. Hubbell SLS System

E. The following information is to be submitted by approved equipment manufacturers no later than ten (10) days prior to bid date:

1. Computer derived calculations/drawings indicating initial and maintained average footcandle levels for each playing field. Calculations to be accomplished as specified herein. Written statement for uniformity ratio and KW load.

2. Construction drawing on manufacturers stationary detailing luminaire(s) to be utilized for this project.

3. Layout indicating dimensioned pole locations.

4. Drawing of each unique pole to be utilized for this project. Drawing to indicate pole type embedment method(s), sealed by a Florida Registered Professional Engineer.

5. Letter on equipment manufacturers letterhead.

6. Manufacturers warranty statements for luminaire(s) and pole(s) and replacement policy.

7. Summary of fixtures required on a per field basis and light aiming point plan showing focus points and reflector types.

8. A registered professional engineer, independent of manufactruer, shall verify and stamp wind load certification of the luminaire assembly using accepted industry calculation method. Physical testing of assemblies shall include results of actual material). Equipment manufacturers who desire to be identified as being capable of meeting performance requirements of this project shall submit the following information in addition to items 1 through 8 above:

9. Proof of experience indicating minimum of six (6) most recent projects. Three (3) of the projects shall have been within the State of Florida. Provide project name, contact person and telephone number for each.

F. Failure on the part of fixture and pole manufacturers to submit all required information will result in rejection of bid. Notification of compliance with pre-bid information requirements will be addendum issued prior to bid date. No other written or verbal representation shall be considered as approval to bid this project.

1.2 SUBMITTALS

A. Submit shop drawings in accordance with Section 16010 of this specification. Shop drawing submittals shall be submitted as one complete package bound together in a binder. Submittals shall include:

1. Lighting layout drawings
2. Aiming drawings
3. Complete computer derived calculations for primary playing field areas
4. Complete computer derived calculations for secondary areas beyond playing fields as described herein
5. Construction drawings on manufacturers stationary detailing all aspects of luminaire to be utilized for this project
6. Fixture manufacturers warranty
7. Concrete pole and associated equipment
8. Embedment design for each type of direct burial concrete pole and wind load calculations bearing professional Engineers seal
9. Pole manufacturers warranty
10. Ballast make and warranty
11. Lamp make and warranty
12. Maintenance and instruction manuals

13. Manufacturer shall submit a computer derived lighting scan with spill control showing point by point horizontal footcandle levels on playing surface, maximum ratio, number of luminaires and initial lamp lumens, average tilt factor and maintenance factor.

PART 2 - MATERIALS

2.1 LUMINAIRE ASSEMBLY

A. Sports lighting luminaire, lamp, ballast and related equipment are specified and scheduled herein and as detailed on drawings. The luminaire assembly shall consist of lamp, lamp socket, reflector, lens, lamp housing, adjustable aiming assembly, ballast, cross arm(s) with integral wiring, wiring and pole clamps. Basis of design shall be Musco Sports Lighting TLC or approved equal.

B. Construction and Design

1. Luminaire - The luminaire shall have the following characteristics:

a. The luminaire assembly shall be capable of withstanding forces equal to 125 MPH wind levels with a gust factor of 1.3 without structural damage or misalignment of the luminaire or the assembly.

b. The reflector shall be .062 one-piece spun 3002 aluminum with Alzak process finish.

c. The lens shall be heavy duty tampered glass with stainless steel lens ring. Lens ring to be fastened to reflector via hinge door and/or through use of stainless steel clips and #12 stainless steel safety chain. Lens rims will be sealed to reflect assembly using a one-piece silicone gasket.

d. Mogul lamp socket housing shall be cast aluminum with integral aiming bracket.

e. All hardware shall be stainless steel.

f. Luminaire shall be UL listed and approved. The luminaire and ballast shall be completely prewired fro ease of installation and service. All internal wiring shall be 14 guage or larger. Filters shall have a secured activated charcoal filter to prolong optical performance.

g. Vertical and Horizontal aiming bracket shall be pre-set at factory to a computer engineered layout and feature a positive repositioning pin.

2. Lamps - Lamps shall be 1000 or 1500 w. as indicated metal halide and be Venture MS-1500(1000)-HOR or prior approved equivalent. No horizontal lamps allowed.

3. Ballast - The ballast shall be capable of starting and operating one 1500 watt metal halide lamp, lamp wattage as indicated. The fixture manufacturer shall submit a statement that the ballast furnished is in full compliance with the lamp/ballast specifications available to the fixture manufacturer from the lamp manufacturer at time of manufacturer. Ballast shall be high power factor, constant wattage, auto transformer peak lead type. The line power factor of the lamp/ballast system shall not be less than 90%. There shall be an individual ballast for each luminaire. A maximum of two ballasts per ballast enclosure shall be located remote with the capacitors and double fusing.

4. Ballast Housing: Shall be hot dipped galvanized (including door) with a NEMA 3R rating with no side screw holes and shall be located remote from the luminaires (located 10' above ground level). Ballast housing shall be full strength stainless steel piano hinge, stainless steel latch and 1/4" silicone gasket, and shall not a load bearing member of the attachment means of the pole. Ballast housing shall be powder coated after fabrication.

5. Cross Arms - Cross arms shall be factory fabricated of steel tubing M.I.G. welded together. The entire assembly shall be hot dip galvanized after fabrication. Cross arm shall be specifically manufactured to accommodate luminaries to be installed. All fasteners utilized to attach luminaries shall be stainless steel. The junction box on the crossarm assembly shall be galvanized steel and NEMA 3R rated. Minimum dimensions of the junction box shall be 6" x 6" x 4" for ease of maintenance.

2.2 POLE PRESTRESSED REINFORCED CONCRETE

A. Scope

1. This section covers design, fabrication and installation of prestressed concrete poles to be used to support sports lighting equipment.

2. The poles are to be statically spun round concrete poles.

3. Poles shall be designed and constructed so that all wiring and grounding facilities are concealed within the pole. All hand holes and wire inlets/outlets shall be cast into the pole during manufacturing process. No field drilling of poles shall be required.

B. Design

1. Poles with luminaire assembly shall be designed to withstand force equal to 120 MPH wind load with 1.1 gust factor.

2. Poles shall be designed to meet design requirements with luminaire assemblies required to accommodate maintained footcandle level indicated. Luminaire assembly quantities and wind load characteristics shall be established by luminaire manufacturer.

3. Pole submittal information shall include calculations and drawings signed and sealed by a Florida Registered Engineer indicating compliance with these design requirements.

4. To minimize flexural cracking under design load, the prestressing steel shall be stressed initially to a minimum of 70% of ultimate for standard stress relieved strand or 75% of ultimate low relaxation type strand.

C. Materials and Manufacturer

1. The concrete mix shall be designed for a 28 day compression strength of 8500 psi for statically cast poles. Cement quality shall be in accordance with ASTM-C150.

2. The prestressing steel reinforcement shall conform with ASTM-A416. Steel spiral reinforcement shall conform with ASTM-A82. All structural steel shall conform with ASTM-A36 and be hot dipped galvanized in accordance with ASTM-A123. Hand hole frames shall be cast aluminum alloy.

3. Poles are to be manufactured in accordance with latest edition of "Guide Specifications for Prestressed Concrete Poles" as published by Prestressed Concrete Institute.

4. Poles shall have a smooth natural form finish, soft gray in color.

5. An anodized aluminum nameplate shall be cast into wall of pole approximately 48" A.F.G. identifying manufacturer, date of manufacture, mounting height of luminaire assembly above finish grade, pole ID as indicated on plans and maximum luminaire capacity. Plate shall face away from playing field.

6. Conduit entrance opening(s) shall be 18" below grade.

D. Handling and Erection

1. Shop drawing shall clearly identify pick-up points for unloading and erection.

2. Final determination of required burial depth and nature of back fill material shall be determined by a Florida Registered Engineer qualified in this area of expertise. The Engineer shall be engaged by pole manufacturer. Submittal information shall include calculations and drawings signed and sealed by this Engineer.

2.3 SPORTS LIGHTING SYSTEM PERFORMANCE

A. The manufacturers shall furnish luminaries in quantities and NEMA beam patterns to meet or exceed the following criteria:

1. Maintained Footcandle Level (minimum at 36" above field surface)

a. Football Fields 50 FC Maintained
Track 30 FC Maintained

b. Softball & Baseball Fields
1) Infield 50 FC maintained
2) Outfield 30 FC maintained

c. Tennis and Basketball Courts
Track 30 FC maintained

2. Uniformity ratios

a. Football Field 1.5:1
Track 2.0:1

b. Softball & Baseball Fields
1) Infield 2.0 to 1
2) Outfield 2.5 to 1

2.4 CALCULATION METHODS

A. Light Loss Factors: The performance criteria requires lighting equipment which will provide initial average light values, after adjustment for an average lamp tilt factor. In determining the target average light values, a recoverable light loss factor of 0.8 is to be applied, in addition to the adjustment for average lamp tilt factor.

Target Light Levels = Initial Light Levels x Recoverable LLF

Recoverable LLF = LLD x LDD = 0.80

B. Printouts shall be prepared for both initial footcandles and maintained footcandles. Printouts shall be prepared to include number of locations equal to or exceeding the following:

Football 30' X 20' GRID 72 points on the field and 48 on the track
Softball 20' X 20' GRID Infield-25 points and outfield-158 points
Baseball 30' X 30' GRID Infield-25 points and outfield-119 points
Practice Field 30' X 20' GRID 171 points on the field area

C. Calculations shall include entire primary playing area as well as the following areas:

Football - Primary playing area and the track

2.5 Warranty – 10 year warranty

Manufacturer will provide services, including all materials and labor, to maintain the sports lighting equipment by the lighting manufacturer for ten years according to original design criteria, including the alignment of luminaires on the pole top luminaire assembly. Lamps will be group replaced at such time that the lamps exceed their useful life, which is 3,000 hours for the 1500 watt lamps (or which is 6,000 hours for the 1000 watt lamp). Individual lamp outages will be repaired when more than 10% of the lamps are out on any one field or when the lamp outages materially effect the usage of the field.

Manufacturer shall be responsible for and provide the warranty services. To assure full compliance with this warranty, manufacturer shall provide the Owner with a signed Certificate of Insurance which guarantees the commitment for the entire ten years as to each of the above terms. The insurance policy shall be fully funded on an actuarially sound basis and underwritten by a top-rated insurance company.

END OF SECTION 16501

SECTION 16670 LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.2 DESCRIPTION

A. General: Provide a complete lightning protection system as specified herein. The lightning protection system shall be installed by a professional firm presently engaged in installation of Master Labeled or LPI certified lightning protection systems. The system as completed shall comply with the latest edition of UL96A, Installation Requirements for Lightning Protection Systems, National Electric Code (NEC) and NFPA-780 "Lightning Protection Code." The system shall meet all requirements of these codes and the Lightning Protection Institute Standard of Practice LPI-175. All components required for a full LPI certification plate shall be provided whether or not such materials are specifically addressed by the contract drawings or described herein.

WHERE MULTIPLE CODES ARE STATED IN THIS SECTION THE MOST STRINGENT
WILL APPLY TO THIS PROJECT. THE ENGINEER OF RECORD SHALL ENFORCE THE
MOST STRINGENT WHERE CONFLICTS AND/OR INTERPRETATIONS OCCUR
BETWEEN THE CODES.

B. Qualification: All installers shall be experienced and UL master labeled and LPI certified systems or of equivalent qualification, as accepted in writing by the engineer of record. A UL/LPI certified installer shall be on the project site at all times during installation of the systems and shall supervise all of the installation. Installer shall be subject to approval by Owner/Engineer.

1.3 SPECIAL REQUIREMENTS FOR COUNTERPOISE CONDUCTOR

A. Counterpoise: As a minimum, the counterpoise conductor shall be connected to each of the following system components utilizing heavy duty, U.L. products:

1. Each down conductor.

2. All counterpoise conductors on power and communications ducts which enter the building.

3. The building electrical service ground.

4. All metallic water and gas services entering the building (ahead of meter).

5. Counterpoise conductor on site light circuits leaving the building.

6. All metallic fence posts, safety railings, etc., or any other metallic item within fifty feet of the project building.

1.4 SUBMITTALS

A. General: Shop drawings identifying all system wiring and component placement, including all details, shall be submitted to the Engineer for review. The Contractor shall not perform any portion of the Work until the respective submittal has been accepted. All work shall be in accordance with accepted submittals.

B. Detail Submission: Details shall be submitted to the Engineer for review indicating the method of cabling connections and attachments starting at the top of the project building to the ground rods at the counterpoise. All details shall be appropriate for the project.

C. Identification: All product data sheets submitted, for proposed system components, shall clearly identify the item being submitted and shall indicate the UL label.

D. Suppression Device: All transient voltage surge suppressors for the project shall be submitted at the same time the lightning protection floor plans, details and product data sheets are submitted. Each suppressor shall clearly indicate the item to be protected and shall comply with Section 16709 of these specifications. Suppressors shall be provided as required in NFPA 780 unless otherwise indicated on the drawings or otherwise specified.

E. Deviations: The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the acceptance of shop drawings, product data, samples or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal and the Engineer has given written acceptance to the specific deviation.

F. Certification: Provide documentation of LPI certification or equivalent qualification of exact installer intended to do this particular job.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Labels: All materials used for the system installation shall comply in size, composition and weight to all requirements of NFPA UL and LPI for the class of system in which they are installed. All materials shall be labeled or listed by Underwriters Laboratories, Inc. for use in master labeled or LPI certified lightning protection systems.

B. Material: Generally, the external lightning protection system at the roof level shall be constructed of aluminum cable and aluminum compatible components. The internal lightning protection system, starting with the down conductors and concluding at the ground termination system (counterpoise and dissipation points) shall be constructed of copper cable and copper compatible components. Likewise, all bonding conductors, equipotential loop conductors, etc, shall also be constructed of copper cable and components.

C. Compatibility: All portions of the system, weather copper or aluminum, shall be galvanically compatible to the building material to which they are to be attached. Connections between copper and aluminum portions of the system shall be made with appropriate bimetallic coupling devices. In all areas, the conductor shall be supported to maintain clearance from all galvanically incompatible materials and/or installed from same.

D. Components: All system components (i.e. air terminals, bases, connectors, cable, thru-roof fittings, ground rods, etc.) shall be, to the maximum extent possible, the product of a single manufacturer. All components shall be heavy duty construction utilizing hexagonal head bolts for fastening. All hospital project air terminal bases shall be securely mounted to the project roof by means of mechanical fasteners. Adhesive type air terminal bases are not acceptable. Submit in shop drawings for proposed air terminal mounting details.

2.2 AIR TERMINALS

A. General: Air Terminals shall be aluminum or copper as required to match the building system to which they attach. Air terminals shall protrude a minimum of 10 inches above the object to be protected. Center roof air terminals shall be 24” high. Air terminal points shall be blunt with the radius of curvature equal to ther rod diameter.

B. Base: Each air terminal shall be equipped with the correct type of base for the location in which it is mounted.

C. Roof Top Equipment: Air terminals and interconnecting cables shall be provided for all roof mounted equipment (fans, A/C equipment, etc.) subject to a direct strike as required by NFPA 780.

2.3 CONDUCTORS

A. General: Main roof conductors shall be aluminum and provide a two-way path from each air terminal horizontally or downward to connections with ground terminals. Conductors shall be free of excessive splices and sharp bends. No bend of a conductor shall form an included angle of less than 90 degrees nor have a radius of bend of less than 8 inches. Conductors shall be secured to the structure at intervals not exceeding 3 feet. Cables connected to "thru-roof" connectors may rise from the roof to the connector at a maximum slope of 3 inches per foot, not exceeding 3 feet horizontally in air. Air terminal conductors shall be concealed behind parapet and drawn tight

B. Down Conductors: Down conductors shall be copper and shall be concealed in the exterior wall construction or structural columns. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. In project structures of structural steel frame construction, down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals averaging not more than 100 feet around the perimeter of the structure. Connections to the steel frame shall be made with heavy duty bonding plates having 8 square inches of contact surface.

C. Main conductor cable shall be 28 strands of 14 gauge copper wire, 1/2 inch diameter, 115,000 cm, 35 lbs per 1000 feet (2/O minimum).

D. Shop Drawing: Submit all conductor type in shop drawing form. Each conductor shall be identified as to location in the lightning protection system.

2.4 ROOF PENETRATIONS

A. General: Roof penetrations required for down conductors or for connections to structural steel framework shall be made using thru-roof type assemblies with solid bars and appropriate roof flashing. Roof flashing shall be compatible with the roofing system and shall be provided under this contract and installed by the roofing contractor. Submit roof flashing data sheets and letter of acceptance from roofing contractor in shop drawing package.

2.5 COMMON GROUNDING

A. General: Common grounding of all ground mediums within the project building shall be made by interconnecting with main size conductors and heavy duty fittings.

B. Bonding: Grounded metal bodies located with the required bonding distance (as determined by the bonding distance formulas in NFPA 780) shall be bonded to the system using bonding conductors and fittings. Bond to rebar utilizing Cadweld braze connections.

C. Lightning protection system ground locations shall not exceed 25 ohms measured at ground electrode.

2.6 GROUND TERMINATIONS

A. General: Two ground terminations shall be provided for each down conductor rod and shall consist of two 5/8 inch x 10 feet copper-clad ground rod with 10 to 15 foot separation. Each down conductor shall be connected to the ground rods by an exothermic weld connection. Tops of ground rods shall be located 2 feet below finished grade and 2 feet from the foundation wall and shall extend a minimum of 20 feet vertically into the earth. Where a counterpoise is provided, rods shall be interconnected with the counterpoise.

B. General: Where the structural steel framework is utilized as the main conductor for the system, perimeter steel columns shall be grounded at intervals averaging not more than 60 feet apart. Steel columns shall be grounded using bonding plates having 8 square inches of surface contact area. Conductors from the grounded connections to the ground termination shall be full size copper lightning conductors.

2.7 FASTENERS

A. General: Conductor fasteners shall be manufactured of a material which is compatible with the type of conductor being supported. Fasteners shall be of sufficient strength to properly support each conductor or terminal base, etc.

2.8 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Equipment manufactured by Thompson Lightning Protection, Inc. Harger Lightning Protection or Heary Brothers shall be considered acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS

A. General: Conductors shall be installed to interconnect all air terminals to the system of grounding electrodes, and in general provide a minimum of at least 2 paths to ground from any point on the system. Conductors shall provide a horizontal or downward path between the system air terminals and grounding electrode system. No bend in any conductor shall exceed 90 degrees or have a radius of less than 8 inches.

B. Routing: Conductors shall be routed in such a manner that maximum concealment from public view is achieved. Down conductors shall be in one-inch PVC conduit from roof to grade.

C. Counterpoise Conductors: Counterpoise conductors shall be installed after finished grades are established to insure specified depth and to minimize the possibility of damage. Any counterpoise conductor which is cut or damaged shall be repaired or replaced with no additional cost to the contract.

D. Connections: All connections between conductors below grade shall be exothermically welded. Improper application of weld shall be replaced at no additional cost to the contract.

3.2 INSTALLATION OF GROUND RODS

A. General: Ground rods shall be installed vertically at each down conductor position at a minimum of 2 feet from the building foundation wall. Inspection and documentation at each grounded location, weld, depth of counterpoise, etc., shall be made by the owners representative prior to backfill. Contractor shall notify engineer in writing at conclusion of his work. Allow a minimum of one week for engineer to make the inspection after notification from contractor.

3.3 BONDING OF SECONDARY METALLIC BODIES

A. General: All metallic equipment located within 6 feet of a lightning protection conductor shall be bonded to the lightning protection system.

B. Structure Grounding: Provision shall be made at the roof level on reinforced concrete structures for bonding between the down conductors, metallic elements of the roof system and metallic exterior wall systems.

C. Bonding: All down conductors run in concrete columns shall be bonded to the reinforcing steel at the top and the bottom of the column. All metallic items within 6 feet of each down conductor shall be bonded to the down conductor.

3.4 GENERAL WORKMANSHIP

A. General: All elements of the Lightning Protection System shall be installed in a professional and workmanlike manner consistent with the best industry practices.

B. Concealed Installation: All system components shall be concealed to the maximum extent possible to preserve the aesthetic appearance of the project building on which the system is installed.

3.5 COORDINATION WITH OTHER TRADES

A. Coordination: The Contractor shall coordinate his work with all trades, to insure the use of proper materials and procedures in and around the roof in order not to jeopardize the roofing warranty.

B. Fasteners: Where fasteners are to be embedded in masonry or the structural system, those fasteners shall be provided to insure installation at the proper time of installation.

C. Certification: Upon completion of the installation the Contractor shall provide to the owner the Master Label issued by Underwriters Laboratories, Inc. for the installation, or the LPI certification issued by LPI.

END OF SECTION

SECTION 16709
TRANSIENT VOLTAGE SURGE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.2 DESCRIPTION

A. General: Transient voltage surge suppression (TVSS) or surge protection device (SPD) is the description and equipment required for the protection of all AC electrical circuits and electronic equipment from the effects of lightning induced voltages, external switching transients and internally generated switching transients.

1.3 REFERENCE STANDARDS AND PUBLICATIONS

A. General: The latest edition of the following standards and publications shall comply to the work of this section;

1. ANSI/IEEE C62.33 Standard for Test Specifications for Varistor Surge Protection Devices.
2. ANSI/IEEE C62.41 (IEEE 587) Guide for Surge Voltages in Low-Voltage AC Power Circuits Categories A, B and C. In addition, table 8, 10x1000µs high exposure testing
3. ANSI/IEEE C62.45 Guide on Surge Testing for Equipment Connected Low Voltage AC Power Circuits.
4. IEEE Standard 142 - Recommended Practice for Grounding
5. IEEE Standard 518 Recommended Guide on Electrical Noise
6. UL-1283 for EMI Filters
7. UL-1449 Standard for Safety, Transient Voltage Surge Suppressors - 2nd Edition
8. NFPA 70 National Electrical Code
9. NFPA 75 Standard for the protection of electronic computer/data producing equipment.
10. NFPA 780 Lightning Protection Standard.
11. Military Standard (MIL Std.) 220A
12. Federal Information Processing Standards (FIPS) Publication 94
13. CCITT Rec. K-17 Waveform specification for electronic system
14. NEMA LS-1.

1.4 SYSTEM PERFORMANCE CRITERIA

A. General: Surge suppression, grounding and bonding shall effectively protect the systems to which it is applied against lightning, transients, internal spikes, and other surge transients throughout the useful life of the system. Surge protection devices and related grounding and bonding systems shall be designed and installed in such a manner that normal operation, performance ratings, and listing of the system is not impaired by the installation of such devices, wiring or connections.

B. Intent: The intent of this specification is to allow manufacturers with varying equipment concepts to provide transient voltage surge suppression which will properly protect equipment within the guidelines set forth herein. Specific manufacturers listed shall be used as the basis of design, however, submitted components shall comply to the minimum and maximum values listed and shall be equal to or better than the specific manufacturers type specified herein. The listed data specified herein shall be used for the comparative analysis of all manufacturers specified herein.

1.5 MANUFACTURER QUALIFICATIONS

A. Repair: The surge protection devices manufacturer shall offer factory repair service and replacement for all units. The manufacturer shall provide this service within four working days, and provide replacement components shipped to the Owner for installation within the allocated response time.

B. Acceptable Manufacturers: Only the following acceptable manufacturers shall be considered; LEA International, Advanced Protection Technologies & Leviton.

C. Installation Certification: The manufacturer shall furnish a letter indicating that the installation was inspected by a factory authorized representative and meets all of the manufacturer's wiring and installation requirements. The Contractor shall submit a check-out memo to the manufacturer indicating the date when the equipment was put into service and the actual method of installation. Submit three copies to the Engineer for review.

D. Manufacturers requesting product approval must meet or exceed the written specification contained herein. Manufacturers requesting approval must receive written verification of product acceptance from the specifying engineer 14 days prior to bid date by addendum. Submit manufacturer's certified test data indicating the ability of the product to meet or exceed requirements of this specification. Third party testing showing the product can withstand the manufacturer's published surge current rating for multiple impulses must be submitted for approval consideration. Manufacturer's that require the use of current limiting devices, internal or external to the surge protection device, will not be considered for approval.

1.6 WARRANTY

A. Period: All surge protection devices and supporting components shall be guaranteed by the installing contractor to be free of defects in materials and workmanship for a period of five years from the date of substantial completion or service activation for the system to which the suppressor is attached.

B. Replacement: Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced at no expense to the Owner including labor and materials. Since "Acts of Nature" or similar statements include the lightning threat to which these suppression devices shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. The warranty shall cover the entire device not just the modules.

C. Installation: Main switchboard SPD shall be mounted internal to switchboard. Installation of SPD's in or on electrical equipment shall in no way compromise or violate equipment listing, labeling, or warranty of the equipment. TVSS shall be installed by switchboard manufacturer. TVSS manufacturer shall ship TVSS for internal mounting to switchboard manufacturer. Refer to section 16425.

1.7 SUBMITTAL

A. General: SPD wiring, bonding, and grounding connections shall be indicated on the wiring diagrams for each system. Include installation details demonstrating mechanical and electrical connections to equipment to be protected.

B. Testing: The test data submitted shall be specific for the actual method on installation proposed. Submittals will not be reviewed unless they include proper project related data. Interpretation of standard manufacturers published data will not be acceptable unless the data coincides with the actual installation procedure.

C. Submittals: The surge protection submittal shall also include, but shall not be limited to, the following additional data;

1. Complete data for each suppressor type indicating conductor sizes, conductor types, connection configuration, lead lengths and all appropriate dimensions.
2. Dimensions for each suppressor type indicating mounting dimensions and required accessory hardware.
3. Manufacturers certified test data indicating the ability of the product to meet or exceed requirements of this specification.
4. If requested, a sample of each suppressor type to be used for testing and evaluation shall be submitted.
5. Drawings shall be provided indicating surge protection device mounting arrangement and lead length configuration, and mounting arrangement of remote diagnostic equipment and assemblies.
6. List and detail all protection systems such as fuses, disconnecting means and protective materials.

PART 2 - PRODUCTS

2.1 SINGLE SOURCE SUPPLY

A. Single Source Supply: All AC power SPD's shall be manufactured by a single manufacturer. All system SPD's shall be manufactured by a single manufacturer.

B. SPD's shall be listed in accordance with UL 1449 Standard for Safety, Transient Voltage Surge Suppressors, 2nd Edition, and UL 1283, Electromagnetic Interference Filters.

2.2 PERFORMANCE

A. Data: The surge suppression equipment shall meet or exceed the minimum performance criteria as follows:

EQUIPMENT TYPE	MINIMUM TOTAL SURGE CURRENT/PHASE	CAT	SYSTEM MAXIMUM RESPONSE TIME IN NANOSECS	COMPONENT MAXIMUM RESPONSE TIME IN NANOSECS	MINIMUM COMMON/& NORMAL MODE NOISE REJECTIONN IN DB.
SERVICE ENTRANCE	300,000 A	C3	5	1	40
DISTRIBUTION EQUIPMENT 400 AMPERES & LARGER	225,000 A	B3	5	1	40
PANELBOARDS	120,000 A	A3	5	1	40

B. Voltage Ratings: Voltage ratings shall be as follows;

1. 120, 120/208, 3Ø 4W "Y" or 120/240 volt systems
2. 277/480 3Ø 4W "Y" volt systems
3. 208V. or 480V. 3Ø 3W delta

C. There shall be seven modes of protection: 3-modes (Line-to-Ground), 3-modes (Line-to-Neutral), and 1-mode (Neutral-to-Ground) for a 3-phase, 4-Wire plus ground voltage system. (Line-to-Neutral-to-Ground is not an acceptable substitute for Line-to-Ground.)

D. Third party testing showing the products ability to meet IEEE C62.41, table 8, 10x1000 high exposure testing

1. Three Phase, Four Wire:

EQUIPMENT 3 PHASE 4 WIRE	VOLTAGE RATINGS	TEST WAVE CATEGORY	VOLTAGE TEST RATING	BIWAVE CURRENT TEST WAVE RATING	MAXIMUM CLAMPING VOLTAGES 7 MODE: LN,LG,NG 4 MODE: LN, NG3, 3W: LL, LG
SERVICE ENTRANCE	120/208V	C3	20 KV	10 KA	600 V
	277/480V	C3	20 KV	10 KA	1000 V
DISTRIBUTION EQUIPMENT	120/208V	B3	6 KV	3 KA	600 V
	277/480V	B3	6 KV	3 KA	1000 V
PANELBOARDS	120/208V	B3	6 KV	3 KA	600 V
	277/480V	B3	6 KV	3 KA	1000 V

2. Three Phase, Three Wire:

EQUIPMENT 3 PHASE 3 WIRE	VOLTAGE RATINGS	TEST WAVE CATEGORY	VOLTAGE TEST RATING	BIWAVE CURRENT TEST WAVE RATING	MAXIMUM CLAMPING VOLTAGES L-L, L-G
SERVICE ENTRANCE	480V	C3	20 KV	10 KA	1500 V
DISTRIBUTION EQUIPMENT	480V	B3	6 KV	3 KA	1500 V

E. Each MOV contained with a current diversion module shall be individually fused (component level safety fusing). For the assurance of safety purposes, this feature must be a standard design feature and not an optional feature of the product. The individual component fusing shall allow a reduction of protection rather than an automatic complete loss of protection.

F. The service entrance and distribution/panelboard units shall be UL 1283 listed as an electromagnetic interference filter. Standardized insertion loss data shall be obtained utilizing MIL-STD E220A 50□-insertion loss methodology. Minimum insertion loss shall be as follows:

Frequency	Insertion Loss (dB)
100kHZ	34
1MHZ	51
10MHZ	54
100MHZ	48

G. Unit Operating Voltage: The nominal unit operating voltage and configuration shall be as shown on the contract documents. The maximum continuous operating voltage (MCOV) of all components shall not be less than 125%.

H. Power Interruption: During normal suppression operation, the unit shall not short circuit or crowbar the power flow that would result in an interruption to the load. Building power shall not require interruption for maintenance.

I. Visual Indication: Visual indication on the cover of the enclosures shall indicate proper system operation. Visual indication shall also indicate mode failure.

J. Modular SPD's shall use a separate path to building ground, the equipment safety ground is not to be used as a transient ground path.

K. SPD's shall be constructed using MOV based modules. The SPD shall have a response time of less than one nanosecond with six inches or less of connected lead length for any individual protection mode.

2.3 SURGE SUPPRESSION

A. Surge Suppression: Modular, solid state componentry, bipolar and bi-directional operation shall be provided for service entrance and distribution equipment. Protection modules shall be individually fused.

B. Fused Disconnect: SPD's shall be provided with an integral fused disconnect switch for service entrance panels, internally mounted shall use pull out type disconnect switch switch. Switches shall have an AIC fault withstand rating equal or greater than the AIC rating of the equipment being protected. The disconnect switch shall have an interlocking rotary type safety switch that turns power off to the device upon opening of the enclosure for inspection and/or module replacement.

C. Enclosures: Enclosures shall be as follows;

1. Minimum 14 gauge painted steel with fully hinged door for SPD's at service entrance and distribution equipment 400 amperes and over.

a. NEMA 12 Dust-tight and drip-tight.

2.4 AUDIBLE AND VISUAL SYSTEMS

A. Service Entrance Equipment

1. Install in front enclosure of equipment

2. Features:
   a. Equipment with LED indicator lights per phase.
      1) Protection: Suppressor Working - Green LED's.
      2) Loss of Protection: Suppressor Burnout – Green LED's not illuminated.
      3) LED's shall be field replaceable.
   b. Visual indication of proper SPD connection and operation shall be provided both on the modules and redundant on the front door of the enclosure. The indicator lights shall indicate which phase, as well as which module is operational. SPD's that require a separate diagnostic test kit to determine and verify proper SPD operation shall be provided with such a test kit.
   c. SPD's shall incorporate copper bus bars for the surge current path. Small round wiring or plug-in modules are not acceptable. Field-replaceable surge current diversion modules shall be bolted to the bus bars for reliable low impedance connections.
   d. Accessories:
      1) Local audible alarm to operate under system or component failure.
      2) Local alarm silencing switch.
      3) Digital surge counters to record transient voltage occurrences

B. Distribution Panel Protection

1. Features
   a. Equipment with LED indicator lights per phase LED shall extinguish to indicate malfunction/loss of protection of surge suppressor.
   b. LED's shall be field replaceable.
   c. Audible alarm and silence switch.
   d. SPD's shall be provided with an integral disconnect. The disconnect switch shall have an interlocking rotary type safety switch that turns power off to the device upon opening the enclosure for safe inspection and/or module replacement.
   e. Visual indication of proper SPD connection and operation shall be provided both on the modules and redundant on the front door of the enclosure. The indicator lights shall indicate which phase, as well as which module is operational. SPD's that require a separate diagnostic test kit to determine and verify proper SPD operation shall be provided with such a test kit.

f. SPD's shall incorporate copper bus bars for the surge current path. Small gauge round wiring or the use of plug-in modules is not acceptable. Field-replaceable surge current diversion modules shall be bolted to the bus bars for reliable low impedance connections.

C. Subpanel Protection

1. The sub panel/panel board panel TVSS equipment shall meet or exceed the minimum performance criteria as follows:

a. The maximum surge current rating shall be a minimum of 120,000 Amps/phase.

b. SPD shall be a compact non-modular design. The mounting position of the SPD shall allow a straight and short lead-length connection between the SPD and point of connection in the panel board.

c. Visual indication of proper SPD operation shall be easily viewed on the front door of the enclosure. The indicator lights shall indicate the presence of protection on each phase.

d. The enclosure type shall have minimum rating of NEMA 12.

e. Provide a 20A, 3pole breaker for each panel board (type 3) TVSS device.

2.5 MANUFACTURERS

120/208V & 277/480V Configurations

TVSS MANUFACTURER (DRAWING DESIGNATION)	**SERVICE ENTRANCE (TYPE 1)**	**DISTRIBUTION EQUIPMENT 400 AMPERES & LARGER (TYPE 2)**	**SUB PANEL PANELBOARDS (TYPE 3)**
LEA INTERNATIONAL*	GB-200S	GB-100S	CFS
LEVITON*	57000-M3S	57000-M3S	47000
ADVANCED PROTECTION TECHNOLOGIES*	TEXHP-CL-G	TEXHP-CX-G	TE-XT

* Manufacturer is contingent on meeting criteria of section 2.02.

2.6 BONDING AND GROUNDING CONDUCTORS AND MATERIALS

A. Size: Conductors utilized for surge suppressor bonding shall be a minimum of #6 AWG solid insulated copper unless otherwise specified.

B. Bus: Ground bus or strip material shall be copper, a minimum of 26 gauge in thickness and three inches wide unless otherwise specified. Bus materials may be secured to surfaces with an appropriate mastic material or mechanical fasteners. Bus connections shall be bolted and reinforced as necessary to provide a permanent and secure connection.

C. Rods: Unless otherwise specified, all surge suppression grounding electrodes, where provided, shall be 5/8" diameter copperweld rods, twenty feet in length.

D. Connections Compliance: Connectors, splices, and other fittings used to interconnect grounding conductors, bonding to equipment or ground bars, shall comply with requirements of the National Electric Code and be accepted by Underwriters Laboratories for the purpose.

E. Connectors: Connectors and fittings for grounding and bonding conductors shall be of the compression type in above grade locations. Connections below grade shall be exothermically welded or brazed.

F. Dissimilar Materials: Bonding connections between electrically dissimilar metals shall be made using exothermic welds or using bi-metal connectors designed to prevent galvanic corrosion.

PART 3 - EXECUTION

3.1 SEGREGATION OF WIRING

A. General: All system wiring shall be classified into protected and non-protected categories. Wiring on the exposed side of suppression devices shall be considered unprotected. Surge suppressor grounding and bonding conductors shall also fall into this category.

B. Protection: All wiring between surge suppressors and protected equipment shall be considered protected and connected in accordance with the latest edition of the NEC.

C. Separation: A minimum of three inches of separation shall be provided between parallel runs of protected and unprotected wiring in control panels, terminal cabinets, terminal boards and other locations. In no case shall protected and unprotected wiring be bundled together or routed through the same conduit. Where bundles of protected and unprotected wiring cross, such crossings shall be made at right angles.

3.2 INSTALLATION OF SURGE PROTECTIVE DEVICES

A. Installation at Service Entrance and Distribution Panels: Suppressors shall be installed in Service Entrance switchboards and as close as practical to distribution equipment to be protected consistent with the available space, however, do not exceed three feet. SPD's installed in this manner shall utilize the equipment chassis as a medium for bonding of their ground terminals. Bonding jumpers not exceeding two inches in length shall be installed between the chassis and suppressor ground terminals. Bolted

connections with star washers shall be used to insure electrical and mechanical integrity of connections to the equipment chassis. Conductors from SPD's shall attach to main service bus connection in the service entrance equipment on the load side of the electrical utility company metering equipment.

B. Installation at Lighting and Appliance Panelboards: The SPD shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space. SPD's shall be close nippled to the device being protected in a position near the neutral bus which will minimize lead length between the SPD's and the buses and disconnect means to which the SPD connects. Pre-wired leads shall be field cut to minimize the length between the SPD and panel connection point. SPD leads shall not extend beyond the suppressor manufacturer's recommended maximum lead length without specific approval of the Engineer. Leads shall be twisted up to the connection points. Do not splice factory leads.

C. Workmanship: SPD's shall be installed in a neat, workmanlike manner. Lead dress shall be consistent with recommended industry practices for the system on which these devices are installed.

D. Disconnect: The main service entrance devices shall be provided with an integral disconnect switch with fuses. The disconnect switch shall be fused with current limiting fuses. Switches must have a fault withstand AIC rating equal to or greater than the power distribution equipment being protected. All panelboard SPD's shall be fused.

3.3 TESTING

A. Disconnect SPD prior to meggar testing of service entrance, distribution equipment and panelboards.

END OF SECTION

16720 FIRE PROTECTION SYSTEM SPECIFICATION

ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the Division 16 Sections for Basic Electrical Requirements, Basic Electrical Materials and Methods, and Sections 16701 and 16709 apply to this Section:

C. The complete installation is to conform to the applicable sections of NFPA 72 and the National Electrical Code with particular attention to Article 760.

D. The entire installed system and all integrated system operations shall be within guidelines of the Uniform Fire Alarm Code for the State of Florida and the SBCCI.

E. NFPA 90A

F. NFPA 101 - Life Safety Code

G. ADA

H. ASME / ANSI A17.1 and A17.3

I. State Requirements for Educational Facilities (SREF).

J. Most stringent requirements apply where conflict exists between documents listed above.

K. Underwriters Laboratories, Inc. (UL)

1.2 SUMMARY

A. This Section includes fire alarm systems, including manual stations, detectors, notification appliances, signal equipment, controls, and devices.

B. Work covered by this specification section includes the furnishing of labor, equipment, materials, and complete operational performance required for installation of the Fire Alarm System as shown on the drawings, as specified, and as directed by the Architect/Engineer.

C. The work covered by this section of the specification is to be coordinated with the related work as specified elsewhere under the project specifications.

D. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:

1. Fire Alarm and Detection Operations.

2. Remote Manual and Automatic Control of Elevators, AHU fan shutdown, Door Hold-open devices, Fire Suppression Appliances, Remote Monitoring of Sprinkler, Fire Pump and Emergency Power Systems, and/or Off Premise Notification.

3. One-Way Supervised Automatic Voice Alarm Operations.

E. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 15 Section "Fire Protection" for water-flow, pressure, or tamper switches connected to fire alarm system.

2. Division 15 Section "DDC" for duct smoke detectors.

3. Division 16 Section "Security Systems" for transmission of signals to central station monitoring location.

1.3 SYSTEM DESCRIPTION

A. General: Complete, no coded, addressable, microprocessor-based fire detection and alarm system with manual and automatic alarm initiation, addressable analog initiating devices, and automatic alert for certain analog smoke sensor zones as indicated.

B. System shall be a campus network, with a fire alarm control unit/network node at each building.

C. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.

D. The system shall have the capability of loading software operations from a single node to all other nodes on the network.

E. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate future changes. For example, monitoring of normally open contact devices to monitoring of normally closed contact devices, or from sensing of normally open contact devices to sensing a combination circuit and being able to differentiate between the two.

F. Resident software shall allow for configuration of notification appliance and control circuits so that additional hardware shall not be necessary to accommodate changes. For example, changing a non-coded notification appliance circuit to a coded circuit, or from a slow march time (20 BPM) to fast march time (120 BPM) coding.

G. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history.

H. Signal Transmission: A combination of hard-wired, using separate individual circuits for each zone of alarm initiation and alarm device operation as required, and multiplexing signal transmission for addressable alarm initiation and alarm device operation, dedicated to fire alarm service only.

I. Data Communication Transmission: The peer-to-peer network communication channel shall operate using digital token-ring communication techniques. Communications shall be dedicated to fire alarm service only.

J. Network communication details shall be per the following:

1. Each building node shall communicate to the next in a token ring configuration, over a dedicated fiber optic cable pair.

2. Provide, as part of this scope, the necessary fiber termination equipment to create the physical ring configuration at the Main Distribution Frame (M.D.F.). The campus fiber backbone is a radial configuration, originating at the M.D.F

3. In the event that the path to the next node on the ring has experienced a communications failure, the node with possession of the token shall transmit it back in the direction from which it came to attempt to reach the next node by going around the ring in the opposite direction. At the same time the status of the noncommunicating node shall be added into the token content.

4. If a group of nodes becomes isolated from the rest of the network ring, that group shall form a subnetwork with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications.

5. In the event that a single node becomes unable to handle the network token, the network interface card shall continue communications to the rest of the network. The off-line node is reported as such to the network and is periodically interrogated to determine if it is ready to be brought back on-line with the rest of the network.

6. The communication method shall be NFPA 72 style 7.

K. Audible Alarm Notification: By horns, for buildings, unless otherwise indicated, By voice alarm messages and tone signals on loudspeakers for buildings indicated.

L. System connections for alarm-initiation and alarm-notification circuits shall be: Style B and Y wiring.

M. Functional Description: The following are required system functions and operating features:

1. Priority of Signals: Accomplish automatic response functions by the first zone initiated. Alarm functions resulting from initiation by the first zone are not altered by subsequent alarms. The highest priority is an alarm signal. Priority two, Supervisory Service and Trouble signals have second-, third-, and fourth-level priority. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all alarm signals regardless of priority or order received.

2. Non-interfering: Zone, power, wire, and supervise the system so a signal on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACU after the initiating device or devices are restored to normal.

3. Signal Initiation: The manual or automatic operation of an alarm-initiating or supervisory-operating device shall cause the FACU to transmit an appropriate signal including:

a .General alarm.
b. Fire-suppression alarm.
c. Manual station alarm.
d. Smoke detector alarm.
e. Heat detector alarm.
f. Fan shutdown.
g. Smoke control initiation.
h. Door release.
I. Elevator recall.
j. Elevator shutdown.
k. Fire pump running.
l. System trouble.
m. Fire pump power supervisory.
n. Valve tamper supervisory.

4. Transmission to Remote Central Station:

Automatically route alarm, supervisory, and trouble signals to a remote central station service transmitter, using listed and approved equipment. Provide interface with communicator furnished as part of the security system. Verify required transmission of fire alarm signals, coordinate with security system contractor.

5. Loss of primary power at the FACU shall sound a trouble signal at the FACU and shall indicate at the FACU when the system is operating on an alternate power supply.

6. Annunciation: Manual and automatic operation of alarm and supervisory initiating devices shall be annunciated both on the FACU and on the annunciator, indicating the location and type of device.

7. *FACU Alphanumeric Display: Shall display plain-language description of alarms, trouble signals, supervisory signals, monitoring actions, system and component status, and system commands.*

8. *General Alarm: A system general alarm shall include:*

   a. *Indicating the general alarm condition at the FACU and the annunciator.*

   b. *Identifying the device or its zone that is the source of the alarm at the FACU and the annunciator.*

   c. *Displaying the alarm on an **40 character orgreater** LCD display and a color touch screen display. The system alarm LED shall flash on the control unit until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control unit and remote annunciator. The display shall show the new alarm information.*

   d. *A pulsing alarm tone shall occur within the control unit and the graphic annunciator until the event has been acknowledged.*

   e. *Operating audible and visible alarm notification signals throughout the building.*

   f. *Sounding a continuous fire alarm audible signal until silenced by the alarm silence switch at the control unit or at the graphic annunciator.*

   g. *Activate voice evacuation signal in auditorium.*

   h. *All visible alarm notification appliances shall flash continuously until the Alarm Reset Switch is operated.*

   i. *Any subsequent zone alarm shall reactivate the alarm notification appliances.*

   j. *Closing fire and smoke doors normally held open by magnetic door holders. All doors normally held open by 24 VDC door control devices shall release.*

   k. *Unlocking designated doors.*

   l. *Stopping supply and return fans serving zone where alarm is initiated.*

   m. *Activating the air handling systems per life safety code, NFPA 90A and NFPA 101.*

   n. *Activating a supervised signal to notify the local fire department.*

   o. *Initiating automatic elevator recall per ASME/ANSI A17.1 and A17.3.*

p. Print out on system printer.

8. Transmit the alarm to the central receiving station via a digital communicator alarm transmitting device at the main telephone background location. Provide conduit and wire from the fire alarm cabinet to the digital communicator whether or not shown on the drawings. Provide the digital communicator device accepted by the central receiving station that the owner selects.

9. The alarm activation of any elevator lobby smoke detector shall, in addition to the operations listed above, cause the elevator cabs to be recalled according to the following sequence:

a. If the alarmed device is on any floor other than the main level of egress, the elevator cabs shall be recalled to the main level of egress.

b. If the alarmed device is on the main egress level, the elevator cabs shall be recalled to the predetermined alternate recall level as determined by the local authority having jurisdiction.

10. Water-flow alarm switch operation:

a. Initiates a general alarm.

11. Smoke detection initiates a general alarm.

12. Smoke Sensor Sensitivity Adjustment:

a. Authorized operation of controls at the FACU shall cause the selection of specific addressable smoke sensors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings.

13. Remote Controllability: Individually monitor sensors at the FACU for calibration, sensitivity, and alarm condition, and individually adjust for sensitivity from the FACU. The alarm decision for each sensor shall be determined by the control unit. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.

14. The sensitivity of each sensor will be as high as it can possibly be for its location without being so sensitive that it will be nuisance alarm-prone.

15. Smoke Sensor Sensitivity: Between .2- and 3.7-percent-per-foot smoke obscuration when tested according to UL 268.

16. The control unit shall maintain a moving average of the sensors smoke chamber value to automatically compensate (move the threshold) for dust, dirt, and component degradation conditions that could affect detection operations. The control unit shall automatically maintain a constant smoke obscuration sensitivity for each sensor (via the floating threshold) by compensating for environmental factors.

17. *The control unit shall automatically indicate when an individual sensor needs cleaning. When a sensors average value reaches a predetermined value, a ADIRTY SENSOR@ trouble condition shall be audibly and visually indicated at the control unit for the individual sensor. Additionally, the LED on the sensor base shall glow steady giving a visible indication at the sensor location. If a ADIRTY SENSOR@is left unattended and its average value increases to a second predetermined value, an AEXCESSIVELY DIRTY SENSOR@trouble condition shall be indicated at the control unit for the individual sensor. To prevent false alarms, these ADIRTY@ conditions shall in no way decrease the amount of smoke obscuration necessary for system activation.*

18. *The control unit shall continuously perform an automatic self-test routine on each sensor which will functionally check sensor electronics and ensure the accuracy of the values being transmitted to the control unit. Any sensor that fails this test shall indicate a ASELF TEST ABNORMAL@ trouble condition.*

19. *Sprinkler valve tamper switch operation shall cause or initiate the following:*

    a. *The activation of any standpipe or sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the control unit and the graphic annunciator. Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided. The differentiation shall be clearly identified in plain-language on the FACU Alphanumeric display.*

    b. *Pressing the Supervisory Service Acknowledge Key shall silence the supervisory audible signal while maintaining the Supervisory Service LED "on" indicating the off-normal condition.*

    c. *A record of the event in the FACU historical log.*

    d. *Transmission of supervisory signal to remote central station and color graphics unit.*

    e. *Restoring the valve to the normal position shall cause the Supervisory Service LED to extinguish, indicating restoration to normal.*

20. *Fire pump power failure, including a dead phase or phase-reversal condition shall cause or initiate the following:*

    a. *Activate the system supervisory service audible signal and illuminate the LED at the control unit, and the remote annunciator. Differentiation between fire pump power failure activation and opens and/or grounds on the initiation circuit wiring shall be clearly identified in plain-language on the FACU Alphanumeric display.*

    b. *Pressing the Supervisory Service Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory Service LED "on" indicating the off-normal condition.*

    c. *A record of the event in the FACU historical log.*

d. Transmission of supervisory signal to remote central station.

e. Restoring the fire pump power shall cause the Supervisory Service LED to extinguish, indicating restoration to normal.

N. Recording of Events: Provide a system printer to record all alarm, supervisory, and trouble events. Printouts are by zone, device, and function. When the FACU receives a signal, the alarm, supervisory, and trouble conditions are printed. The printout includes the type of signal (alarm, supervisory, or trouble) the zone identification, date, and the time of the occurrence. The printout differentiates alarm signals from all other printed indications. When the system is reset, this event is also printed, including the same information concerning device, location, date, and time. A command initiates the printout of a list of existing alarm, supervisory, and trouble conditions in the system. Trouble conditions shall indicate and differentiate in plain-language open circuit trouble, short circuit trouble, disable trouble, and manual override trouble for each circuit.

*1. Permissible Signal Time Elapse: The maximum permissible elapsed time between the actuation of any fire alarm or fire-detection system alarm-initiating device and its indication at the FACU shall be **per NFPA72**.*

2. Circuit Supervision: Circuit faults shall be indicated by means of both a zone and a trouble signal at the FACU. Provide a distinctive indicating audible tone and alphanumeric annunciation.

3. Independent System Monitoring: Supervise each independent smoke detection system, fire suppression system, duct detector, and elevator smoke detection system for both normal operation and trouble.

4. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary(AC) and secondary (battery) power conditions. Systems which cannot support 100% of their points in alarm simultaneously cannot assure appropriate system response and are not acceptable.

5. Priority Two UL 1076 Security Zones: Shall be indicated by means of an indicating audible tone and alphanumeric annunciation. Zones shall be supervised during bypass mode to indicate tampering or fault conditions.

O. Automatic Voice Evacuation Relocation Sequence (Auditorium Only):

1. The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. The audio alarm signals shall sound alternately until the signal silence switch has been operated.

2. All audio operations speaker circuit selection and alarm tone / voice messages and timing variations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.

P. Manual Voice Paging

1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.

2. If any speaker manual control switches are activated, the control panel operator shall be able to make announcements via the push-to-talk paging microphone over the preselected speakers. When the microphone button is released, the alarm tone shall resume.

3. Facility for total building paging shall be accomplished by the means of an "All Circuits" switch.

Q. Alarm Silencing

1. If the "Alarm Silence" button is pressed, audio only alarm signals shall cease operation.

2. Signals shall not be silenced during the 60 second alarm silence inhibit mode.

R. System Reset

1. The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. Display messages shall provide operator assurance of the sequential steps("IN PROGRESS","RESET COMPLETED")as they occur, should all alarm conditions be cleared.

2. Should an alarm condition continue, the system will remain in an alarmed state. System control relays shall not reset. The control unit alarm LED shall remain on. The alarmed points will not require acknowledgment if they were previously acknowledged.

3. Upon reset of the fire alarm control unit, air handling units shall sequentially start up to minimize power demand.

S. A manual evacuation drill switch shall not be provided.

*T. Activation of an auxiliary bypass switch located **at the MDF or FACP,** shall override the selected automatic functions, including air handling unit/fan shutdown and gas supply cut-off**, and all notification circuits campus wide.***

U. The system shall have a single key that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.

*V. The actuation of the **"walk test"** program at the control unit shall activate the **"walk test"** mode of the system which shall cause the following to occur:*

1. The city circuit connection shall be bypassed.

2. Control relay functions shall be bypassed.

3. The control unit shall show a trouble condition.

*4. The alarm activation of any initiation device shall cause the audible notification **at the FACP**.*

5. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to voice announce sound for 4 seconds indicating the trouble condition.

6. The system shall have the capacity of 8 programmable pass code protected one person testing groups, such that only a portion of the system need be disabled during testing.

W. Auxiliary manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble. The Aoff normal@ status shall be clearly identified in plain-language on the FACU alphanumeric display.

X. Each independently supervised circuit shall include a discrete readout to indicate disarrangement conditions per circuit.

Y. The System Modules shall be electrically supervised for module placement. Should a module become disconnected the system trouble indicator shall illuminate and the audible trouble signal shall sound.

Z. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

AA. Power Requirements

1. The control unit, color graphics unit and printer shall receive 120 VAC power via separate dedicated circuits.

2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of 24 hours with 5 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic. Batteries and chargers shall be mounted within each control panel.

3. All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control unit.

4. The incoming power to the system shall be supervised so that any power failure must be audibly and visibly indicated at the control unit and the remote annunciator. A green "power on" LED shall be displayed continuously while incoming power is present.

5. The system batteries shall be supervised so that allow battery condition or disconnection of the battery shall be audibly and visibly indicated at the control unit and the remote annunciator. Batteries shall be located within the FACP or FACU ***or a remote cabinet next to the FACP or FACU.***

AB. Network Nodes (Fire Alarm Control Units)

1. Fire Alarm Control Units shall be microprocessor based, housed in an all metal cabinet suitable for surface or wall mounting. Each control unit shall be an NFPA 72, stand-alone, complete fire alarm control unit with communications into the network and custom network programming capabilities. One control unit shall be located in each building on campus.

2. All points monitored and controlled by the Fire Alarm Control Unit shall be capable of being made available to the network. Such points shall include: initiating circuit devices such as addressable sensors, including sensor type and sensor values; addressable manual fire alarm pull stations; supervisory operation, such as for sprinkler flow and tamper monitoring; control circuits, such as for notification appliances, fan control, elevator control, and other similar operations.

3. Each point made in the network may be programmed to be operated by any other Fire Alarm Control Unit connected to the network. When point information is programmed into a node other than the "owner", a "replica" of that point is programmed into the other node. When a replica is so programmed, the node with the replica can operate on those points as though they were directly connected to that node.

4. Network communications shall be capable of supporting "point lists" that can be handled as though they were a single point.

a. When any point in the list enters into an off-normal condition, the list is annunciated as in that condition.

b. The network message shall include the point list name, the point list status, and the number of devices in that status.

c. The network message shall not be burdened with detail information on each point in the point list. If such information is needed by the network, the points required shall be declared public and programmed accordingly.

d. Individual point information shall be available either by inquiry at the owner node, or by accessing the point if it is public and programmed as external at the inquiring node.

e. Individual point information shall be available through an external CRT /Keyboard inquiry at the owner node, or by issuing a Aset host@ command to access the points on any other node as if it were the owner node.

AC. Automatic Voice Evacuation Relocation Sequence (Auditorium):

1. The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic alarm digital voice message. At the end of the voice message, the alarm tone shall resume. The audio alarm signals shall sound alternately until the signal silence switch has been operated.

2. All audio operations speaker circuit selection and alarm tone / voice messages and timing variations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component requiring or hardware additions.

AD. Manual Voice Paging (Auditorium):

1. *The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.*

2. *If any speaker manual control switches are activated, the control panel operator shall be able to make announcements via the push-to-talk paging microphone over the preselected speakers. When the microphone button is released, the alarm tone shall resume.*

3. *Facility for total building paging shall be accomplished by the means of an AAll Circuits@ switch.*

1.4 SUBMITTALS

A. General: Submit the following according to Basic Electrical Requirements Section of this Specification.

B. Product data for system components. Include dimensioned plans and elevations showing minimum clearances and installed features and devices. Include list of materials and NRTL-listing data.

C. Wiring diagrams from manufacturer differentiating between factory- and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Indicate components for both field and factory wiring.

D. Shop drawings showing details of remote annunciator.

E. System operation description covering this specific Project including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

F. Operating instructions for mounting at the FACU.

G. Listing of function and operation of all network components, node addresses, and all device addresses of completed system.

H. Operation and maintenance data for inclusion in Operating and Maintenance Manual delivered to Owner. Include data for each type product, including all features and operating sequences, both automatic and manual. Include recommendations for spare parts to be stocked at the site. Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.

I. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.

J. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of annotated Contract Drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, submit them for review. Make resubmissions if required to make clarifications or revisions to obtain approval.

K. Submission to Owner: Provide identical submission, as described above, to Osceola county School District

L. Record of field tests of system, including detector sensitivity tests.

1.5 QUALITY ASSURANCE

*A. Installer Qualifications: A factory-authorized Technician, with minimum 5 years experience, is to perform the Work of this Section. Technician shall be licensed and certified on the installed system**, and NICET level II certification.** All other installers to have alarm status per State of Florida Business and Professional Regulation.*

B. Compliance With Local Requirements: Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authority having jurisdiction.

C. Comply with NFPA 70, "National Electrical Code."

D. NFPA Compliance: Provide fire alarm and detection systems conforming to the requirements of the following publications:

1. NFPA 72, "National Fire Alarm Code"

E. NRTL Listing: Provide systems and equipment that are listed and labeled.

1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory"(NRTL) as defined in OSHA Regulation 1910.7.

F. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listings shall NOT be acceptable.

G. All control equipment must have transient protection to comply with UL864 requirements. Fire alarm system shall utilize EDCO TVSS devices only. All requirements of Specification Section 16709 apply to Fire Alarm System. Provide ground rod within eight (8) feet of all TVSS devices.

H. Where Fire Alarm circuits leave the building, additional transient protection must be provided for each circuit. Devices must be UL listed under standard #497B (Isolated Loop Circuit Protectors).

I. Architectural and Transportation Barrier Compliance Board: Title III of the Americans with Disabilities Act.

J. Single-Source Responsibility: Obtain fire alarm components from a single source ISO 9000 certified manufacturer who assumes responsibility for compatibility for system components.

1.6 MAINTENANCE SERVICE

A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months commencing with Substantial Completion, using factory-authorized service representatives.

B. Basic Services: Systematic, routine maintenance visits on an annual basis at times coordinated with the Owner. In addition, respond to service calls within 3 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.

D. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. Owner will be under no obligation to accept maintenance service contract renewal proposal.

1.7 SPARE PARTS

A. General: Furnish spare parts, matching products installed (as described below), packaging with protective covering for storage, and identifying with labels clearly describing contents. ***Provide wiring schematic with spare parts.***

B. Glass Rods for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed; minimum of 6 rods.

C. Lamps for Remote Indicating Lamp Panels: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.

D. Lamps for Strobe Units: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.

E. Smoke Detectors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of the number of units of each type installed but not less than one of each type.

F. Detector Bases: Furnish quantity equal to ***10*** *percent of the number of units of each type installed but not less than one of each type.*

G. Printer Ribbons: Furnish 6 spare ribbons.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: The equipment and service described in this specification are those supplied and supported by Silent Knight and represent the basis of design for the equipment.

B. Subject to compliance with requirements, provide acceptable equivalent products by one of the following:

1. *Notifier*
2. *Edwards Systems Technology (EST)*
3. *Simplex*

C. Being listed as an acceptable Manufacturer in no way relieves the Contractors obligation to provide all equipment and features in accordance with these specifications.

D. If equipment of another manufacturer is submitted for approval, the contractor shall state how much is to be deducted from the base bid for the substitution, and also shall state what, if any, specific points of system operation differ from the specified points of the system operation. This differentiation report must reference every paragraph of this specification.

E. The Manufacturer shall be a nationally recognized company specializing in smoke detection and fire alarm systems. This organization shall employ factory trained and NICET certified technicians. The Manufacturer and service organization shall have a minimum of 10 years experience in the fire protective signaling systems industry.

2.2 MANUAL PULL STATIONS

A. Description: Double-action type, fabricated of high impact red LEXAN or metal, and finished in red with molded, raised-letter operating instructions of contrasting color. The manual station shall be fitted with screw terminals for field wire attachment. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. Stations requiring the breaking of a glass panel are not acceptable. Stations requiring the breaking of a concealed rod may be provided.

B. Station Reset: The front of the station is to be hinged to a book plate assembly and must be opened with a key to reset the station. The key shall be common with the control units. Stations which use Allen wrenches or special tools to reset, will not be accepted.

1. Addressable pull stations will contain a communication transmitter and receiver having a unique identification and capability for status reporting to the FACU. There shall be no limit to the number of stations, detectors, or zone adapter modules, which may be activated or "in alarm" simultaneously.

2.3 AUTOMATIC DETECTORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

1. Factory Nameplate: Serial number and type identification.

2. Operating Voltage: 24-V d.c., nominal.

3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

4. Plug-In Arrangement: Detector and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection requires no springs for secure mounting and contact maintenance. Terminals in the fixed base accept building wiring. Detector construction shall have a mounting base with a twist-lock detecting head that is lockable. The locking feature must be field removable when not required. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control Unit. Detector design shall provide compatibility with other fire alarm detection loop devices (heat detectors, pull stations, etc.)

5. *Each sensor base shall contain a LED that will flash each time it is scanned by the Control Unit. When the Control Unit determines that a sensor is in an alarm or a trouble condition, the Control Unit shall command the LED on that sensor's base to turn on steady indicating that abnormal condition exists. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable.*

6. *Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location**, or other approved testing method.***

7. *Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. The Control Unit shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.*

8. *The sensor's electronics shall be immune from false alarms caused by EMI and RFI.*

9. *Visual Indicator: Connected to indicate detector has operated.*

10. *Addressability: Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACU.*

B. *True Alarm Photoelectric Smoke Detectors: Include the following features and characteristics:*

1. *An infrared detector light with matching silicon cell receiver and actuated by the presence of visible products of combustion.*

C. *Duct Smoke Detector: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Detector includes relay as required for fan shutdown.*

1. *The addressable TrueAlarm duct smoke sensors shall operate on the light scattering, photo-diode principle, and shall communicate actual smoke chamber values to the system control. The sensors shall not have a self contained smoke sensitivity setting and shall automatically communicate actual smoke chamber values to the system control unit. The sensor's electronics shall be shielded to protect against nuisance alarms from EMI and RFI.*

2. *The Duct Housing shall provide an auxiliary alarm relay with two "Form C" contacts rated at 2A@ 28VDC or 120 VAC resistive. This auxiliary relay operates when the sensor reaches its alarm threshold, or when the control unit via software control, manually or automatically operates the relay in response to inputs from other devices. Provide manual bypass switch **for duct detectors at the FACP.***

3. *For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.*

4. *Each duct detector shall have a Remote Test Station with an alarm LED and test switch.*

E. *True Alarm Addressable Thermal Sensor: Rate-compensated/fixed-temperature type with plug-in base and alarm indication lamp. Detectors have a communication transmitter and receiver with unique identification and capability for status-reporting to the FACU.*

2.4 ALARM-NOTIFICATION APPLIANCES

A. *General: Equip alarm-notification appliances for mounting as indicated. Provide terminal blocks for system connections.*

B. *Fire Alarm Horns: Electric-vibrating polarized type, operating on 24-V d.c., with provision for housing the operating mechanism behind a grille. Horns produce a sound pressure level of 87 Db, measured 10 feet from the source, with a resultant level of 60 Db in all areas of facility.*

1. *The system manufacturer shall review the placement of visual and audible signals throughout the facility and shall provide additional devices where deemed necessary, for the equipment furnished, to meet all codes and in particular, the ADA Requirements and NFPA 72. In addition, the Contractor shall bid 20 additional devices over and above those shown on the plans (and those deemed necessary by the manufacturer) to be installed at time of substantial completion, where the Architect/Engineer requests for complete coverage. Per NFPA and SREF, audible devices shall provide a level of 60 dB in all areas of the facility.*

C. *Visual Notification Appliances: 100 candela-Second Xenon flash output, 24 VDC operation, wall mounted, compatible with ADA requirements with "FIRE" printed vertically. Provide synchronization of visual flash in areas with multiple appliances, per ADA and NFPA requirements.*

1. *Combination notification appliances consist of factory-combined, audible and visual notification units in a single mounting assembly.*

2. *The system manufacturer shall review the placement of visual and audible signals throughout the facility and shall provide additional devices where deemed necessary, for the equipment furnished, to meet all codes and in particular, the ADA Requirements and NFPA 72. In addition, the Contractor shall bid 20 additional devices over and above those shown on the plans (and those deemed necessary by the manufacturer) to be installed at time of substantial completion, where the Architect/Engineer requests for complete coverage.*

D. Voice/Tone Speakers: Comply with UL 1480, "Speakers for Fire Protective Signaling."

1. Speakers: Compression-driver type with flared projectors having a frequency response of 400 to 4000 Hz; equipped with a multiple tap, varnish-impregnated, sealed, matching transformer. Match transformer tap range and speaker power rating to the acoustical environment of the speaker location.

2. High-Range Speaker Units: Rated 2-15 watts.

3. Low-Range Speaker Units: Rated .25-2 watts.

4. Speaker Mounting: Recessed.

5. Combination speaker/strobe appliances shall be provided for all wall mounted devices. Ceiling units shall be fully recessed and speaker only. Ceiling speaker shall be white round perforated. Wall units shall be red square perforated.

2.5 ADDRESSABLE CIRCUIT INTERFACE MODULES

A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for multiplexing communication. Modules transmit identification and status to the FACU using a communication transmitter and receiver with unique identification and capability for status reporting to the FACU. Modules shall be used for monitoring of water flow, valve tamper, Halon Control Units, non-addressable detectors, and for control of evacuation indicating appliances and AHU systems.

B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.

C. There shall be three types of modules:

*1. Type 1: Monitor Circuit Interface Module**, or equivalent.***

For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision: This type of module will provide power to and monitor the status of a zone consisting of conventional 2-wire smoke detectors and/or N/O contact devices as specified elsewhere and identified in a schedule on the plans. The supervision of the zone wiring will be Class B. This module will communicate the zone's status (normal, alarm, trouble) to the FACU.

For conventional 4-wire smoke detector with Class B wiring supervision: This type of module will provide power to and monitor the contact status of a zone consisting of conventional 4-wire smoke detectors as specified elsewhere and identified in a schedule on the plans. The module will provide detector reset capability and a 2 amp fuse to provide over-current power protection for the 4-wire detector. This module will communicate the zone's status (normal, alarm, trouble) to the FACU.

*2. Type 2: Control Circuit Interface Module**, or equivalent.***

Module for signals, speakers and other device control with Style D and Style Z wiring supervision.

For Non-Supervised Control: This type of module will provide double pole double throw relay switching for voltages up to 120VAC. It shall contain easily replaceable 2 amp fuses, one on each common leg of the relay.

*3. Type 3: Monitor Circuit Interface Module**, or equivalent.***

This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module is required for monitoring water flow and tamper switches.

D. The Circuit Interface Module shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Should the module become non-operational, tampered with, or removed, a discrete trouble signal, unique to the module, shall be transmitted to, and annunciated at, the control Unit.

E. The Circuit Interface Module shall be capable of being programmed for its "address" location on the multiplexing signaling line circuit. The Circuit Interface Module shall be compatible with addressable manual stations and addressable detectors on the same multiplexing signaling line circuit.

F. Provide for interface to future portables at three (3) locations. Each location shall include Type 1, Type 2, and Type 3 module for minimum (4) initiation circuits and 6 amperes signal power. Locate modules as shown on plans or as directed in field.

2.6 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall mounting and are complete with matching door plate. Electromagnet operates from a 24-V d.c. source, and develops a 25 lbs. holding force.

B. Material and Finish: Match door hardware.

2.7 FIRE ALARM CONTROL UNIT (FACU)

A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."

B. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures. Accommodate all components and allow ample gutter space for interconnection of units as well as field wiring. Identify each enclosure by an engraved, red-laminated, phenolic resin nameplate.

C. Systems: Alarm and supervisory systems are separate and independent in the FACU. The alarm-initiating zone boards in the FACU consist of plug-in modules. Construction requiring removal of field wiring for module replacement is not acceptable.

D. Control Modules: Types and capacities required to perform all functions of the fire alarm systems plus 20% for future expansion. Local, visible, and audible signals notify of alarm, supervisory, and trouble conditions.

E. Zones: Provide for all alarm and supervisory zones indicated.

F. Resetting: Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm or trouble condition still exists.

G. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at FACU and addressable system components, including annunciation and supervision. A display with alarm, supervisory, and component status messages. Arrange keypad for use in entering and executing control commands.

H. Voice Alarm: An emergency communication system, integral with the FACU, includes central voice alarm system components complete with microphones, pre-amplifiers, amplifiers, and tone generators. Features include:

1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems."

2. One alarm channel permit transmission of announcements to zones or floors automatically or by use of the central control microphone. All announcements are made over dedicated, supervised communication lines.

3. Status annunciator indicates the status of the various voice alarm speaker zones.

I. Instructions: Printed or typewritten instruction card mounted behind a LEXAN plastic or glass cover in a painted steel or aluminum frame. Install the frame in a location observable from the FACU. Include interpretation and appropriate response for displays and signals, and briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

J. Network Display Unit (Network Nodes) shall contain the following features:

*1. **40 character display** by 2 line back-lighted LCD readout of point status.*

2. Capacity to annunciate network point and/or point lists.

3. Multiple NDUs shall be capable of being installed as needed to vector point information by type, location, or other qualifier.

4. Historical event logs shall maintain separate Alarm and Trouble events.

5. ***Printer*** *ports shall be provided:*

a. *Interface to serial printer to record network information as programmed at the NDU.*

b. *Interface to CRT / Keyboard to display network information as programmed at the NDU.*

c. *Interface to wireless notification message paging.*

d. *Interface for interrogating the status of any other node on the network.*

e. *Third party systems interface.*

2.8 FIRE ALARM CONTROL UNIT (FACU - DEFINED AS NETWORK NODES)

A. *Control Unit construction shall be modular with solid state, microprocessor based electronics. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall also sound during each keypress to provide an audible feedback to ensure that the key has been pressed properly.*

B. *The following primary controls shall be visible through a front access Unit:*

1. ***40 or greater*** *character liquid crystal display.*
2. *Individual red fire alarm LED.*
3. *Individual red priority 2 alarm LED.*
4. *Individual yellow supervisory service LED.*
5. *Individual yellow trouble LED.*
6. *Green "power on" LED.*
7. *Yellow signals silenced LED.*
8. *Fire alarm acknowledge key.*
9. *Priority 2 alarm acknowledge key.*
10. *Supervisory service acknowledge key.*
11. *Trouble acknowledge key.*
12. *Alarm silence key.*
13. *System reset key.*

C. *The following programmable secondary control switches and LED's shall be available behind an access door:*

1. *City disconnect/switch*
2. *Elevator bypass*
3. *Door holder release bypass*
4. ***Manual over-ride of AHU/fan shutdown, Gas shutdown and signal circuits to bypass automatic control by fire alarm system****.*

D. The control Unit shall provide the following:

1. *Setting of time and date.*
2. *LED testing.*
3. *Alarm, trouble, and abnormal condition listing.*
4. *Enabling and disabling of each monitor point separately.*
5. *Activation and deactivation of each control point separately.*
6. *Changing operator access levels.*
7. *One Person test enable.*
8. *Running diagnostic functions.*
9. *Displaying software revision level.*
10. *Displaying historical logs.*
11. *Displaying card status.*
12. *Point listing.*

E. For maintenance purposes the following lists shall be available from the point lists menu:

1. *All points list by address.*
2. *Monitor point list.*
3. *Signal/speaker list.*
4. *Auxiliary control list.*
5. *Feedback point list.*
6. *Pseudo point list.*
7. *LED/switch status list.*

F. Scrolling through menu options or lists shall be accomplished in a self-directing manner in which prompting messages shall direct the user. These controls shall be located behind an access door.

G. Primary Keys, LED's and LCD Display

1. *The Control Unit shall have a **40 or greater** character liquid crystal display which shall be backlit for enhanced readability. So as to conserve battery standby power, it shall not be lit during an AC power failure unless an alarm condition occurs or there is keypad activity.*

H. Under normal conditions the front Unit shall display a "System is Normal" message and the current time and date.

I. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The Unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

J. The LCD shall display the following information relative to the abnormal condition of a point in the system:

1. *40 character custom location label*
2. *Type of device (i.e. smoke, pull station, water flow)*
3. *Point status (i.e. alarm, trouble)*

K. Two methods of acknowledgment for each abnormal condition shall be provided. One may be chosen depending on the NFPA requirements.

L. These acknowledge functions may be pass code protected. If the user has insufficient privilege to acknowledge such conditions, a message shall indicate insufficient privilege but allow the user to view the points without acknowledging them. Should the user have sufficient privilege to acknowledge, a message will be displayed informing the user that the condition has been acknowledged.

M. After all points have been acknowledged, the LEDs shall glow steady and the tone alert will be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated by an end of list message "END of LIST".

N. Alarm Silencing:

1. Should the "Alarm Silence" button be pressed all alarm audible only signals shall cease operation and a signals silenced LED will illuminate.

2. Signals shall not be silenced during alarm silence inhibit mode.

O. System Reset:

1. The SYSTEM RESET button shall be used to return the system to its normal state after an alarm condition has been remedied. The LCD display shall step the user through the reset process with simple English Language messages. Messages, "SYSTEM RESET IN PROGRESS", will first be displayed followed by the message, "SYSTEM RESET COMPLETED", and finally, "SYSTEM IS NORMAL", should all alarm conditions be cleared.

2. Should an alarm condition continue to exist the message, "SYSTEM RESET IN PROGRESS", will be followed by the message, "SYSTEM RESET ABORTED", and the system will remain in an abnormal state. System control relays shall not reset. The tone alert and the Alarm LED will be on. The display will indicate the total number of alarms and troubles present in the system along with a prompt to use the ACK keys to review the points. These points will not require acknowledgement if they were previously acknowledged.

3. Should the Alarm Silence Inhibit function be active, the (SYSTEM RESET) key press will be ignored. The message, "SYSTEM RESET INHIBITED", will be displayed for a short time to indicate the action was not taken. As feedback to the operator, the message "SYSTEM RESET NO LONGER INHIBITED" will be displayed when the inhibit function times out.

P. Function Keys: Additional function keys shall be provided to access status data for the following points:

1. Initiating device circuits
2. Indicating appliance circuits
3. Auxiliary relays
4. Feedback points
5. All other input/output points

The following status data shall be available:

1. *Primary state of point*
2. *Zone, PID and card type information*
3. *Class "A" status*
4. *Current priority of outputs*
5. *Disable/Enable status*
6. *Verification tallies of initiating devices*
7. *Automatic/Manual control status of output points*
8. *Acknowledge status*
9. *Relay status*

Q. The system shall be capable of logging and storing events in an alarm log and events in a trouble log. Each recorded event shall include the time and date of that event's occurrence.

The following Historical Alarm log events shall be stored:

1. *Alarms*
2. *Alarm acknowledgment*
3. *Alarm Silence*
4. *System reset*
5. *Alarm historical log cleared*

The following Historical Trouble log events shall be stored:

1. *Trouble conditions*
2. *Supervisory alarms*
3. *Trouble acknowledgment*
4. *Supervisory acknowledgment*
5. *Alarm verification tallies*
6. *One Person test results*
7. *Trouble historical log cleared*

R. Silent One Person Testing with History Logging

The system shall be capable of being tested by one person. While in testing mode the alarm activation of an initiating device circuit shall be silently logged as an alarm condition in the historical data file. The unit shall automatically reset itself after logging of the alarm.

The momentary disconnection of an initiating or indicating device circuit shall be silently logged as a trouble condition in the historical data file. The Unit shall automatically reset itself after logging of the trouble condition.

Should the one person test feature be on for an inappropriate amount of time it shall revert to the normal mode automatically. The control unit shall be capable of supporting up to 8 separate programmable one person testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered completed, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.

Should an alarm condition occur form an active point, not in one person test mode, it shall perform operations described in Section 1.

S. LED Supervision: All control module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the LCD shall display the module and LED location numbers to facilitate location of the LED.

T. System Trouble Reminder: Should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at preprogrammed time intervals to act as a reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable to suit the owner's application.

U. Access Levels

1. There shall be four (4) access levels with level 4 being the highest level. Level 1 actions shall not require a pass code. Changes to passcodes shall only be made by authorized personnel.

2. In order to maintain security when entering a pass code the digits entered will not be displayed but a cursor will move along filling the position with an x to indicate that the digit has been accepted. All key presses will be acknowledged by a local audible sound.

3. When a correct pass code is entered, the message "Access Granted" shall be displayed. The new access level shall be in effect until the operator manually logs out or the keypad has been inactive for ten (10) minutes.

4. Should an invalid code be input, the operator shall be notified with the message, "ERROR...INCORRECT PASS CODE", and shall be allowed up to three chances to enter a valid code. After three unsuccessful tries, the message, "ACCESS DENIED", shall be displayed. The level shall not be altered, and the operator shall no longer be in the menu option.

5. Access to a level will only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.

6. The following keys/switches shall have access levels associated with them:

a. Alarm silence
b. System reset
c. Set time/date
d. Manual control
e. On/off/auto control
f. Disable/enable
g. Clear historical alarm log
h. Clear historical trouble log
i. One person testing
j .Change alarm verification

U. Acknowledge keys shall also require privileged access to acknowledge points. If the operator presses an (ACK) key with insufficient access, an error message will be displayed. The points will scroll with (ACK) key presses to view the points on the list, but the points will not get acknowledged in the database.

V. Fire Alarm Control Unit shall be capable of operating remote CRT's and/or printers; output shall be ASCII from an EIA RS-232-C connection with an adjustable baud rate. Each RS-232-C port shall be capable of supporting and supervising a remote Printer, supporting as many as four (4) remote CRT displays or printers. Data amplifiers shall be used to increase CRT or printer line distance. Each RS-232-C port shall only communicate with one keyboard. Each port shall be field ***configurable for supervised operation (to be used when the remote CRT or printer is permanently installed as part of the system) or for unsupervised operation (for use with portable remote devices that are temporarily connected for testing reports or diagnostic analysis).***

2.9 REMOTE ANNUNCIATOR (FAAP)

A. Annunciator Unit: Provide an alphanumeric, 80 character liquid crystal display (LCD) that matches information displayed on FACU, for point status, type of alarm, number of alarms in system and custom label. Manual control switches shall provide for system reset, alarm silence

B. Enclosure: Finish to match Fire Alarm Control Units. The locking cover/display assembly is. Key and lock shall be common to all secured fire alarm system enclosures.

2.10 SYSTEM PRINTER

A. General: Printer is dot-matrix type, listed and labeled as an integral part of the fire alarm system.

2.11 FIBER TERMINATION EQUIPMENT

A. Provide all interface equipment necessary to allow direct communication over fiber optic cable backbone.

B. Provide fiber termination cabinet as required to create ring configuration. Refer to network communication details in "System Description" paragraph of this section.

2.12 FIBER OPTIC CABLING

A. General: Multi-mode fiber optic cabling shall be provided between system rooms as designated on the contract drawings. Refer to the Telecommunication (TE) drawings for more detail on fiber optic cable.

2.13 FIBER OPTIC CONNECTORS

A. General: Provide field installable, multimode and/or ST to ST type connectors. Connectors shall be Glass-in-Ceramic, UV curable, with a maximum loss of .2 dB.

B. Design selection: Siecor Cam-Lite or equal by Leviton Thread Lock, or Hubbell.

2.14 EMERGENCY POWER SUPPLY

A. General: Components include battery, charger, and an automatic transfer switch.

B. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 5 minutes.

1. Magnetic door holders are not served by emergency battery power. Magnetic door holders are released after 15 seconds when normal power fails.

2.15 WIRE

A. Line-Voltage and Low-Voltage Circuits: Solid copper conductors with 600 V-rated insulation. Minimum signal circuit wire size, #12. Minimum initiating circuit wire size, #14.

2.16 TAGS

A. Tags For Identifying Tested Components: Comply with NFPA 72.

2.17 GAS SHUTOFF VALVE

A. Provide and install 24 VDC gas solenoid shutoff valves at all points where gas enters a building; science classrooms, kitchens, etc. Solenoids shall be manual reset type. The fire alarm shall control the valve to be normally energized (open); de-energized, (closed) on general alarm and remain closed until F/A reset. Provide manual over-ride switch to bypass automatic control by fire alarm system.

2.18 SIGNAGE

A. Provide plastic laminate signs outside spaces and adjacent to doors where pull stations are located inside; sign shall read "Fire Alarm Pull Station Inside". Sign shall have red background with white letters. Affix sign to structure with brass or stainless fasteners. Coordinate sign construction and installation with architect; reference signage in specifications.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system according to NFPA Standards referenced in Parts 1 and 2 of this Section.

B. Fire Alarm Power Supply Disconnect: Shall be painted red and labeled "FIRE ALARM." Provide with a lockable handle or cover.

3.2 EQUIPMENT INSTALLATION

A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

B. Manual Pull Stations: Mount semi-flush in recessed back boxes with center of operating handles 46 inches above finished floor or as indicated.

C. Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised. Flow and tamper switches provided by sprinkler contractor.

D. Smoke Detectors: Install ceiling-mounted detectors not less than 12 inches from a side wall to the near edge. Install detectors located on the wall at least 12 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors on the bottoms of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than 5 feet from air registers. Install duct-mounted detectors per manufacturer's recommendations and NFPA, coordinate with Division 15 mechanical contractor.

E. Audible Notification Appliances: Install not less than 80 inches above the finished floor nor less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille or as indicated. Combine audible and visual notification appliances at the same location into a single unit. Refer to Part 2, "Products", of this section for manufacturer's requirements to provide sufficient quantity of appliances to meet code.

F. Visual Notification Appliances: Install not less than 80 inches above the finished floor and at least 6 inches below the ceiling. Provide synchronization of flash in all areas with multiple appliances. Refer to Part 2, "Products", of this specification section for manufacturer's requirements to provide appliance quantities to meet code.

G. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

H. Fire Alarm Control Unit (FACU): Surface mount with tops of cabinets not more than 6 feet above the finished floor.

I. *Remote Annunciator: Arrange as indicated, with the top of the Unit no more than 6 feet above the finished floor.*

3.3 WIRING INSTALLATION

A. *Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways." Conceal raceway except in unfinished spaces and as indicated.* ***All fire alarm system wiring shall be in conduit.***

B. *Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.*

C. *Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where any circuit tap is made. Utilize wire nuts, no stacons.*

D. *System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of the National Electric Code (NEC)(NFPA 70). It is the Contractor's responsibility to obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.*

E. *Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red. Color:* ***signal circuit - brown and Osceola, initiating circuit - red & black, air handler bypass - white and blue.***

F. *Wiring to Central Station Transmitter: 1-inch conduit between the FACU and the central station transmitter connection, furnished as part of security system. Install number of conductors and electrical supervision for connecting wiring as required to suit central-station monitoring function. Final connections to terminals in central station transmitter are made under this contract.*

3.4 GROUNDING

A. *Ground equipment and conductor and cable shields as specified by the equipment manufacturer. For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance. Provide bond to main service ground rods.*

B. *Provide ground rod within (8) feet of all TVSS devices in the system.*

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system. A factory-authorized technician shall install and be available at all times to coordinate system installation with other trades.

B. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA72. Minimum required tests are as follows:

1. Verify the absence of unwanted voltages between circuit conductors and ground.

2. Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1-megohm for evaluation.

3. Test all conductors for short circuits utilizing an insulation-testing device.

4. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.

5. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.

6. Test initiating, notification, and signaling circuits for proper signal transmission under open circuit conditions. All connections should be opened for the initiating and notification devices. Observe proper signal transmission according to class of wiring used.

7. Test each initiating device and notification appliance for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.

8. Measure and record the actual current draw of each Notification Appliance Circuit.

9. *Test the system for all specified functions according to the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.*

10. *Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.*

11. *Detector sensitivity tests.*

F. *Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.*

G. *Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.*

H. *Tag all equipment, stations, and other components at which tests have been satisfactorily completed.*

I. *Final Test, Certificate of Completion, and Certificate of Occupancy: Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Demonstrate that the system meets the Specifications and complies with applicable standards. This final test shall be witnessed by a representative of the Authority Having Jurisdiction and a factory-authorized service representative. Place certification sticker on each panel after all tests have been passed.*

3.6 CLEANING AND ADJUSTING

A. *Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.*

B. *Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.*

3.7 TRAINING

A. *Provide trip to factory authorized site to demonstrate the system and train and certify Owner's maintenance personnel as specified below.*

1. *Provide for certification of Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, upgrading and preventive maintaining of the system.*

2. *Provide transportation, lodging and cost of training for two (2) Osceola County School Board Technicians.*

3. *Schedule training with the Owner at least seven weeks in advance.*

4. *Provide three (3) copies of all program and data software upon completion of training. Issue a release form to the Owner for the use of the software.*

5. *Training shall be performed by a factory authorized trainer whose primary function is to train and certify technicians for the manufacturer. Training by any other personnel will not be acceptable. Training length to be 40 hours.*

6. *Provide at the end of the project, four hours of on-site training specifically for this project to review sequence of operation, drawings, programming and panel operations.*

7. ***Provide training for terminating, splicing and testing of fiber optic cable**.*

END OF SECTION 16720

END OF
DIVISION 16 - ELECTRICAL

DIVISION 17 – VOICE, VIDEO & DATA

School District of Osceola County
Technology Standards and Specifications
October 2006

This document is designed to assist certified designers such as Professional Engineers and RCDDs in the preparation of telecommunications/technology documents in the appropriate CSI format that will accompany a full set of Telecommunications drawings for new construction projects, major renovation projects, and minor renovation projects in School District of Osceola County (SDOC) facilities. This document is also intended as a standard by which all low voltage telecommunications/technology infrastructure and equipment shall be installed district wide.

Suggested changes to this document or variances from these standards and specifications must be coordinated for approval through the Technology Services Department (TSD) project manager at (407)870-4037.

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SECTION 17000
DESIGN REQUIREMENTS

Communication technologies are a critical element in the design of virtually all new and renovation building projects. Whether it be voice, data, and video transmission, security and fire alarm systems, audio/visual systems, or other communications technologies, it is important that a team of experienced professionals be involved in the design of these complex systems.

A Structured Cabling Plant (Premise Distribution System) is a key concept in enabling Information Technology for SDOC's community of staff, teacher's and students. In order to maximize network functionality and to minimize labor and material costs, a common set of network codes and standards shall be complied with. To accomplish, this SDOC has adopted a policy in which these codes and standards are managed and administered centrally. SDOC's TSD is charged with this responsibility.

General: Designers shall verify that all applicable portions of these standards and specifications are incorporated into the project's design, drawings, specifications, and final construction. Requests for variances from these standards shall be submitted in writing to SDOC's project manager within the Technology Services Department, using the TSD Variance Request Form found at the end of this document.

It is the responsibility of the Project Engineer and Construction Manager to ensure that any awarded systems contractor meets all applicable requirements laid out in this document. The requirements include but are not limited to:

- ***The awarded communications contractor must be a certified installer for the solution chosen.***
- ***The PDS (Premise Distribution System) solution must be one of the following, Panduit, Ortronics, or Amp/Tyco. All cabling and components must meet the chosen manufacturer's list of approved partners and be certified by the manufacturer for a minimum warranty of 15 years.***
- ***The awarded communications contractor must have an RCDD assigned as the project manager.***

Telecommunications Projects Eligibility Requirements: All projects designed by a consulting architect/engineer, shall have the telecommunications infrastructure design by a qualified consultant team. Such a team shall include an electrical engineer and an RCDD (Registered Communications Distribution Designer). The Premise Distribution System shall be installed by a qualified communications contractor. This infrastructure shall include all pathways, cabling, terminations, testing, and telecom room construction related to the telecommunications systems. The designer will provide these services in accordance with these standards and specifications, and as directed by the School District of Osceola County's Technology Services Department.

School District of Osceola County's Final Provisioning Work for all Projects: Projects: For all construction projects for the School District of Osceola County, Construction budgets are required to fund all internal and external telecommunications assets. This includes all wiring, connectivity products, electronics, handsets, etc. Further, the construction budget is required to pay for any additions to outside plant infrastructure that is needed to support the operation of the building. Designers and Contractors shall be required to develop construction schedules that allow adequate time for SDOC TSD to complete this final provisioning work, prior to Substantial Completion and the Owner's occupancy of each part of a project.

Contractors shall be required to cooperate with SDOC TSD personnel and allow them equal access to the jobsite to inspect and complete any work necessary in the completion of the project, concurrent with other work underway by the Contractor. TSD may be contacted by calling (407)870-4037.

Codes and Standards: SDOC's communications systems shall follow the codes and standards set forth in the following: NEC 2002, NESC, NFPA, ANSI/TIA/EIA Telecommunications Infrastructure Standards, FCC, IEEE and BICSI'S Telecommunications Distribution Methods Manual. These codes and standards are to be used as references when designing telecommunications systems.

The Technology Services Department promotes the use of widely accepted industry standards in deploying the district's telecommunications infrastructure. Employees of the district, consultants and contractors working on behalf of the district should have a working knowledge of these standards prior to performing work for the district and should follow the district's preferred standards and practices while deploying telecommunications infrastructure. District employees, consultants and contractors should contact TSD for clarification and interpretation of these standards. The following standards are practiced at the Schools District of Osceola County:

- *ANSI/TIA/EIA-568-B.1.2.3 Commercial Building Telecommunications Cabling Standard (May 2001)*
- *ANSI/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces (February 1998)*
- *ANSI/TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure (May 2002). See Appendix 1 for the current UF Labeling standard based on ANSI/TIA/EIA-606-A*
- *ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications (August 1994)*
- *ANSI/TIA/EIA-758 Customer-Owned Outside Plant Telecommunications Cabling Standard (February 1999)*

These standards can be obtained through BISCI at www.bicsi.com as well as www.tiaonline.org .

These standards are NOT to be used as the final specification or bid document for any specific new construction. It is to be used as a starting point in a process of collaboration between the architect/designer, the occupant, and TSD.

Detailed specific requirements for the particular project at hand will depend on the unique purpose of the space(s) of that project and shall be supplied during the design phase of the space in that collaboration.

The design team shall include the resources needed to fully develop a complete scope of work for all telecommunications, I/T, and audio/visual systems and components (including BICSI or RCDD qualified staff). The design team shall include a Professional Engineer (PE) and Registered Communications Distribution Designer (RCDD).

The architect/engineer shall coordinate with SDOC-TSD to eliminate conflicts with other utilities, landscaping, etc., shall include all such work "by others" in the construction

documents, and shall ensure that no gaps exist between the contractors' scope of work and the scope(s) of work "by others." Building interior telecommunication installation must be preformed by a contactor who is qualified by SDOC-TSD. SDOC-TSD maintains a list of pre-qualified Low-Voltage Contractors; this list can be obtained from the SDOC Purchasing Department: Lisa Kesecker (407)870-4622

Interior voice & data work shall be designed, specified, packaged, and competitively procured, as are other trades. TSD shall have approval authority in the bidder pre-qualification process. All such work shall be included in the construction documents and coordinated by the architect/engineer.

Bid Documents: It is expected that the result of this collaboration shall be the creation by the design team of a bid-quality document that contains commonly accepted and standard language of the industry. These documents are to include a set of appropriate division specifications (e.g. Division 17 for older CSI formats or Divisions 25, 27, and 28 for the new CSI Master Format) as well as Telecommunications Drawings or Sheets (a.k.a. T-Drawings or T-Sheets) and Telecommunications Electrical Drawings or Sheets (a.k.a. TE-Drawings or TE-Sheets).

SECTION 17010
BASIC TECHNOLOGY SYSTEMS REQUIREMENTS

PART 1- GENERAL REQUIREMENTS

1.01 SUMMARY

A. It is the responsibility of the School District to separately direct purchase the following equipment for voice, video, data and security communications.

1. *Media Retrieval Equipment. (See SECTION 3- VIDEO- MEDIA RETRIEVAL & CCTV)*
2. *Television Headend including television mounts, VCR & DVD players and TV's. Television mounts shall be contractor installed. School District Personnel (IMC Dept.) will install TV's.*
3. *Intercom Headend only. Wiring, speakers, call-buttons, volume controls, surge protection, labor to install equipment, etc. shall be contractor provided.*
4. *Network Electronics for data and VOIP systems (TS Dept.).*
5. *Satellite Antenna. Owner shall purchase the Satellite Antenna and the School District Representative shall manage the installation.*
6. *Video Surveillance and Burglar Detection Devices. Owner shall purchase the Video Surveillance and Burglar Detection Devices and the School District Representative shall manage the installation of these devices. Cabling, conduit and pathways shall be contractor provided.*

B. This section outlines the quality, type and installation of the building premise wiring systems to include voice, video, data and security. Included in this Section the contractor shall provide all labor, equipment, and materials necessary for a complete, tested and operational system.

C. The installation shall be based on the equipment and systems as specified herein. The Project Engineer and the School District Representative must approve any alternate system.

D. If the Contractor wishes to submit alternate equipment, the Contractor shall submit to the Project Engineer and the School District Representative, the equipment proposed to provide a precise functional equivalent system to meet or exceed specifications. Contractor shall also be prepared to provide documentation to support the proposed alternate system as being an equal or superior system. Contractor shall provide adequate information prior to bid date such as specification sheets, working drawings, shop drawings, and demonstration of the system. Alternate supplier-contractor must also provide a list to include three installations of a system similar to that proposed which have been in operation for a period of two years.

E. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system at the Contractor's expense.

F. The Contractor shall provide a complete, tested and operational Premise Distribution Wiring System (PDS). All wiring, accessories, hardware, equipment, terminations, etc. necessary for a complete and operational system shall be provided. All wiring, patch panels, jacks and other related equipment will be rated and tested to meet EIA 568A, Category 5E or above requirements. The testing of all UTP cabling and terminations are to be tested to pass 350 MHz or above as required. The Contractor shall provide to the Project Engineer and the School District Representative, shop drawings, equipment lists and specifications for all equipment, cabling, terminations, labeling and accessories prior to installation of any equipment.

G. All work associated with the installation of the PDS and all other systems outlined in this document shall be performed in accordance with, but not limited to the following:

a. National Electrical Code latest ratified
b. Florida Dept. of Education, Retrofit for Technology Guidelines, Rev. 1/30/95
c. EIA/TIA 568, 569, 607
d. IEEE Standards 802.3, ANSI, NFPA &NESC
e. EIA/TIA-TSB-36, 40 & EIA/TIA-492
f. Division 16000 of the specifications
g. BICSI TDMM
h. BICSI ITS Installation Manual
i. BICSI COSP Design Manual
j. BICSI Electronic Safety & Security Reference Manual (ESSDRM)
k. Underwriter's Laboratories
l. Local Codes and Ordinances
m. The School District of Osceola County Division 17 - Voice, Video, Data & Security Specifications

(Should conflicts exist, the authority having jurisdiction for enforcement will have responsibility for making interpretations.)

1.02 CONTRACTOR QUALIFICATIONS

It is the responsibility of the Project Engineer and Construction Manager to ensure that any awarded systems contractor meets all applicable requirements laid out in this document. The requirements include but are not limited to:

- ***The awarded communications contractor must be a certified installer for the solution chosen.***
- ***The PDS (Premise Distribution System) solution must be one of the following, Panduit, Ortronics, or Amp/Tyco. All cabling and components must meet the chosen manufacturer's list of approved partners and be certified by the manufacturer for a minimum warranty of 15 years.***
- ***The awarded communications contractor must have an RCDD assigned as the project manager.***

A. The Contractor shall have a minimum of (3) three years experience satisfactorily installing systems such as described in this document.

B. A resume of qualification shall be submitted with the Contractor's bid indicating the following:

1. A list of all completed projects for the past year of similar type and size with contact names and telephone numbers for each.

2. A list of test equipment proposed for use in verifying the installed integrity of metallic cable or fiber systems on this project. The following is a list of required test equipment necessary for certifying the installation of the Premise Wiring System.

a) OTDR for MM Fiber
b) OTDR for SM Fiber
c) Light Source Power Meter
d) Field Strength Meter
e) TDR for Coax
f) Volt Meter
g) LAN Cable Meter- 350 MHz

3. A technical resume of experience for the company and on-site installation foreman who will be assigned to this project. The project foreman for communications installations must be an RCDD. The project foreman for security installations must hold a NICET Level 3 certification. Copy of certification shall be provided to the Engineer and School District Representative.

4. Similar documentation for any sub-Contractor who will assist the Contractor in performance of this work.

5. Previous experience with similar projects for the School District of Osceola County. (If any.)

6. Required installation certification from chosen vendor. (Contractor must previously have been, for at least six months, a certified installer for vendor chosen.)

C. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

D. The Communications or Security Contractor shall be an established operated business for at least (3) three years. The Contractor shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges.

E. Intercom cabling and required intercom equipment (including but not limited to call buttons, volume controls, speakers, horns, surge protection, etc…) shall be provided and installed by Rauland-Borg of Florida.

F. The Contractor shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization with a full time staffed office within 75 miles of project capable of furnishing adequate inspection and service to the system. The Contractor shall maintain at this facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

G. The Contractor shall be a responsible service and installation provider, showing evidence of properly operating systems in Florida Schools. A list of these schools, including any Osceola County Schools, shall be submitted in the Contractor's bid.

1.03 STORAGE

All Contractor activities shall be coordinated with the Project Engineer, School District Representative, and/or the General Contractor in order to properly utilize the available space upon the property.

1.04 PROGRESS MEETINGS

Progress meetings shall be held on the first day of construction and each week thereafter on a pre-determined date. This date and time shall be agreeably arranged at the first construction meeting. At this meeting, all concerns of the Contractor, Project Engineer and the School District Representative shall be addressed. At this time a review of the specifications and blueprints shall be completed. Any questions, concerns and verification needed shall be addressed at this time.

1.05 WORK SCHEDULE

Work hours shall be coordinated with the approval of the School District Representative and on site Construction Manager.

SECTION 17020
PREMISE DISTRIBUTION SYSTEMS
CABLING INFRASTRUCTURE

PART 1 – GENERAL REQUIREMENTS

1.01 SUMMARY

The concept is an infrastructure standard designed to enable educators to move to technological centered models of teaching and learning. The philosophy is such that school initiated implementations of various technologies would seek their own time and would not be hindered by facility-based constraints. These specifications are designed to permit the most flexible connections and integration of different types, brands, and models of computing, multimedia, and communications equipment. Basic assumptions include, but are not limited to, voice communications (PA, Intercom, and Telephone), data networking and security systems.

1.02 VOICE/DATA INFRASTRUCTURE

A. The Voice/Data infrastructure is based on the ability to wire a campus to provide flexibility not only for the present, but also for the future.

B. Communication equipment rooms (MDF/IDF) shall be located in the interior of the building. Access doors to the communication closets shall not open to the exterior of the building.

C. MAIN DISTRIBUTION FACILITY (MDF) - In normal situations there will only be one (1) MDF location per campus with multiple IDF locations feeding back to this MDF. The MDF is normally where feeds such as the CATV, telephone demark and other signals from outside the campus originate, terminate and are distributed through out the campus as needed. The MDF shall be a minimum 10' x 10' area. The size of the MDF shall be based on the size of the building it services, the number of buildings it serves, as well as the amount of technologies installed. The access door to the MDF shall swing out. Additional MDF size requirements shall be coordinated with the District Representative to comply with the fiber optic installation standards where applicable.

1. *The location of the MDF shall be such that the 295' distance limitation for the Communication Outlet cabling is not exceeded. The MDF shall also be located adjacent to the Media Center.*

2. *If necessary an Intermediate Distribution Facility (IDF) will be added to adhere to the 295' requirement.*

3. *The MDF houses the telephone system, outside service point for telephone, data lines, and primary data communications equipment. The MDF is also the room for connection of voice and data services for the administrative functions. All voice and data backbone links are terminated in the MDF.*

4. *The PA/Intercom system, IDS control panel, video surveillance DVR(s) and Server Rack are typically located in the MDF or another IDF/Equipment room within the same building.*

5. ***Dedicated clean power receptacles shall be mounted behind the equipment racks at 80" A.F.F., U.O.N. Location of these receptacles must be coordinated with the School Board Representative and Engineer. There shall be one (1) 120 VAC 20-AMP power receptacle for each equipment rack installed. There shall also be two (1) 208VAC NEMA-L6-30R receptacle for every three (3) racks installed. Each power receptacle shall be dedicated, clean power. There shall also be one (1) additional 208 VAC NEMA-L6-30R at 80" A.F.F., U.O.N. at the server rack location. These outlets shall be used for the connection of a multi-outlet surge suppression device and/or UPS. In addition to meeting the power requirements of the network electronics there shall also be the installation of 20-AMP clean power receptacles strategically placed every 8', minimum of one (1) per wall, to accommodate the installation of the phone switch and any other necessary electronics also at 80" A.F.F, U.O.N. (Telephone Switch, CATV Distribution, and Intercom, etc.) The Design Engineer and a School District Representative shall determine final design requirements.***

6. ***All walls shall be covered with sheets of ¾" marine grade plywood painted on all sides with 2 coats of fire retardant white paint. Each sheet shall have a 2" colored coded border and be labeled to match the system that it will be designated for. Labeling shall be stenciled on with paint. All systems equipment must be mounted on the designated sheets for that system. The T-Drawing shall reflect this. The color code shall be as follows.***

   - ***Fire alarm system– Red***
   - ***Security systems – Osceola***
   - ***HVAC/Auxiliary system – White (no border)***
   - ***Intercom system - Blue***
   - ***TV Distribution/CATV carrier service entrance – Green***
   - ***Voice/Data cabling - Yellow***
   - ***Voice/Data carrier service entrance - Violet***

7. ***The MDF shall be environmentally controlled 24 hours a day, 7 days a week. These systems must automatically restore to there original settings after a power failure. The HVAC, janitorial or non-telephone/data communications equipment must not reside in this room. Nor shall any piping exist or extend through or above this room. The floor shall be smooth and finished with a covering that will not generate dust. Carpet is not acceptable.***

8. ***To Facilitate HVAC controls and security camera installations, a 24-strand multi-mode fiber optic cable shall be installed between the rack-mounted Fiber Distribution Center (FDC) and a wall-mounted FDC. The wall mounted FDC shall be installed on the HVAC/Auxiliary system backboard. The HVAC/Auxiliary system backboard shall be adjacent to the Security system backboards. Also, a dual Category 5E or above cable run shall be installed between designated ports on a patch panel within the rack to a dual jack interface mounted on the backboard in the vicinity of the telephone demark.***

9. ***There shall be a minimum 3' clearance maintained on all sides of the equipment racks. This measurement must be 3' minimum from the base (footer)(outer edge) of the rack to the backboard. Verify with the Design Engineer and the School Board Representative.***

10. In the MDF, Velcro cable wraps or approved equivalent shall be used to bundle all PDS wiring below ceiling. Cable ties will not be accepted.

D. INTERMEDIATE DISTRIBUTION FACILITY (IDF) - The IDF shall be a minimum 6' x 8' area. The size of the room shall be based on the size of the building it services as well as the amount of technologies installed.

a. IDF's are to be located in each wing, house, floor, pod, etc., within the campus. The access door to the IDF shall swing out. The location of the IDF shall be such that the 295' distance limitation for the Communication Outlet cabling is not exceeded. If necessary a second IDF will be added to adhere to the 295' requirement.

b. The IDF houses the connections for telephone backbone, intercom backbone, data backbone, and the individual wire runs to each faceplate at each workstation location.

c. Dedicated power receptacles shall be mounted behind the equipment racks at 80" A.F.F., U.O.N. Location of these receptacles must be coordinated with the School Board Representative and Engineer. There shall be one 120 VAC 20-AMP power receptacle for each equipment rack installed. There shall also be one (1) 208 VAC NEMA-L6-30R. Each power receptacle shall be dedicated, clean power. These outlets shall be used for the connection of a multi-outlet surge suppression device and/or UPS. In addition to meeting the power requirements of the network electronics there shall also be the installation of 120 VAC 20-AMP clean power receptacles strategically placed every 8', minimum of one (1) per wall, to accommodate the installation of the phone switch and any other necessary electronics. (Telephone Switch, CATV Distribution, Intercom, etc.) The Design Engineer and a School District Representative shall determine final design requirements.

d. Each IDF shall be environmentally controlled 24 hours a day, 7 days a week. These systems must automatically restore to there original settings after a power failure. The HVAC, janitorial or non-telephone/data communications equipment must not reside in this room. Nor shall any piping exist or extend through or above this room. The floor shall be smooth and finished with a covering that will not generate dust. Carpet is not acceptable.

e. To facilitate HVAC controls and security camera installations, a 12-strand multi-mode fiber optic shall be installed between the rack-mounted Fiber Distribution Center (FDC) and a wall-mounted FDC. Also, a dual Category 5E or above cable run shall be installed between designated ports on a patch panel within the rack to a dual jack interface mounted on the backboard.

f. There shall be a minimum 3' clearance maintained on all sides of the equipment racks. This measurement must be 3' minimum from the base (footer)(outer edge) of the rack to the backboard.

g. In the IDF, Velcro cable wraps or approved equivalent shall be used to bundle all PDS wiring below ceiling. Cable ties will not be accepted.

E. WORKSTATIONS - Workstations are characterized into two categories, Administrative and Classroom.

1. The administrative workstation is defined as any work site not based in a classroom or a work site that is not used for student based instructional purposes (typically front office, deans area, cafeteria, stage, etc.).

2. The classroom workstation is defined as a work site that directly involves student based instruction (classrooms, teacher work areas, labs, library, media center, etc.). Classrooms would have one faceplate typically located at the teacher's work area (to accommodate a teacher workstation). There should be a minimum of (2) two additional faceplates in each classroom for student use. Teacher work areas adjacent to the classrooms would have one faceplate for every two teachers. Common teacher work areas or lounges would have a minimum of two faceplates each. The labs, library, media center, etc. would require faceplates based on the educational needs of the school.

F. FACEPLATES - At each workstation location, a four position modular faceplate will be installed to accommodate both voice and data. The faceplates will consist of four (4) Category 5E or above, RJ45 Non-keyed jacks. Typically jack one will be for voice, and the other three jacks will be for data and be positioned consistently throughout the facility. An additional requirement of the installation of an RG6 Coaxial Cable shall be installed in each faceplate as designated by Owner. This requirement must be coordinated with the School District Representative and Design Engineer.

G. POWER RECEPTACLES- General use power receptacles shall be gray or ivory with stainless steel faceplates. The computer power receptacles shall be black with stainless steel faceplates.

H. COMMUNICATION OUTLETS - Data communication outlet boxes shall be a minimum 2.5" deep. All Category 5E or above cabling shall terminate in the MDF and IDF rooms with no intermediate splices and so as not to extend the cabling over the maximum distance limited by the EIA/TIA standard of 295 feet.

I. All clean/general power receptacles and communication outlets shall be located at 18" A.F.F., U.O.N.

I. Typically, each classroom shall have a dedicated power circuit. Administrative locations will have a dedicated power circuit for workstation connections based on functionality, but not to exceed normal requirements. Teacher workrooms with at least one workstation must also have dedicated power. A dedicated duplex power receptacle will be provided, not closer than 12" nor further than 24", adjacent to the workstation faceplate. Computer power systems shall be separated using "K-13" rated isolation transformers in each building feeding surge protected power panels. Additionally, each circuit shall have it's own neutral, oversized to handle the additional neutral current. Each branch circuit feeding computer power receptacles shall not exceed (3) three duplex receptacles. All dedicated power circuits must be surge protected. (Refer to the Retrofit for Technology Guidelines, Revised 1/30/95.)

J.

K. In the Cafeteria, the Point of Sale System (P.O.S.) shall have the following additional requirements for terminations between the cash registers and the Food Service Managers Office.

1. *Install two (2) Category 5E, cables at each P.O.S. location. One cable shall terminate in the respective IDF and the other shall terminate in the Food Service Managers Office. Label accordingly.*

2. *At a designated location install a single or double gang junction box attached to a stub up homerun back to the Food Service Managers Office to allow an external ringer to be installed from the telephone set in the Food Service Managers Office to the preparation area.*

L. The telephone infrastructure will consist of shielded/flooded PE89 level 3 copper backbones from the MDF to each IDF (wing, house, floor, pod, etc.) and Category 5E or above copper from the IDF to the workstation location faceplate.

M. Voice cross-connects shall be provided in the MDF and each IDF. The voice trunk cable shall terminate on 66 blocks (one side only) on the Voice/Data Backboard. Additionally, to allow cross-connect between the voice trunk cable and user stations a 25 or 50 pair voice cable, as required, shall be terminated on 66 blocks (one side only) on the Voice/Data Backboard. The other end of this cable shall terminate on a "voice" patch panel, as required, on each rack/cabinet. There shall be (2) two pair per port terminated sequentially on the blue and Osceola pins of each sequential port on this patch panel. The MDF and each IDF shall have (1) one 48-port patch panel. The determining factor shall be the number of phones to be serviced out of each communications closet.

N. Intercom infrastructure and protection shall consist of the following:

1. *Cabling between the MDF and each IDF shall be West Penn AQC369. One cable for each call button and each indoor (5 speakers max per zone) or outdoor (2 speakers/horns max per zone) speaker zone plus 5 spare cables per IDF homerun with no splices.*

2. *Cabling between the IDF and each classroom Call-Button shall be West Penn 355.*

3. *Cabling between the Call-Button and the speaker in the classroom shall be West Penn 291.*

4. *Cabling between the IDF and the designated indoor and outdoor speaker zones shall be West Penn 291. No more than 5 speakers per indoor speaker circuit no more than 2 speakers per outdoor speaker/horn circuit will be accepted.*

5. *Additional single Category 5E cables shall be installed at designated television outlet locations and terminated at their own patch panel in the respective MDF/IDF room. This patch panel must be labeled to distinguish between the Voice, Data and Auxiliary use. All ports on the patch panel shall be used in sequence. No ports on the patch panel shall be skipped.*

6. *All Intercom terminations/66 blocks shall be labeled as Speaker circuit, Call-In Circuit, etc. Spare cables/circuits will be labeled spare sequentially.*

7. *In the MDF all shields shall be looped together on the Intercom side of the 66 blocks. The shields shall all be bridged to the field wiring.*

8. *The MGB ground bars shall be mounted behind the 66-block mounting brackets to allow the PB-CLN and PB-SPK protectors, as required to sit flush on the 66-blocks. The MGB Ground Bars shall be mounted on the same side as the outside plant cable.*

9. *The labeling on all 66-blocks shall correspond with a location in the field. Identify all circuits by room number, and type of equipment (Call-Button, Speaker, Hall Zone or Outdoor Zone). All Intercom cabling shall be labeled at both ends with an approved labeling system. The Intercom Cable labeling shall correspond with the Intercom physical port number on both ends.*

10. *The system circuit numbers shall be permanently identified on the left side of the 66-blocks. The location of the field device shall be identified on the right side of the 66-blocks. This labeling must also be an approved labeling system.*

11. *In all IDFs, bridge the shields through on the 66-blocks.*

12. *The intercom system shall be balanced for All-Call and Call-In.*

13. *Room (FISH) numbers shall be properly programmed. (SEE 1.12 LABELING)*

14. *Zones shall be properly programmed.*

15. *The intercom system shall be fully programmed with all features operational.*

16. *Intercom cable shall not be installed in the same raceway/pathway as data cable.*

17. *Voice/Intercom equipment protection shall be as follows:*

    a. *CO Lines- EDCO HCO*
    b. *Analog telephones- EDCO HAE as required by the manufacturer.*
    c. *Digital telephones- EDCO HDE as required by the manufacturer.*
    d. *Speakers- EDCO PB-SPK*
    e. *Call-Button- EDCO PB-CLN*

1.03 CABLING, RACEWAY, WIRE MANAGEMENT & FLOORBOXES

A. All workstation locations will have data communication access. The data infrastructure will consist of a minimum (24) twenty-four strand multi-mode fiber and a (12) twelve-strand single-mode fiber backbone between the MDF and each IDF. (4) Four Category 5E, Category 5E copper lines from the respective IDF to each Communications Outlet.

B. If raceways are used between the IDF's, the data and intercom/telephone cables must be separated from other systems so as to not have electronic interference or crossover. Intercom cabling shall not be installed in the same path as the data cable.

C. If raceways are used from the IDF to the workstation, the data and backbone telephone cables must be separated from other systems so as to not have electronic interference or crossover. Intercom cabling shall not be installed in the same path as the data cable.

D. The power contractor shall install all sleeves as identified on the plans. The power contractor shall fire-stop around all sleeves and stub-ups as identified on the plans. The systems contractor shall be responsible for providing the proper fire stopping material inside all sleeves. The systems prints shall show the recommended, minimum size and location of all sleeves. It is the responsibility of the systems and power contractors to coordinate the final size, location and quantity of sleeves. All conduit stub outs and sleeves shall be provided with couplers and/or bushings. All sleeves must be adequately supported on both sides of the penetration.

E. The Electrical Contractor shall provide conduit between the Intercom, Video Surveillance and Burglar Detection Head ends and the device locations to include drilling of door frames and concrete walls for the installation of flush door contacts. Minimum size of the conduit shall be 3/4" EMT with bushings on all stub outs. It is the responsibility of the systems and power contractors to coordinate the final size, location and quantity of stub outs.

F. On exterior sleeves the portion of the sleeve on the outside wall shall be attached to either a single or double gang junction box installed and secured to the building. The interior portion of the sleeve shall have a bushing installed. All exterior and interior wall penetrations shall be sealed around the exterior portion of the sleeve and after all cable is installed the interior of each sleeve shall be packed with an approved material. The School District Representative shall approve conduit and sleeve placement. All exterior conduit connections and boxes shall be weatherproof. All conduits and boxes on the exterior of any building shall be painted to match the building shell or trim, as required by the Owner's representative. All cable runs shall be properly supported with approved devices.

G. Provide cable ladder rack, Homaco TR Series or approved equal above the "MDF" extending from the backboard to each equipment rack frame for proper cable management. Also, provide conduit stub-ups from the MDF and each of the IDFs to allow a clean transition of cabling into the ceiling space.

H. Provide cable tray, cable guides, "D" Rings, J-hooks, posts, wire management devices, cable tray, cable ties, etc. as required to provide a neat, clean and professional installation. The contractor shall adhere to the requirements as described in the BICSI TDMM. Cable ties will not be accepted as primary means of supporting horizontal cabling.

I. Provide specified horizontal wire management devices for all equipment racks/cabinets. Install wire management devices between each patch panel, fiber optic inter-connect center, proposed hub, switch and router. Horizontal wire management devices shall start at the top of each rack/cabinet. Additionally provide (3) three wire management devices for each rack/cabinet.

J. Provide vertical, Homaco or approved equal, wire management devices on each side of all freestanding equipment racks. (1) one equipment rack shall have (2) two vertical wire management devices and (2) two equipment racks shall have (3) three vertical wire management devices.

K. CONDUIT SYSTEM

1. ***The conduit system between MDF and IDF locations shall consist of the necessary quantity of 4" conduit with (3) three 1-1/4" inner-ducts, 3" conduits and 2" conduits for the delivery of the backbone system.***

2. ***All ends of each conduit run shall be permanently labeled. Provide sample of labeling to the Engineer and School District Representative for approval.***

3. ***The electrical contractor shall install all conduit and inner-duct. The contractor who installs the conduit and inner-duct shall also install a heavy-duty pull line. All unused/spare conduit and inner duct shall be sealed with an approved device or substance.***

4. ***Fiber-optic and telephone backbone cable systems may be run in the same conduit system. No other types of cables shall be run with the fiber-optic and telephone backbone cables.***

5. ***Industry standard pull boxes and or pedestals shall be installed sized and placed accordingly. Follow all industry guidelines for sizing and placement.***

6. ***Proper bend radius shall be used when placing conduit with sweeps for the installation of fiber cabling. No more than 2 sweeps or 90-degree bends between pull points or pull boxes shall be accepted.***

7. ***For CATV, Voice and Data access from outside entities, as a minimum, (2) two 4" conduits shall be provided between the MDF and the street. Each 4" conduit shall have (3) three 1-1/4" inner-ducts with install pull-line.***

8. ***Based on site requirements, present and future, spare conduit shall be placed between all communication closets and buildings.***

9. ***All Fire Alarm cabling shall be installed in a separate conduit and pull box system. Fire Alarm cabling and termination points shall be separated from the rest of the communications system. When sharing a manhole with other communication cabling, install the Fire Alarm System feeders in corrugated, flexible, non-metallic conduit within the manhole. Use appropriate connectors to terminate the conduit within the manhole.***

10. ***Floor Boxes for all locations, inclusive of computer labs, multi-purpose room, Media Center, etc. shall be Walkerbox, Fully Adjustable Floor Box (RESOURCE RFB Multiservice Shallow Steel Recessed Floor Box, Part #RFB4 or RFB4-CI-1 as required). Please note that the cast Iron box may be required depending on whether or not the slab is poured above or below grade.***

    a. ***<u>Cast Iron Configuration-</u>***

    Floor Box
    RFB4-CI-1
    This boxes comes with 2 brackets for 2 duplex power receptacles.

    Communications Bracket- (order 1 for each box)

CILT-2-RT

Blank- (order 2 for each box)
CIH/LT-B

Aluminum Cover w/flange for installation for VCT- (order 1 for each box)
S36BBTCAL

b. Steel Box Configuration-

Floor Box-
RFB4
This boxes comes with 2 brackets for 2 duplex power receptacles.

Communication Bracket- (order 1 for each box)
DTB-2-2RT

Blank- (order 1 for each box. this one will cover the extra power receptacle location.)
RFB-B

Blank- (order 1 for each box. this one will cover the extra communications receptacle location.)
DTB-2-2-TKO (do not remove knockouts when used as a blank.

Aluminum Cover w/flange for installation for VCT- (order 1 for each box).
S36BBTCAL

All conduit between boxes shall be home run to stub outs. No looping of conduit between boxes will be accepted.

11. Conduit installed outdoors shall be installed per last ratified revision of NEC. In addition, 6" expansion fittings shall be installed in all long conduit runs and 2" and 4" expansion fittings shall be installed between junction boxes and conduit termination points.

1.04 PORTABLE CLASSROOMS

A. An appropriately sized conduit system shall be installed dependant on the number of connections to be provided. A minimum 4" conduit with (3) three 1-1/4" inner-ducts shall be installed between the nearest IDF and a pull-box located in the vicinity of the proposed site for portable classrooms. This conduit shall be the path for the communications cabling to include fiber for data and multiple pairs of intercom cabling as required to support existing and future needs. A 2" conduit shall be installed for the installation of .500 hardline for CCTV. An additional 4" conduit with (3) three 1-1/4" inner-ducts shall be installed for the installation of a flooded,

shielded voice cable. A 2" conduit shall also be installed between the fire alarm panel
located in the main building and the portable site. Fire alarm cable shall not be installed in the same conduit, pedestal or pull box as the voice, video, data and intercom cabling.

Summary:

Install (1) one 4" conduit with (3) three 1-1/4" inner-ducts.
a. Fiber Optic Cable for Data sized accordingly
b. Multiple Pairs of Intercom Cable
c. SPARE

Install (1) one 4" conduit with (3) three 1-1/4" inner-ducts.
a. Voice Cable sized accordingly
b. Voice Cable sized accordingly
c. SPARE

Install (1) one 2" conduit for .500 hardline for CATV.

Install (1) one 2" conduit for Fire Alarm. This conduit shall be installed between the designated Fire Alarm Panel and it's own Pedestal or Cabinet.

Typically, the conduit system shall originate from an IDF located within a building nearest a proposed portable site. There will be an appropriate transition point between the portables and the IDF. This transition point shall be a weatherproof, communications equipment pedestal or an outdoor, weatherproof, Hoffman style terminal cabinet mounted on or near the side of the building.

Install marine grade plywood painted with fire retardant paint in all cabinets and pedestals to accommodate the installation of systems equipment.

Consideration of all site requirements shall be reviewed before final decision is made for conduit placement and quantity of cable pairs.

See section 17090 of this document for detailed portable classroom instructions.

1.05 CABLE (Voice/Data)

A. Data fiber backbone from between the MDF and each IDF is FDDI grade, 24-strand fiber, color coded, multi-mode, 62.5/125 micron tight buffered design, rated for indoor/outdoor use. Also, a (6) strand fiber, color-coded, single-mode, 9-micron shall be installed. (Corning Cable Systems or approved equal only.) Refer to plans for exact quantities.

B. Data fiber Patch Cords are FDDI grade, duplex, multi-mode /single-mode, as required. (Corning Cable Systems or approved equal only.)

C. The voice cable between the MDF and IDFs shall be a multi-pair, flooded, and shielded Level 3 cable with sufficient pairs for 25% growth. Install separately sheathed trunk cables for analog and digital signals between buildings.

D. Voice/Data copper from the IDF to the workstation faceplates shall be (BLUE) Category 5E or above Unshielded, Twisted Pair (UTP), 24 AWG, 4 pair for each RJ45 data line jack.

E. RJ45 Patch Cords are to be Unshielded Twisted Pair (UTP), stranded, Category 5E or above, 4 pair. (Approved Manufacturer Only)

F. All cabling shall be plenum rated as required.

1.06 TERMINATIONS

A. Backboards: 4' by 8' 3/4" plywood, as required. All backboards shall be painted, both sides with (2) two coats of white fire-retardant paint. (School District personnel shall assist with the locations of these backboards.)

B. Voice terminations and cross-connects shall be 66-style with adequate spools for wire management. Minimum two (2) spools per 66-block.

C. Category 5E Patch Panels: 24 or 48 port only, as required. Panduit, Ortronics, or Tyco as required to meet the required 15-year warranty.

D. Fiber Termination units – Superior Modular or approved equal.

E. Fiber Cable Termination Connectors: SC duplex type, multi-mode and single-mode, as required.

1.07 PATCH CORDS

Copper and Fiber patch cables are project specific for type and quantity. The type and quantity for each project will be determined by the district representative and the project engineer. The Contractor shall provide the appropriate number, type, and length of patch cords as required by the contract documents. The patch cords provided shall be 4 pair, #24AWG, stranded, Category 5E or above patch cords as required wired for EIA/TIA 568A sequence. The project engineer must estimate the necessary quantities of the following types of cords based on potential equipment to be installed:

Category 5E or greater 3’ UTP patch cords

Category 5E or greater 5’ UTP patch cords

Category 5E or greater 7’ UTP patch cords

Category 5E or greater 14’ UTP patch cords

Category 5E or greater 25’ UTP patch cords

6' Multi-mode duplex fiber patch cords (SC to ST).

6' Multi-mode duplex fiber patch cords (ST to ST).

6' Multi-mode duplex fiber patch cords (SC to SC).

6' Single-mode duplex fiber patch cords (SC to SC).

6’ Multi-mode duplex fiber patch cords (SC to MTRJ).

6' Multi-mode duplex fiber patch cords (SC to LC).

1.08 RACKS/CABINETS/WIRE MANAGEMENT DEVICES

A. Floor Mount 19" by 72" Equipment Racks: Homaco, 19-84-T2SD series or approved equal. (Include necessary isolation pads, insulator kits and ladder racks) Install HOMACO, VO-84 series or approved equal, vertical wire management between and at the end of all equipment racks in the MDF and each IDF.

B. Soundolier #320-61B w/304-61B cabinet w/door (Television Distribution System).

C. Wire management devices shall be EMP# 005-00010 for the Cabinets and (Homaco, FCM-19-2SR or approved equal) for the Floor Mount Equipment Racks.

D. Server Rack - Floor mount (1) APC NetShelter SX42U Cabinet, part number #AR3100 in the MDF. (Include necessary ladder rack w/ end caps and grounding)

1.09 LABELING

A. Equipment Racks, cables and terminations shall be identified at all locations using an alpha-numeric sequence. Spare cables (if any) shall be terminated and identified as “SPARE” at each location.

B. Communications outlets shall be identified using white with black lettering, permanent, clean, typewritten labels. Provide a label that fits within the designated area on the faceplate, as one continuous piece. Before installation, submit sample for approval by an Osceola County School District Representative.

C. The patch panels in the MDF and each IDF shall be using white with black lettering, permanent, clean, typewritten labels. Panels shall be labeled as Patch Panel “A”, Patch Panel “B” as required by the number of patch panels in each communications closet/cabinet. Therefore, the Communication Outlet shall be labeled to identify the IDF it is being served from as well as the patch panel and port number it is being served from. Before installation, submit sample for approval by an Osceola County School District Representative. Identify the Main Distribution Closet as the MDF. Identify each Intermediate Distribution Closet/Cabinet as an IDF. Each IDF shall be labeled to match the building in which it is housed. A Communication Closet or Cabinet within building #800 shall be labeled as IDF#8.

D. All cabling and terminations shall be labeled at each end with permanent markings. NO HANDWRITTEN LABELING WILL BE ACCEPTED! Submit a sample to the Engineer and School District Representative for approval.

E. All 188/110 protectors and all 66-block terminations shall be permanently labeled with type written labels. All Intercom terminations/66-blocks shall be labeled as Speaker circuit, Call-In Circuit, etc.

F. All Communications Cabinets shall be permanently labeled with an engraved plate.

1.10 GROUNDING/SURGE SUPPRESSION

A. All equipment racks and terminations shall be properly grounded using jacketed ground cable as follows:

1. *The power contractor shall install a minimum #4 THNN stranded, green jacketed ground cable between the Computer/clean power panel and each ground bar located in the MDF, each IDF and any other communications room. This #4 THNN stranded, green jacketed ground cable must be installed in conduit and the conduit must be grounded with the same size conductor as is in the conduit. The power contractor shall also install a minimum #6 THNN stranded, green jacketed ground cable between building steel and each ground bar located in the MDF, each IDF and any other communications room. A separate ground bar shall be installed on each wall in the MDF and IDFs that have communication cabling terminations. Security and Surveillance Systems shall be grounded on a buss bar bonded back to the TMGBB.*

2. *In any building having more than one (1) communications room, there must be a grounding backbone between each Telecommunications Ground Bus Bar as per ANSI/TIA/EIA-607. Grounding wire must be sized in accordance with specifications.*

3. *The Systems Contractor shall terminate the ground cable by installing a copper ground bar 1/4"D x 4"H x 20"W. Harris/Dracon #10622-020.*

4. *Install a single ground wire under a single ground lug. There shall be no stacking of ground cables under ground lugs. Use approved devices only.*

5. *Each section of ladder rack and each equipment rack shall be grounded using a minimum #6 stranded, green jacketed ground cable.*

B. Provide lightning and surge voltage protection for all lead in video cables. Also include lightning and surge voltage protection on all A/C power connections. Protection of the following locations is imperative:

1. *The CATV input to the building.*

2. *The TV Antenna Tower and coaxial leads entering the building.*

3. *The Satellite Antenna and its cables entering the building.*

4. *All trunk lines between buildings.*

C. Ground all devices with a minimum #6 stranded, green jacketed ground cable.

D. Voice cabling shall be grounded as follows:

1. *Each end of all Voice trunk cable shall be grounded with a Ground Bond Connector. Each Ground Bond Connector shall have a protective sheath installed between the bond connector and the voice cable pairs. Use a minimum #6 stranded, green jacketed ground cable.*

2. *Install a 3M TELCOM "ONLY" PN# 4460-S SHIELD BOND CONNECTOR KIT to PE89 voice cables as follows:*

   a. *Measure where the shield bond connector is to be installed on the PE89 voice cable. Insure you have enough length on your conductors to properly punch them down once finished. Carefully cut and remove the unneeded portion of the sheath and shield insuring no conductors are cut or damaged in the process. Split the PE89 sheath and shield approximately 1-1/2 inches from the top down. Do this parallel to the conductors insuring not to cut the conductors in the process.*
   b. *Make a hole through the sheath and shield in the same location approximately ¼-inch from the top of the sheath. Make this hole large enough only to insert the connector post through. Insert the connector post through the hole from the inside where the body of the connector is against the metal shield.*
   c. *With the post of the connector still inserted through the sheath and shield place the post of the connector through the piece of the connector with the hole in it placing this piece against the outer sheath.*
   d. *Clamp this assembly together with one of the 2 threaded-nuts provided. Tighten the outer connector piece to the inner connector piece clamping the sheath and shield between the 2 shield-bond connector pieces.*
   e. *Insert a plastic insulating boot between the conductors of the cable and the back of the metal connector portion with the post on it. Install the plastic boot far enough down the assembly that no metal from the connector will be in contact with the cable conductors.*
   f. *Close this assembly tightly together and tape it with electrical tape. Tape the outside of the sheath to include the entire exposed outside portion of the metal connector. Tape from approximately ¼-inch below the bottom of the cut in the sheath, to approximately ¼-inch above the end of the sheath tightly winding the electrical tape. Insure the top of the installed threaded nut and the threaded post of the connector assembly are the only exposed metal items on the outside portion of the sheath.*
   g. *After taping the assembly, install a ground connector lug on the shield bond connector post and butt the ground lug up against the first threaded nut installed using the second threaded nut on the shield bond connector post to securely fasten the ground connector lug to the assembly.*
   h. *Avoid stripping the cellophane and ribbons from the cable conductors at this point and your cable conductors will be less likely to unravel causing you to have to tone them to make them match.*

3. *All ground wire shall be no smaller than #6 stranded, green jacketed ground cable. All ground wire shall be home-run. There shall be no looping of ground wire. All ground wire shall be installed in as straight a line as possible to the main ground bus.*

4. *There shall be no intermediate ground bus between the devices and the main ground bar.*

E. Install a Rack Mount six (6) outlet surge suppression power strip with a 6' cord in each IDF Cabinet and in each rack in the MDF and each IDF. PANAMAX RACMAX #GRM0600, Homaco PSS series or approved equal.

1.11 INSTALLATION

A. Prior to installation, the Contractor shall verify with the School District Representative all device locations, eg., racks and communications outlets.

B. All cables shall be installed in continuous runs between the communications outlets and patch panels, between the patch panels and communication closets and between the MDF and IDFs without any intermediate splices. Provide adequate service loop at all termination locations. (10' at the MDF and IDFs and 3' at all Communication Outlets.)

C. The installation path for all cables shall be carefully planned to minimize the total length of each cable run. Cables shall be bundle wrapped every 24" and structurally supported every (5) five feet. Existing ceiling/grid support wires shall not be used as structural support. Contractor is to install a separate support system. Cabling shall run above the corridor ceiling and shall be installed within 4" of side wall to allow unobstructed access to the ceiling space. Cabling shall maintain 24" clearance from all fluorescent light fixtures. Cable shall not be tie-wrapped to existing conduit. Cabling shall not lay on ceiling tiles, HVAC duct, building steel, conduits, tubing, etc…

D. All drawings provided are diagrammatic only! All material to complete the operational system may not be shown, but shall be provided.

E. Contractor must adhere to all applicable codes and standards regardless of design.

1.12 SUBMITTALS

A. Specification Sheets shall be submitted on all items including cable types for approval by the Owner at time of Bid opening. Any Contractor not supplying submittals on all items shall be subject to being rejected at time of Bid Opening.

B. Submit outline drawing of equipment racks showing relative position of all major components if placement of equipment is other than what is on the drawings provided in the Bid Document.

C. Submit wiring diagrams showing typical connections for all equipment.

D. Submit a certificate of completion of installation and service training from the system manufacturer.

E. Submit labeling examples as specified in Section 1.09 Labeling.

1.13 TESTING

A. Each outlet shall be tested to demonstrate the Category 5E transmission capability and to verify the integrity of the cabling and termination process. Testing shall be performed between the modular jacks at the communications outlet and the panels at the MDF and each IDF. Provide test results to the Owner for approval. Provide printed results of all tests. Testing of the UTP shall be performed in accordance with the guidelines outlined in the Florida

Department of Education, Retrofit for Technology Guidelines, Revised January 30,1995 and in strict accordance to meet the Category 5E requirement.

B. *Fibers within the Fiber Optic Cabling shall be tested using an "OTDR" to verify the integrity of the cabling, termination process and the overall transmission loss. Provide test results to the Owner for approval. The OTDR trace output shall become a part of the as-built documentation.*

1.14 SERVICE AND MAINTENANCE

A. The Contractor shall provide a (15) fifteen-year warranty of the installed system against defects in workmanship. All labor and materials shall be provided at no expense to the Owner during normal working hours. The warranty period shall begin on the date of acceptance by the Owner/Engineer. Warranty notices shall be addressed as soon as possible but, no later than (2) two business days.

B. *It is the responsibility of the Contractor to arrange and submit all necessary paperwork to ensure the (15) fifteen-year vendor warranty.*

C. *The Contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.*

D. *The system manufacturer shall maintain Engineering and service departments capable of rendering advise regarding installation and final adjustment of the system.*

E. *One of the following warranty packages shall be provided:*

Panduit Certification Plus
Ortronics
Tyco

Other Category 5E Certified Systems with a minimum (15) fifteen year warranty shall be considered but must be submitted before the bidders' questions are due for prior approval.

F. *The Contractor shall provide the School District Representative with 20 spare dual jacks, 20 blanks and 20 matching faceplates.*

1.15 COMPLETION

A. *Documentation and as-builts shall be provided in accordance with the guidelines outlined in the Florida Department of Education, Retrofit for Technology Guidelines, Revised January 30,1995.*

B. *Upon completion of all testing and before system commissioning, actual Communications Outlet (CO) testing shall be performed. The tests shall be performed on a sample basis (10% installed COs) on various portions of the network as determined by the Osceola County School District Representative. The Contractor and an Osceola County School Representative shall witness the test. All Communications Outlets including the existing outlets shall be tested.*

C. It shall be the responsibility of the Contractor to verify the ceiling tiles before performing this installation. The Contractor shall replace any broken or damaged ceiling tiles found at the end of this project before final payment is made.

SECTION 17030
MEDIA RETRIVAL & TELEVISION DISTRUBUTION SYSTEM

PART 1 – GENERAL REQUIREMENTS

1.01 DESCRIPTION

A Television Distribution System (TDS) is to be installed throughout the school. The channel modulators are to be used to accept base-band audio and video from selected VCRs located in the headend rack. This system shall support the transport of the RF signal from the source equipment controlled manually or via the Media Retrieval System.

1.02 MEDIA RETRIEVAL SYSTEM REQUIREMENTS

A. A Media Retrieval System shall be installed terminating with the television headend. The School District standardized media retrieval system is the Rauland-Borg Telecenter IP system. An area designated by the School District Representative and the Design Engineer shall accommodate the installation of up to (5) 7' equipment racks that will house all of the Media Retrieval and distribution equipment for the TDS System.

B. Additional requirements to supply the equipment racks with clean power shall be fed through power poles into the top of the racks. To accommodate the power requirements within the rack the Electrical Contractor shall install (2) dedicated circuits from a clean power panel into the equipment racks. The Electrical Contractor shall coordinate the installation of the circuits with the Media Retrieval/Television Headend Contractor. Each equipment rack shall require the installation of power poles or masts to not only accommodate power, but also necessary voice, video and data cabling as well.

1.03 TELEVISION DISTRIBUTION SYSTEM

A. Cables at terminal locations shall be neatly formed to prevent kinks or other discontinuities. Cables showing evidence of abuse or physical damage shall be replaced.

B. All connectors shall be installed in strict accordance with manufacturers instructions. All dielectric residue shall be removed from surfaces of center conductors to insure proper electrical contact. Crimp type connections on coax shall be made with a Hex crimp tool equal to LRC Electronics type CT 600. Contractor shall provide a sample connector for inspection by the Engineer and the School District Representative.

C. The distribution of the signal from the Headend out to the designated areas is to be home-run design and must be able to accommodate a return sub-channel system. The cabling transport to each of the classrooms from their respective Communications Closet shall also be home-run. Distribution Amplifier- Blonder Tongue BIDA Series or approved equal. (Use BIDA 750-30)

D. Trunk line cables shall be a minimum .500, hardline coaxial cable for the distribution of signals between Communication Closets. All cables shall be 100% shielded, certified 5-750 MHz sweep tested and UL approved with an indoor fire rating, as required. Trunk lines are defined as cables that transport the signal from the headend to splitters and directional couplers at main distribution points. All underground cables shall be jacketed and flooded, in conduit. All hardline terminations shall be properly heat shrinked with gel filled heat shrink covering the entire connector and including the jacket where it has been stripped back. Trunk cable- Commscope or approved equal.

E. Drop line cables shall be RG6 type, all cables shall be certified sweep tested, 100% shielded, 5-750mhz (minimum) sweep tested and UL approved with an indoor fire rating. Drop lines are defined as cables that transport the signal from the directional couplers to the room outlets. Contractor shall provide a sample piece of cable for inspection by the Engineer and the School District Representative. Drop Cable- Commscope or approved equal.

F. The directional couplers to be installed should be of die-cast construction, 75 ohm, 5-750 MHz bandwidth and 100 dBmV minimum RF shielding. Directional Coupler- Blonder Tongue CRL/DMT Series or approved equal.

G. The splitters to be installed should be of die-cast construction, 75 ohm, 5-750 MHz bandwidth and 100dBmV minimum RF shielding. Blonder-Tongue or equal.

H. Line amplification shall be provided as necessary to meet strength specifications. These amplifiers shall also be able to provide two-way capability with either a passive or active sub-channel return path. Sub-band amplification must be installed. Amplification- Blonder Tongue BIDA Series or approved equal. (750 MHz) (Use BIDA 750-30).

I. The designated locations for the individual television installations shall consist of one single outlet television and an Owner provided, contractor installed wall mount bracket mounted not less than 6'8". Each wall mount bracket shall be able to support the weight of a 19" or 27" television as required. Placement of the Television mounts must be coordinated with the placement of black boards, corkboards and any other wall-mounted equipment. Typically, separation of black boards is necessary to accommodate the proper placement of the television mounts not less than 6'8" with a duplex power receptacle and coax/data faceplate. Wall-mount Brackets- Peerless only.

J. The television outlet for each TV shall be located at 96" A.F.F., U.O.N. level in classrooms, offices and other workspaces. Television outlets located in spaces with ceiling heights of 10' and more shall be identified on the blueprints.

K. A 120 VAC general power receptacle shall be located adjacent to each TV outlet.

L. The television outlet in each room shall be provided with a RG6 coaxial cable 36" minimum in length with two "F" type connectors.

M. In each classroom and/or designated instructional area an Audio/Video connection shall be installed under each television location, at 18" A.F.F, U.O.N.. This will allow the use of a source device for delivering Audio and Video to the wall mounted TV. A 120 VAC power receptacle shall be located adjacent to each Audio Video Outlet. Provide labeling at both A/V receptacles to identify ports. The homerun coax cabling feeding these outlets from the associated MDF/IDF shall be split and connected at the stub-out location using a Blonder-Tongue DSV diplex splitter mounted to the wall above ceiling at the stub-out location to allow the use of sub-band from the lower outlet in the classroom.

N. Each television faceplate shall also accommodate the installation of (1) one RJ45 connector allowing Category 5E or above cable to be installed between the MDF/IDF Room on their own separate labeled patch panel and each designated Television location.

O. Provide all attenuators, filters, traps and other accessories for a complete, balanced and operational system.

P. Provide a duplex power power receptacle at each television distribution point for the powering of additional distribution equipment amplification.

1.04 SYSTEM PERFORMANCE

A. System bandwidth shall be 0-750 MHz, flat within 1 dBmv across any 6 MHz part of the spectrum. At no point in the system shall the signal level between channels vary more than 6 dBmv.

B. The minimum signal level at any outlet shall be no less than +5 dBmv, the maximum signal level at any outlet shall not exceed +10 dBmv.

C. Cross modulation shall be -57 dBmv or better.

D. Signal to noise at the most remote outlet of any leg shall be at least +46 dBmv.

1.05 SURGE SUPPRESSION

Surge Suppression -Surge suppression shall be installed on all trunk cable at each building entrance. Attach to ground using a homerun #6 stranded, green jacketed ground cable. Surge Suppression- EDCO CATV-145 or approved equal.

1.06 COMPLETION

A. The system will be considered complete when all of the following requirements have been met:

1. *All ending cable leads and unused ports are terminated.*

2. *All equipment is installed to manufacturers' specifications.*

3. *Indoor/Outdoor cabling in each enclosure, cabinet or closet is to be appropriately labeled as outlined in section 17020.*

4. *Copy of the blueprints showing all cabling and any changes to the "initial design layout" has been provided to the Owner.*

5. *All channels in the system have been properly balanced with an audio/video signal passing through each channel.*

6. *The sub-channel system has been tested from various locations in the building with satisfactory results.*

7. *All pictures shall be clear of any interference caused by cross-modulation, distortion, or adjacent signal levels.*

8. *Documentation and as-builts shall be provided in accordance with the guidelines outlined in the Florida Department of Education, Retrofit for Technology Guidelines, Revised January 30,1995.*

9. *Upon completion of all testing and before system commissioning, actual Communications Outlet (CO) testing shall be performed. The tests shall be performed on a sample basis (10% installed COs) on various portions of the network as determined by the Osceola County School District Representative. The test shall be witnessed by the Contractor and an Osceola County School Representative. All Communications Outlets including the existing outlets shall be tested.*

10. *It shall be the responsibility of the Contractor to verify the ceiling tiles before performing this installation. Any broken or damaged ceiling tiles found at the end of this project shall be replaced by the Contractor before final payment is made.*

1.07 ACCEPTANCE INSPECTION

A. Be prepared to demonstrate to Engineer/Owner compliance of these specifications by all major items or pieces of equipment, as well as compliance with specifications for entire system at time of turn over. The Contractor shall demonstrate the operation of the system to the Engineer during the final inspection in the following manner:

1. *Measure signal levels with a calibrated field strength meter at all outlets and record the High and Low channel levels selected by the Engineer.*

2. *Observe picture quality at outlets selected by the Engineer/District representative using a 17" (diagonal screen size) color television receiver.*

3. *Test the last outlet on every cable run via a spectrum analyzer for carrier level, carrier to noise ratio, hum, modulation, and system frequency response.*

4. *Any other test the Engineer deems necessary to establish the system is operating properly.*

5. *The above tests and measurements shall be documented in the operation and maintenance manuals as the as-built conditions.*

6. *Provide a technician to instruct Owner personnel in operation and maintenance procedures of system.*

7. *Instruction scheduled at Owner's convenience.*

1.08 TEST EQUIPMENT REQUIRED

A. *17" minimum diagonal screen size color receiver in good working order. Signal level meter capable of measuring peak carrier levels within the 5 MHz to 750 MHz spectrum.*

B. *Formal instruction shall be given to Owner designated key personnel at a time selected by Owner. Such instruction shall consist of no less than 6 hours delivered in two (2) separate sessions. Training shall cover operation, programming, troubleshooting and maintenance.*

C. *A written report, signed by the instructor, shall be submitted to the Owner with copies to the Architect, and Engineering Consultant, detailing subjects covered, names of persons instructed, dates and amount of instruction each person received. This report shall be submitted within one week following the instruction.*

1.09 WARRANTY

A. All television system equipment and wiring shall be guaranteed by the installing contractor to be free of defects in materials and workmanship for a period of one year from the date of substantial completion of the system.

B. *Any system component, which shows evidence of failure or incorrect operation during the manufacturer's warranty, shall be repaired or replaced by the Contractor at no expense to the Owner.*

1.10 ASBUILT DRAWINGS

A. *General: Complete system as-built drawings shall be provided with the following information:*

1. *A block diagram of the entire system indicating all cables, cable types, active and passive components.*

2. *Aural and visual carrier levels on all channels at off-air antenna leads and the headend output.*

3. *Measured signal level on all visual carriers at:*

   a. *input and output to all active devices.*
   b. *Each tap.*
   c. *Each feeder termination.*
   d. *Each building service. (CATV, Satellite, etc.)*
   e. *Each TV location*

SECTION 17040
SATELLITE ANTENNA

PART 1 – GENERAL REQUIREMENTS

1.01 REQUIREMENTS

A. Owner shall purchase the Satellite Antenna and the School District Representative shall manage the installation. The Electrical Contractor shall provide conduit between the Television Headend and the Satellite Antenna location. Minimum size of the conduit shall be 1-1/2" with pull boxes at mid span or every 200' as applicable. The School District Representative shall approve conduit placement. All conduit connections and pull boxes shall be weatherproof. All conduits on the exterior of any building shall be of appropriate schedule & type, according to code and painted to match the building shell or trim, as required by the Owner's representative.

1.02 All civil work and the concrete foundation designed for the antenna supplied, including all conduit work, and all wiring from within the building to the foundation.

A. Conduits, if used, shall be water-tight.

B. All hardware shall be galvanized.

C. A soil test report related to the construction of the nearby building will be provided if available

D. The Contractor shall provide a foundation design sealed by a registered professional Engineer.

E. Contractor shall obtain all permits that may be required for the work.

F. Completion of TVRO Site Survey Form. (See Attachment B)

G. Options that may be accepted from the Form of Proposal.

1.03 INSPECTIONS

A. Inspections will be made prior to accepting the equipment/installation. Contractor shall provide a one-day notice to Owner's representative when ready for the following inspections.

B. Upon completing the preparation of the site to be ready for pouring the concrete foundation, but prior to pouring the concrete.

C. Upon completion of the system installation and when ready for final testing, Contractor shall complete the installation and all adjustments, including sufficient preliminary tests to verify that the final measurements will meet all specifications in advance of Owner's Representative arriving on-site. A PVC conduit set into the concrete foundation with a sweep EL shall be used to route the cable from the motor drive and LNBs to the trench used to route the cables in PVC conduit to the building. Supply the top of the conduit at the antenna with appropriate weatherproof cap. Verify with Owner's representative.

SECTION 17050
VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL REQUIREMENTS

1.01 SUMMARY

A. A Video Surveillance System (VSS) is to be installed in each individual school as designed by the School District Representative. These systems will consist of one (1) Digital Video Recorder (DVR) or Network Video Recorder (NVR) and up to 16 cameras. The DVR shall be located within the school's Main Distribution Facility (MDF) where a powered rack will receive signals from color cameras located inside and outside the facilities. For video retrieval or live video surveillance, the DVR shall be connected to the school district's Wide Area Network using the Internet Protocol method (IP addressing) provided by the School District IT department. At the individual school, the School District Representative shall designate those personnel who will have access to the video and software will be installed on their personal computer systems. The School District is responsible for deciding and granting permission levels.

B. Security systems are critical in assuring life and property protection. Therefore, it is imperative that they perform their function properly and reliably. This specification has been prepared to assure that all installations of these systems do their job well.

C. This section outlines the quality, type and installation of the building video surveillance system. Included in this Section the contractor shall provide all labor, equipment, and materials necessary for a complete, tested and operational system. The scope of these specifications is to insure the delivery of a complete unit, ready for operations. Omission of any essential detail from these specifications does not relieve the supplier from the furnishing of a complete unit.

D. Approval of samples, cut sheets, shop drawings, and other matter submitted by the contractor shall not relieve the contractor's responsibility for full compliance with the specifications, unless the attention of the School District Representative is called to each non-complying feature by letter accompanying the submitted matter.

E. All equipment must be new, of current manufacture and carry standard warranties. At least two complete shop repair manuals and parts lists must be furnished with each type of equipment at the time of delivery.

F. Typical camera locations include but shall not be limited to: Reception, Main lobby, Cafeteria, bus drop-off/pick up, parent drop-off/pickup, courtyards, play areas, stair towers, parking areas, hallways, entrance gates and as specified by the principal and School District Representative. The exact number, type and location of cameras shall be dependent on the site plan as approved by the Project Engineer and School District Representative .

1.02 CONTRACTOR QUALIFICATIONS

A. The contractor must be a qualified systems integrator with local service facilities within 25 miles of the School District offices located at 817 Bill Beck Blvd in Kissimmee, Florida.

B. The contractor must have sufficient personnel and facilities to be able to provide 2 hour on-site response to any and all situations involving the video surveillance system. The contractor must provide 24 hour on-call service via a toll free number.

C. The contractor must have performed work of comparable scope at educational facilities within the last 2 years with proof of exemplary performance. Should the School District Representative require it, the contractor must facilitate site visits.

D. The contractor must have the ability to provide Auto CAD drawings of the system design and as-built drawings upon project completion.

1.03 EQUIPMENT - The system shall include but not be limited to the following:

A. Digital Video Recorder (DVR) – Specification is for the Pelco DX8000 series DVR or VMX300 video management system. Digital Video Multiplexer Recorder with Ethernet connectivity (DVR) shall meet the following minimum performance specifications: allow up to 4CIF (720X480) recording, allow up to 480 NTSC frames per second recording at CIF (320X240), 16 looping camera inputs and outputs with audio termination, 640 GB internal storage capacity, multiple displays for live viewing or playback while recording, continuous motion detection + alarm + scheduled recording, ability support 5 simultaneous clients, network bandwith throttling, digital zoom on playback, pre-motion and pre-alarm recording, on-screen PTZ control with dome programming capability, and include Remote PC + Web + Handheld client software. The DVR shall require minimal training for the end user. The unit shall operate like a conventional multiplexer and VCR with local display monitors for live and playback viewing while the system continues to record new images. It shall be an integrated security system, capable of time division multiplexing multiple cameras and storing their digitized and compressed images on integral hard disk drives for fast search and retrieval either locally at the unit, or from a remote workstation using a Graphical User Interface (GUI). Software/Graphic User Interface. The system GUI is dependent on the DVR equipment used and must be from the same manufacturer.

B. Cameras - General Requirements: The monochrome/color camera, as required, shall use a high-resolution 1/3-inch format, interline transfer, CCD image sensor containing 768 Horizontal by 494 Vertical active picture elements. Typical horizontal picture resolution produced by this camera shall be a minimum of 570 TV lines monochrome and 480 TV lines color as measured on an EIA 1956 Test Pattern Chart. The camera shall include, but not to be limited to, the following features: electronic iris, backlight compensation, automatic gain control, 24V AC/DC power, four white balance modes, line lock with phase adjust, C/CS lens mount, digital signal processing elected by Owners Representative for each project, electronic light control, and selectable automatic white balance. Cameras shall be lined-locked to the power line zero crossing to ensure roll-free vertical interval video switching and recording. Approved models are listed below.

1. Vandal Resistant, Color, Indoor/Outdoor, Fixed Dome Camera - The product specified shall be the Model LTC 146x Series FlexiDome^{XT} Vandal Resistant Color Camera manufactured by Bosch Security Systems or an approved equal. The product specified shall be a full-featured, vandal resistant, fixed dome camera designed for indoor or outdoor applications. The camera shall be a 470 TVL resolution, high sensitivity integral color camera using a ¼-inch format CCD imager prepackaged in an impact-

resistant cast aluminum housing with a clear polycarbonate dome. As required by the application, the camera shall come equipped with an integral 2.8 to 6mm, F1.4; 3 to 6mm, F1.2; or 4 to 9mm, F1.4 DC-iris lens. The camera shall be sealed for outdoor use and provide protection against water and dust to NEMA-4 (IP66) standards. The camera shall provide immunity to shock and vibration and be virtually vandal-proof by being able to withstand the equivalent of 120 lbs. of force. The camera specified shall incorporate technology that extends the sensitivity of the camera by a factor of 3X when the camera is operating in the monochrome mode. Typically installed for general purpose use indoors or outdoors. Also required for areas of probable vandalism to camera.

2. ***Indoor High Light Sensitivity Color Camera - The product specified shall be the Extreme Dynamic Range Color Camera model CCC5100-H6 manufactured by PELCO or an approved equal. The digital single instruction, multiple data (SIMD) color camera shall consist of a 1/3-inch, super wide dynamic range SIMD imaging chip. The digital SIMD color camera shall utilize an imaging system such that when light strikes the imager it is converted to a digital signal at the pixel level, enabling the processor to analyze the scene and correct the exposure by pixel. The imager shall use progressive scanning to use every pixel on every field, resulting in doubling the vertical resolution of a CCD imager and, thus, decreasing digital distortion. Typically installed for areas where varying lighting extremes are present simultaneously, such as a shaded subject strongly backlit briefly.***

3. ***Indoor Day/Night Color Camera - The product specified shall be the Digital CCD Day/Night, Color/B-W Camera, model CC3770-OH6 manufactured by PELCO, or an approved equal. The high resolution camera shall consist of a 1/3-inch imager and switch from color to black and white mode, depending upon available light. The camera shall us an IR cut filter in color mode and an optical low pass filter in black and white mode. The camera shall have a sensitivity of 0.7 lux in color mode and 0.9 lux in black and white mode. Typically installed in areas where interchangeable lenses are needed for more flexibility.***

C. Outdoor Camera Housing - All exterior cameras shall be installed in an approved weatherproof housing. The product specified shall be EH3512-2HD manufactured by PELCO or an approved equal. All outdoor camera housing shall be provided with a sunshield. All cameras installed below 10' shall be installed in vandal proof housings.

D. Fiber Optic Converter/ Transmitter/ Receiver – The Product specified shall be Fiber options models S700VT-MST and S7011/2R-RST manufactured by GE Security. Receivers shall be rack mounted at the MDF in a 515R1, 15 slot card chassis, with an appropriately rated power supply. The card chassis shall be installed in the same equipment rack as the DVR.

E. Power Supply - Appropriately sized, wall mounted, multi-camera power supplies are to be used. The specified product shall be the MCSx-xE series power supply manufactured by PELCO or an approved equal. The use of individual transformers will not be accepted. A centralized Low Voltage power supply with Low Voltage wiring distribution to cameras for each building shall be included. Designs may vary and will need to be District approved. These power supplies shall be located in the appropriate MDF/IDF room in each building having surveillance cameras.

1.04 CABLING, RACEWAY, CONDUIT, SUPPORT AND LABELLING

A. All cabling, conduit, support and labeling shall comply with the requirements as outlined in Section 17020 of this document.

B. Video Cables: Video cables shall be RG59U equivalent or better up to 500FT, RG6 up to 750FT and RG11 up to 1500FT. All video cabling shall have 95% copper braid shielding and a solid copper center conductor.

C. All coaxial cabling for cameras mounted on the same building as the MDF room is housed in shall be home-run to the MDF to be connected to the DVR.

D. All coaxial cabling for cameras mounted on buildings other than where the MDF room is housed shall be home-run to the nearest IDF room. There the video signal will be converted to run over fiber optic cabling to be connected back to the MDF. Existing fiber optic backbone cables may be used for this purpose. If this will completely utilize all available spare fiber optic cabling strands the School District Representative shall be notified in writing.

E. All system cabling shall be neatly routed. Do not lay cables across joists. Security and/or Surveillance cable shall take the highest point available to ensure no interference with other types of required cable. All cabling shall be a minimum of 18" off joist. No system cabling shall be run across any electrical fixture or within 18" of any florescent lights. System cable shall not lay on or against any HVAC equipment, ducting, conduit system or plumbing system. No fastening devices shall be clamped to any existing equipment, threaded rods, ceiling hangars, straps, etc.

F. Cables of similar signal level shall be bundled together and kept physically separate from power cords, plug strips or other circuits with a difference of potential. All cabling must be supported with Bridle Rings or J-Hooks every 5 feet (Bridle Rings or J-Hooks must be at the highest point of the Building). If you have 2 or more cables in a run they must be tie wrapped every 2 feet. Cable bundles or individual cables shall be neatly secured with self-clinching nylon cable ties (Thomas & Betts or equal). Lacing of cables shall not be permitted.

G. Service loops at equipment panels shall be 5' and at the device location shall be 3'. All service loops shall be neatly secured above ceiling.

H. All cabling shall be pulled from central location to each building, even though all cameras for that building may not be installed. Contractor must take every precaution to protect all existing equipment, wiring, fixtures and building materials from damage during installation of equipment required in this bid. All cabling installed and not placed into operation must be properly terminated and protected. There will be no splicing of any cabling on these systems.

I. Connector Tooling: Tooling used to provide connectors shall be specifically designed for the connector being used. Utilization of non-specified tools shall be considered as grounds for cease and desist as well as possible grounds for termination of contract. Coaxial Cable Terminals shall be bayonet style two-piece connectors matched to the coaxial cable wire diameter in use. Twist on style connectors may NOT be used. Fiber Optic Connectors should be Anaerobic ST connectors.

J. All cabling entering an existing communications closet or electrical room shall be sleeved in EMT conduit. The conduit shall be carefully reamed and terminated with plastic bushings on both ends.

K. Equipment panels or equipment racks shall have EMT conduit installed between the panel and the ceiling space. The conduit shall be carefully reamed and terminated with plastic bushings on both ends.

L. All penetrations shall be properly sleeved and sealed according to applicable codes. Upon completion of project, a certified statement is to be submitted by the Contractor assuring the District that all penetrations have been sleeved and sealed. Example: Fire Wall penetration must be resealed using a Fire Proof/Resistant material to ensure the Fire Wall maintains original fire rating.

M. All cable exposed to the exterior shall be installed in the appropriate size conduit. (PVC/EMT as required). All conduit sleeves and raceways shall be carefully reamed to remove all burrs and sharp edges. Plastic bushings shall be used at all terminations and properly sealed.

N. All video connectors exposed to the weather at camera locations shall be filled with an insert of silicon 'grease' equal to Dow Corning DC #5 compound before mating with opposite connector half. The connection shall then be completely covered with heat shrink tubing.

O. System Labeling:

1. Cameras: all system cameras, housings, cables, power supplies, video adapters, and monitors shall be labeled with numbers corresponding to camera numbers shown on the contract drawings.

2. Console: A typewritten schedule of all camera numbers and their locations shall be laminated in clear plastic and fastened where directed in each operator's station with a suitable adhesive.

3. A campus map identifying each camera location shall be laminated and fastened where directed in each operator's station with a suitable adhesive.

4. Provisions: The exact description of each location shall be obtained from the Owner.

1.05 SURGE SUPPRESSION

A. Surge suppressors shall be provided for the video cable at each exterior mounted camera and for power cables to all cameras and associated equipment. All video cables and power circuits exiting any building must be protected. Where camera cables enter a building a surge protection device must be installed. Another protector shall also be installed at the headend location. Both ends of the power and video cable must be protected.

B. Surge suppressors shall be designed specifically for video surveillance use with BNC connectors. Suppressers located at the camera where the suppressor is <u>not</u> grounded shall utilize a suppresser that isolates the shield from ground during normal installation. Design selection; Ditek DTK-iBNC or equal.

C. Power/Video Protector shall protect as required the independent video and power cables to and from a particular camera. Design selection: Ditek DTK-PVP or equal.

D. As required at the headend location where all coaxial cables terminate, install a rack - mountable unit that supports the connections of up to 16 cameras with a single point ground. Design Selection: Ditek DTK-RM8/9/16 or equal.

E. Power surge suppression shall be provided for all 120V power supplying video surveillance equipment. Ditek DTK-8F-S or equal.

F. All surge suppressors required to be grounded shall be bonded to a ground buss bar by a home-run #10 stranded copper, green jacketed cable. Crimp style terminal lugs shall be used as required. The buss bar shall be bonded to a properly grounded telecommunications ground buss bar by a #6 stranded copper, green jacketed cable. No 'looping' of bonding cables will be accepted.

1.06 SYSTEM PERFORMANCE

G. The DVR shall be configured to support (3) three capture rates for archived video.

a. Alarm Mode – As triggered by an alarm from the intrusion detection system.

b. Event Mode – As triggered by motion detection sensed through pixelation.

c. Time Lapse Mode – Standard rate of capture for archived video.

H. The camera image quality and capture rates shall be optimized for the highest quality of archived video possible while maintaining a minimum 40 day archive. A return visit shall be required 45 days after substantial completion of the system. At that time the quality of archived video and storage capacity will be evaluated. Adjustments shall be made to ensure highest possible quality of video and to meet minimum archive capacity.

I. The DVR shall support five seconds of pre-alarm recording, maintained in a buffer, and shall append this buffer to the beginning of all recorded alarms. The DVR shall continue to record at the alarm rate until the alarm is reset, times out, or is acknowledged as determined by the alarm menu.

J. The DVR shall support from five seconds of pre-event recording, maintained in a buffer, and shall be append this buffer to the beginning of all recorded events. The DVR shall continue to record at the event rate until the programmed post-event duration of 15 seconds expires.

K. Each camera shall be titled in the programming with an appropriate, easily understood name as well as the camera number.

L. Integrity: A time domain reflectometer (TDR) shall be used to verify the integrity of all installed video cables and connectors. Any cables or connection which exhibits a structural return loss characteristic of less than 26db (reflection coefficient of 5.1%) shall not be considered acceptable and shall be replaced.

M. Charts: A strip chart for each cable tested shall be provided to the owner for future diagnostic use. Each chart shall be marked with the following data.

1. ***Description of cable being measured.***
2. ***At what point on the cable the TDR was attached.***
3. ***The footage to each anomaly.***
4. ***The reflection coefficient of each anomaly.***
5. ***The overall length of the cable or circuit being measured.***

D. The FM Systems Camera Master shall also be used for fine-tuning each camera. The CM-1 Camera Master shall be used to measure the five attributes of each camera's video signal:

1. ***SYNC to measure the amplitude of the video synchronizing pulse and thus can be used to establish correct video level, coaxial cable continuity and correct termination impedance.***
2. ***LUMINANCE to measure the "white level" of video, thus is used to adjust the camera IRIS to the correct setting for the existing lighting conditions.***
3. ***COMPOSITE to measure the overall amplitude of the video signal (the peak to peak level).***
4. ***COLOR BURST to measure the Color Burst amplitude of a Color Camera and is used to correctly slope equalize coaxial cable runs for best transmission of detail and color.***
5. ***FOCUS to set the Focus ring on the camera for the sharpest picture.***
6. ***Provide results of tests for each camera.***

1.07 COMPLETTION

A. The system will be considered complete when all of the following requirements have been met:

1. ***All ending cable leads and unused ports are terminated.***
2. ***All equipment is installed to manufacturers' specifications.***
3. ***All cabling in each enclosure, cabinet or closet is labeled.***
4. ***Copy of the blueprints showing all cabling and any changes to the "initial design layout" shall be provided to the owner.***
5. ***It shall be the responsibility of the Contractor to verify the ceiling tiles before performing this installation. Any broken or damaged ceiling tiles found at the end of this project shall be replaced by the Contractor before final payment is made.***

6. *Cleaning: Upon completion, all exterior surfaces of equipment shall be cleaned of fingerprints, paint splatters, and other foreign substances.*

7. *Repair: Any exposed surface, which has been scratched or damaged, shall be restored to like-new condition.*

8. *Debris: All wire trimmings, mortar, and foreign debris shall be removed from equipment areas and any area directly affected during the installation or service of equipment.*

9. *The contractor must provide a bound document complete with as-built drawings, programming, cut-sheets of the equipment used and training information.*

1.08 ACCEPTANCE INSPECTION

A. Be prepared to demonstrate to Engineer or School District Representative compliance of these specifications by all major items or pieces of equipment, as well as compliance with specifications for entire system at time of turn over. The Contractor shall demonstrate the operation of the system to the School District Representative during the final inspection in the following manner:

1. *Observe picture quality at all monitor locations and where software interfaces are installed. All cameras must be clear, focused and directed at the appropriate target.*

2. *Any other test the Engineer deems necessary to establish the system is operating properly.*

3. *The above tests and measurements shall be documented in the operation and maintenance manuals as the as-built conditions.*

4. *Formal instruction shall be given to owner designated key personnel at a time selected by owner. Such instruction shall consist of no less than 2 hours delivered in two (2) separate sessions. Training shall cover operation, programming, troubleshooting and maintenance.*

5. *A written report, signed by the instructor, shall be submitted to the owner with copies to the Architect, and Engineering Consultant, detailing subjects covered, names of persons instructed, dates and amount of instruction each person received. This report shall be submitted within one week following the instruction.*

1.09 WARRANTY

A. All video surveillance system equipment and cabling shall be guaranteed by the installing contractor to be free of defects in materials and workmanship for a period of one year from the date of substantial completion of the system.

B. Any system component, which shows evidence of failure or incorrect operation during the warranty period, shall be repaired or replaced by the contractor at no expense to the owner.

1.10 ASBUILT DRAWINGS

A. General: Complete system as-built drawings shall be provided with the following information;

1. A block diagram of the entire system indicating all cables, cable types, active and passive components.

SECTION 17060
INTRUSION DETECTION SYSTEM

PART 1 – GENERAL REQUIREMENTS

1.01 SUMMARY

A. All schools within the district shall have an Intrusion Detection System (IDS). The basic system will consist of door contacts on exterior doors, dual technology motion detectors in key areas and keypads at main employee entrances. All devices will connect to a master control panel located in the school's Main Distribution Facility (MDF). It shall be each individual school's decision to have the system monitored, and to grant arm/disarm privileges to employees. The school's principal shall determine acceptable pass-codes, which shall be provided to the School District Representative. The School District has selected Digital Monitoring Products as their single-source manufacturer of Intrusion Detection Systems. No substitute is allowed.

B. Security systems are critical in assuring life and property protection. Therefore, it is imperative that they perform their function properly and reliably. This specification has been prepared to assure that all installations of these systems meet the District's security needs.

C. This section outlines the quality, type and installation of the building intrusion detection system. Included in this Section the contractor shall provide all labor, equipment, and materials necessary for a complete, tested and operational system. The scope of these specifications is to insure the delivery of a complete unit, ready for operations. Omission of any essential detail from these specifications does not relieve the supplier from the furnishing of a complete unit.

D. Approval of samples, cut sheets, shop drawings, and other matter submitted by the contractor shall not relieve the contractor's responsibility for full compliance with the specifications, unless the attention of the School District Representative is called to each non-complying feature by letter accompanying the submitted matter.

E. All equipment must be new, of current manufacture and carry standard warranties. At least two complete shop repair manuals and parts lists must be furnished with each type of equipment at the time of delivery.

F. Contractor shall be responsible for all false alarms reported and invoiced by the local Police and Sheriff's Office during the time of installation, until the system is accepted and signed off on by the School District Representative.

G. Contractor shall be responsible for the demolition, removal and disposal of obsolete/unused IDS cabling and equipment on any replacement/retrofit projects.

H. Typical locations to be monitored by the IDS include but shall not be limited to: Administration Offices, Media Centers, Computer Labs and as specified by the School District Representative. The exact number, type and location of sensors shall be dependent on the site plan as approved by the Project Engineer and School District Representative

I. All control or zone expansion panels shall be installed in the local MDF/IDF room at a location accessible without a ladder. No equipment shall be installed above ceiling.

1.02 CONTRACTOR QUALIFICATIONS

A. The contractor must be a qualified systems integrator with local service facilities within 25 miles of the School District offices located at 817 Bill Beck Blvd in Kissimmee, Florida.

B. The contractor must have DMP factory trained technicians on staff.

C. The contractor must have sufficient personnel and facilities to be able to provide 2 hour on-site response to any and all situations involving the intrusion detection system. The contractor must provide 24 hour on-call service via a toll free number. Additionally, the contractor must be able to provide full alarm monitoring at a UL certified Central Station.

D. The contractor must have performed work of comparable scope at educational facilities within the last 2 years with proof of exemplary performance. Should the School District Representative require it, the contractor must facilitate site visits.

E. The contractor must have the ability to provide Auto CAD drawings of the system design and as-built drawings upon project completion.

1.03 EQUIPMENT - The system shall include but not be limited to the following:

A. Intrusion Detection Control Panel – The IDS control panel with Ethernet connectivity shall be DMP XR500NL as manufactured by Digital Monitoring Products. The IDS control panel shall be of modular design for ease of future system extension and/or modification. Zones shall be configured for ease of operation and servicing.

B. Motion Detectors - Motion Detectors shall be dual-technology employing microwave motion detection combined with passive infra-red heat detection to minimize false alarms. Individual motion detectors may be corner mounted or 360 degree ceiling mounted units. Motion detectors intended for use outdoors must be designed for external use and must be mounted using industry standard weather-resistant materials and methods. The contractor shall mount motion detectors according to manufacturers recommendations. The motion detector must be Rokonet 150T, Rokonet 125T, Rokonet 115T, Protech or an approved equal.

C. Door Contacts – Door contacts shall be flush mounted where possible. All new school installations will be designed to incorporate flush mounted contacts. For existing facilities, the contractor shall use recessed contacts whenever possible. The exception shall be when it is cost prohibitive to get cabling to the connection point or the installation would require substantial labor. The School District Representative shall be contacted to grant permission on an as-needed basis. For flush-mounted door contacts, the contact shall be the Sentrol 1078C or an approved equal. For surface mounted contacts, the contact shall be a Sentrol 2505A or an approved equal. For roll-up doors, the contact shall be the Sentrol 2207AU-L or an approved equal.

D. Keypads – The Product specified shall be DMP models 690 or 793 manufactured by Digital Monitoring Products. Keypads shall be located at primary entrances determined by the School District Representative. The keypad shall be mounted at a height that is convenient to read the LCD and meets all applicable codes.

E. Power Supply - Power supplies shall be manufactured by DMP unless otherwise approved by the School District Representative in writing. The power supply shall have a continuous rating adequate to power all zones and functions in full alarm indefinitely. Contractor shall be responsible for the mating of the transformer to the power receptacle. If the power receptacle will not allow for the proper mounting of the transformer then the contractor must supply an approved receptacle replacement. (Electrical Contractor required).

1.04 CABLING, RACEWAY, CONDUIT, SUPPORT AND LABELLING

A. All cabling, conduit, support and labeling shall comply with the requirements as outlined in Section 17020 of this document.

B. Cabling in metal conduit or surface metal raceway shall have copper conductors, sized in accordance with the equipment manufacturer's recommendations, but in no case shall detection circuits be less than 22 AWG stranded/solid, or alarm circuits less than 18 AWG. All junction boxes that are visible or accessible shall be marked, unless in finished areas.

C. All devices (keypads, motion detectors, etc.) shall be installed with the cabling concealed in the wall. If cabling cannot be concealed in the wall the contractor shall submit a method of concealment to the School District Representative for approval.

D. All cabling to devices shall be home-run back to the local MDF/IDF room. The keypad and LX buss cabling between buildings shall be 18 gauge 4 conductor wet location cables minimum. The product specified shall be West Penn AQ244 manufactured by CDT or an approved equal.

E. All wiring shall be appropriately color-coded, and permanent wire markers shall be used to identify the terminations for each circuit at the control panel.

F. All system cabling shall be neatly routed. Do not lay cables across joists. IDS cabling shall take the highest point available to ensure no interference with other types of required cable. All cabling shall be a minimum of 18" off joist. No system cabling shall be run across any electrical fixture or within 18" of any florescent lights. System cable shall not lay on or against any HVAC equipment, ducting, conduit system or plumbing system. No fastening devices shall be clamped to any existing equipment, threaded rods, ceiling grid hangars, straps, etc.

G. Cables of similar signal level shall be bundled together and kept physically separate from power cords, plug strips or other circuits with a difference of potential. All cabling must be supported with Bridle Rings or J-Hooks every 5 feet (Bridle Rings or J-Hooks must be at the highest point of the Building). If two or more cables are ran together they must be tie wrapped every 2 feet. Cable bundles or individual cables shall be neatly secured with self-clinching nylon cable ties (Thomas & Betts or equal). Lacing of cables shall not be permitted.

H. Service loops at equipment panels shall be 3' and at the device location shall be 1'. All service loops shall be neatly secured above ceiling.

I. All cabling shall be pulled from central location to each building, even though all devices for that building may not be installed. Contractor must take every precaution to protect all existing equipment, wiring, fixtures and building materials from damage during installation of equipment required. All cabling installed and not placed into operation must be properly terminated and protected. There shall be no splicing of any cabling on these systems.

J. All cabling entering an existing communications closet or electrical room shall be sleeved in EMT conduit. The conduit shall be carefully reamed and terminated with plastic bushings on both ends.

K. Equipment panels or equipment racks shall have EMT conduit installed between the panel and the ceiling space. The conduit shall be carefully reamed and terminated with plastic bushings on both ends.

L. All penetrations shall be properly sleeved and sealed according to applicable codes. Upon completion of project, a certified statement is to be submitted by the Contractor assuring the District that all penetrations have been sleeved and sealed. Example: Fire Wall penetration must be resealed using a Fire Proof/Resistant material to ensure the Fire Wall maintains the original fire rating.

M. All cable exposed to the exterior shall be installed in the appropriate size conduit. (PVC/EMT as required). All conduit sleeves and raceways shall be carefully reamed to remove all burrs and sharp edges. Plastic bushings shall be used at all terminations and properly sealed.

N. System Labeling:

1. *All system devices, housings, cables and power supplies shall be labeled with numbers corresponding to zone/room numbers shown on the contract drawings.*

2. *Control Panel: A typewritten schedule of all device zone numbers and their locations shall be laminated in clear plastic and fastened in each IDS control/expansion panel with a suitable adhesive.*

3. *A campus map identifying each device location shall be laminated and fastened at the IDS control panel with a suitable adhesive.*

4. *The exact title/description of each location shall be obtained from the Owner.*

5. *Identification of individual devices is required, by assigning each a unique number on the plans as follows: (Zone # - Device #). This number shall also be permanently noted on the device.*

1.05 SURGE SUPPRESSION

A. The system must be equipped with protective devices to prevent damage or false alarms by nearby lighting strikes, stray currents, or line voltage fluctuations.

1. On AC Input: Ditek DTK-1FS or equal.

2. On DC Circuits Extending Outside Building: Ditek DTK-LVLP Series or equal.

B. All surge suppressors required to be grounded shall be bonded to a ground buss bar by a home-run #10 stranded, copper, green jacketed cable. Crimp style terminal lugs shall be used as required. The buss bar shall be bonded to a properly grounded telecommunications ground buss bar by a #6 stranded, copper, green jacketed cable. No 'looping' of bonding cables will be accepted.

1.06 SYSTEM PERFORMANCE

A. The DMP intrusion detection system may either be auto-armed according to a schedule determined by the school principal and the School District Representative, or, armed and disarmed via access code. Alternatively, the school district may elect to use proximity technology to eliminate the use of access codes.

B. When armed, the system must respond immediately to an alarm activation. No dialer delay is acceptable. Upon activation, the system will cause blue siren/strobes located on the school's exterior façade to power up. If the system is monitored, a Central Station shall call the district based on the information provided at installation completion.

C. All Systems shall be installed, configured and made ready for remote programming capability via Ethernet.

D. The panel shall be programmed to require a closing code to prevent false alarms due to unauthorized arming of the system.

E. Each zone shall be titled in the programming with an appropriate, easily understood name as well as the zone number. See 1.04 – N – 5.

1.07 COMPLETTION

A. The system will be considered complete when all of the following requirements have been met:

1. All devices are installed as per the drawings.

2. The system notes and responds to alarm activations by all connected devices.

3. The system activity is logged and visible at the School District Representative's central monitoring server.

4. All applicable personnel at the school have been trained and a document noting the training, date, trainer and attendees has been signed and forwarded to the School District Representative.

5. *All ending cable leads and unused ports are terminated.*

6. *All equipment is installed to manufacturers' specifications.*

7. *All cabling in each enclosure, cabinet or closet is labeled.*

8. *Demolition of any pre-existing cabling or equipment has been accomplished.*

9. *Copy of the blueprints showing all cabling and any changes to the "initial design layout" shall be provided to the owner.*

10. *The contractor must provide a bound document complete with as-built drawings, programming, cut-sheets of the equipment used and training information.*

11. *It shall be the responsibility of the Contractor to verify the ceiling tiles before performing this installation. Any broken or damaged ceiling tiles found at the end of this project shall be replaced by the Contractor before final payment is made.*

1.08 ACCEPTANCE INSPECTION

A. Be prepared to demonstrate to the Project Engineer or School District Representative compliance of these specifications by all major items or pieces of equipment, as well as compliance with specifications for entire system at time of turn over. The Contractor shall demonstrate the operation of the system to the School District Representative during the final inspection in the following manner:

1. *Observe the arming and disarming of the system with no zone faults. Observe the activation of an alarm. Observe verification that the system is transmitting to the monitoring station.*

2. *Any other test the Engineer deems necessary to establish the system is operating properly.*

3. *The above tests and measurements shall be documented in the operation and maintenance manuals as the as-built conditions.*

4. *Formal instruction shall be given to owner designated key personnel at a time selected by owner. Such instruction shall consist of no less than 2 hours delivered in two (2) separate sessions. Training shall cover operation, programming, troubleshooting and maintenance.*

5. *A written report, signed by the instructor, shall be submitted to the owner with copies to the Architect, and Engineering Consultant, detailing subjects covered, names of persons instructed, dates and amount of instruction each person received. This report shall be submitted within one week following the instruction.*

1.09 WARRANTY

A. All intrusion detection system equipment and cabling shall be guaranteed by the installing contractor to be free of defects in materials and workmanship for a period of one year from the date of substantial completion of the system.

B. Any system component, which shows evidence of failure or incorrect operation during the warranty period, shall be repaired or replaced by the contractor at no expense to the owner.

1.10 ASBUILT DRAWINGS

A. General: Complete system as-built drawings shall be provided with the following information:

1. *A block diagram of the entire system indicating all cables, cable types, active and passive components.*

2. *A block diagram of the building or campus indicating the zone/area layout of the system.*

3. *If the site already has CAD drawings available the contractor shall update them as requested by the District Representative.*

SECTION 17090
PORTABLE CLASSROOMS SYSTEMS CABLING, HARDWARE AND EQUIPMENT INSTALLATION

PART 1 – GENERAL REQUIREMENTS

1.01 SUMMARY

A. Although portable systems installation layouts will vary dependant upon the age or re-use of the original systems installation within each portable the basic cabling and hardware scheme should remain reasonably constant. Installation locations can and do also vary within each portable. However, all systems equipment, cabling and hardware for data, telephone, television and intercom systems signals should normally be installed at the same location as the data cabinet or shelf.

B. All cabling, conduit, support and labeling shall comply with the requirements as outlined in Section 17020 of this document.

1.02 PORTABLE DATA/IDF CABINET INSTALLATION

A. In each portable at a pre-determined location shall be installed one (1) data/systems cabinet. The specified cabinet shall be the Hubbell REBOX brand cabinet. The model, size, and/or installed accessory components of which could vary dependant upon needs within the portable. Model #s will most commonly be the IDF32, RE2, or RE4X. Each cabinet shall have an equipment cooling fan installed, model: CPI 13051-001. Consult authorized district representative for exact location. This data cabinet shall be installed as a common point of cross-connection for incoming signals to the appropriate outlet cabling or other locations as needed. A voice and data backboard painted with fire retardant paint shall be installed for support as required by authorized district representative. On newer installations the rule in most situations is to install this backboard however, on older or temporary installations this may not be installed which is acceptable as long as all hardware is properly mounted and secure. Authorized district representative shall have final say in all installation decisions.

B. At this location shall be installed one (1) general power duplex receptacle and one (1) #6 stranded copper green jacketed ground wire homerun installed from the portable electrical panel to a systems grounds block. Both items shall be installed within all systems cabinets or for systems shelves both items will be installed within approximately twelve inches distance of the shelf at a height above eighty-inches.

C. All systems cabinets to include their ground cable and power receptacle will normally be installed where permissible at minimum 80 inches above finished floor or as high as the portable ceiling will permit installation. However, height may vary with each installation.

D. All systems cabinets shall be homerun grounded to the systems ground block and by installation of the dedicated duplex general power receptacle.

1.03 SYSTEMS GROUNDING BLOCK INSTALLATION

A. Installed at the systems data cabinet whichever is the case shall be an installed grounding block with a homerun #6 stranded copper green-jacketed ground connection installed to the space electrical panel.

B. All grounding connections for the incoming systems cabling will be individually homerun installed from each device to this ground block.

C. Normally three devices apply. These are one (1) CATV 145 voltage / surge suppression device, the shielded sheath of the incoming PE89 voice cable and the MGB (main grounding bar) installed on the voice / 66 block. Other items not listed may apply dependant upon the installation.

1.04 VOICE AND DATA OUTLET INSTALLATION

A. For the normal portable classroom installation configuration there shall be installed three (3) Category 5E or above data outlets at pre-determined locations. These outlets will normally be four (4) port D4 type outlets. Consult authorized district representative for exact locations.

B. The normally blue Category 5E or above cable used for all voice and data outlet installations shall be homerun installed from each outlet location to a patch panel installed within the systems cabinet at each portable.

C. All outlets shall be labeled with printed labels consecutively numbered to match the respective patch panel port for ease of location in patching or troubleshooting.

D. The top of each voice and data outlet shall be installed at a height of eighteen inches above finished floor or installed to match existing power and data outlets and within twelve to twenty-four inches distance from an installed dedicated duplex general power receptacle. Any unused ports of the data outlets will be blanked off with an appropriate faceplate blank.

1.05 CLOSED CIRCUIT TELEVISION (CCTV) INSTALLATION

A. For the normal portable classroom installation there will be installed one (1) Closed Circuit Cable Television coaxial outlet connection. This connection shall be installed dependant upon the layout of the portable either separately or in the same outlet as one of the three D4 data outlets is installed. Consult authorized district representative for exact location.

B. The coaxial cable connection (indoor cable) will be homerun installed from the CCTV outlet location to the output side of one (1) CATV 145 voltage / surge suppression device located at the data shelf or systems data cabinet at each portable. Each coaxial "F" connector shall be properly trimmed and crimped with an appropriate crimp tool and have a clean tight connection.

C. A #6 stranded copper green jacketed ground connection shall be homerun installed from a lug attached to the center post of the CATV 145 voltage / surge suppression device to the installed systems ground block located at the data shelf or in the systems data cabinet at each portable.

D. The incoming coaxial cable (flooded outdoor cable) will be homerun installed from the pedestal location to the input side of the installed CATV 145 voltage / surge suppression device. Each coaxial "F" connector shall be properly trimmed and crimped with an appropriate crimp tool and have a clean tight connection.

E. The top of each CCTV outlet will be installed at a height of eighteen inches above finished floor and or installed to match existing power and data outlets and within twelve to twenty-four inches distance from an installed dedicated duplex general power receptacle. Any unused ports of the CCTV/data outlets will be blanked off with an appropriate faceplate blank.

1.06 INTERCOM SPEAKER AND CALL BUTTON INSTALLATION

A. An operational intercom speaker shall be located at minimum eighty-inches above finished floor where permissible with an operational call button usually installed at 48 inches above finished floor. Note: Even though usually installed, the call button may not be operational dependant upon the intercom system configuration at that particular campus location. In both cases the installed speaker shall be connected and function for purposes of "All Call" general announcements.

B. The main indoor intercom cable shall be homerun installed from the location of the intercom speaker and call button assembly and terminate on up to five (5) pins (usually terminating on the bottom five pins) to one side only of the installed voice / 66 block.

C. Terminated on the same five adjacent indoor intercom 66 block pins as the will be the terminated outdoor intercom cable. Bridge clips will be installed between the adjacent pins allowing the intercom signal path to be completed to the installed speaker and call button assembly.

1.07 TELEPHONE INSTALLATION

A. A PE89 telephone cable (shielded flooded outdoor cable) usually containing not more than six (6) phone pairs shall be terminated to the top six pairs of pins and shall be installed to one side only of the voice 66 block.

B. One (1) - #6 stranded copper green-jacketed ground connection shall be homerun installed from a lug attached to the PE89 telephone cable shielded jacket to the installed systems ground block located at the data shelf or systems data cabinet at each portable.

C. One (1) - #6 stranded copper green-jacketed ground connection shall be homerun installed from a lug attached to the MGB (main grounding bar) installed on the voice / 66 block bracket to the installed systems ground block located at the data shelf or systems data cabinet at each portable.

D. The first or blue/white pair of leads on the PE89 cable shall terminate on the first pair of on side of 66 block pins. On the pins adjacent to the outdoor cable will usually be the blue/white terminated pair of a category 5E or above patch cord (consisting of indoor cable) or an installed cross connect wire and RJ11 connector carrying the telephone signal to the patched in port of a data outlet where the telephone shall be installed.

E. An EDCO voice voltage / surge suppression device (protector) usually either marked HAE or HDE (until superceded) shall be installed to complete the connection between the indoor and outdoor cables thus completing the path for dial tone to the installed telephone. The EDCO Protector shall fasten to the 66 block pins and to the MGB (main grounding bar), which shall be installed on the same side of the 66 block as the outdoor phone cable, has been installed.

1.08 FIBER OPTIC MULTIMODE CABLE INSTALLATION

A. A minimum of two (2) connectors on each end of an indoor/outdoor six strand tight buffered multi-mode fiber optic data cable shall terminate to an installed fiber block and barrels with either "SC" or "ST" type connectors. Normally only the first two strands - blue and Osceola in color will be terminated to these connectors.

1.09 OUTDOOR / INCOMING BACKBONE CABLE INSTALLATION

A. A systems cable access point shall be installed to supply the building feeds to each portable. The usual installation shall include a homerun 1-¼ inch PVC conduit from a nearby pedestal location. This 1-¼ inch PVC conduit will normally stub out into a 12X12 inch PVC box. Out of this 12X12 inch PVC box will stub a 1-¼ inch PVC conduit sweep to the under side of each portable.

B. The location of this box and conduit may or may not be near the location of the entrance to the portable shelf or systems cabinet within the portable. Regardless of the location of the conduit the outdoor cable will be adequately supported and cable tied from the box and stub out to the access point / entrance into the portable for each portable shelf or cabinet location.

C. At the access point all cabling will have a minimum five foot service slack properly cable tied and supported usually but not always located near the box and stub out. These cables will be labeled at the portable shelf or cabinet location indicating the location of the far end point of termination.

D. Where all systems cables enter the portable there shall be installed a PANDUIT T-70 or other approved raceway that will cover all exposed cable from the entrance point to the point of termination at the data shelf or systems data cabinet in each portable.

1.10 OVERALL SYSTEMS CABLE INDOOR AND OUTDOOR TO OUTLET / EQUIPMENT INSTALLATION

A. For all cable run installations to include the outdoor feeder cables consisting of shielded flooded PE89 telephone and flooded coaxial cable, indoor/outdoor rated intercom and fiber optic cable as well as the indoor cable normally blue Category 5E or above cable, indoor coaxial cable, indoor/outdoor rated intercom and fiber optic cable whether the cable runs are above ceiling or underneath the portable, all cabling will be adequately supported and cable tied from the outlet or space equipment to the point of termination at the systems cabinet or shelves.

B. Supports should be placed approximately every four to five feet with tie wraps installed approximately every two feet. However, the distance of the supports and tie wraps may vary more or less dependently upon the installation. Under no circumstance shall systems cable runs of any type be strapped to portable straps, anchors, EMT conduit or supports not intended for systems wiring support. Consult authorized district representative for clarification if an issue arises. Authorized district representative shall have final say in all aspects of the installation.

1.11 CABLE STUB OUT / OUTLET LOCATIONS

A. At each EMT type data stub out whether located above ceiling or underneath the portable there shall always be a bushing or coupler installed on the conduit and a minimum one-foot of service slack for all types of cable installed.

B. All cable will be properly cable tied and supported. In no circumstance is electrical or other tape or any type of wire or string a suitable or acceptable substitute for cable tie wraps.

C. No cable support device shall be attached to any grid hangar or threaded rod not intended for cable system support.

At the portable access point stub out / entrance to each data or coaxial CCTV outlet cabling installation the cable run will have a minimum one (1) foot service slack properly dressed.

Appendix A

SDOC MDF/IDF CAT 5
Patch Cable
Color Standard

Yellow/Blue – Data

Osceola – Safety/Security (Video Surveillance, Intrusion & Fire alarm systems only)

Black – VoIP

Pink – Wireless

Red – Crossover

Violet/Purple – Servers

Green – IPTV

Gray – Printer

White – HVAC

Appendix B

Standards Variance Form

Technology Standards Variance Request Form

To request an exception to the School District of Osceola County's Technology Standards, complete this form and turn it over to the Facilities Planning Project Coordinator for the project involved. The SDOC Technology Services Department Project Manager will review your request within one week of receipt, approve or deny and contact the Project Coordinator. Deviation from the School District of Osceola County's Technology Standards will not be allowed without the SDOC TSD's approval.

Project Coordinator _____
Project involved _____
Date Variance Requested _____
Requesting Agency _____

Variance Requested:

_____
_____
_____
_____
_____

Reason for Variance Request:

_____
_____
_____
_____
_____

SDOC TSD Approval:

_____
_____

TSD Signature: _____
Date Approved: _____

END OF
DIVISION 17 – VOICE, VIDEO & DATA

APPENDIX A

Cad Standards – Osceola County School District

Osceola School District currently implements AutoCAD for three main purposes:

1 *Master Planning*
2 *Maintenance of the survey map database*
3 *Maintenance of construction drawing databases for both existing buildings and new projects.*

It is required that all drawings for new buildings be created using AutoCAD, most current version, or a version compatible with the most current version. In order for the school district to utilize drawings created by consultants on the District's AutoCAD system, the following standards have been established.

Dimensions and Leaders

Dimensions shall be created using slash tick marks 3/16" long; extension line shall extend beyond dimension line 3/16"; dimension line shall not extend beyond extension line; dimension lines will be located 1/4" from object being dimensioned; adjacent dimension lines will be located 1/4" apart; architectural dimensions will be indicated to the closest 1/16" unless design requires closer tolerances; text shall be parallel to dimension line, 1/8" in height and shall be centered 1/16" above dimension line when practical; all dimension components shall be the same color in relationship to each other and the same color as the layer they are on.

Schedules and Attributes

It is the district's goal to utilize attributes to help maintain inventory lists of items such as hardware, equipment, and furnishings. It is preferred that such items shown on the drawings be associated with an attribute which is used to generate the schedules. If the items specified are not the items installed, then the attributes shall also be changed on the as-builts. (See Final Deliverables below)

Final Deliverables

1 *At the completion of "THE PROJECT", the Architect shall turn over to the district the following: (per "Agreement for Architectural/Engineering Services - exhibit G - 2.13.3.2)*

a. *All drawing databases on Windows compatible CD. The disks shall also include any fonts, custom blocks, symbols, etc. that the district does not have loaded on their system. All conversions that may be required will be complete. Drawings will be loadable on the district's system without any further manipulation required.*

2 *At the completion of "THE PROJECT", the contractor shall provide through the Architect as-built drawings. The architect shall supply the Osceola County School District as-built drawings as follows: (per "Agreement for Architectural/Engineering Services - exhibit G - 2.13.3.1)*

a. *ARCHITECT/ENGINEER shall prepare and furnish to OWNER, within thirty days (30) after completion of construction of "THE PROJECT", a complete reproducible Mylar set of as-built drawings, three (3) sets of printed as-built documents, (30"x42"), and three (3) sets of printed as-built documents (17"x22"). Owner will pay the printing cost incurred in connection therewith.*

b. *The architect shall consult with the district to obtain the district room numbers (FISH) and the reduced plans shall contain those district room numbers (FISH). (Not the room numbers used for room scheduling purposes on the construction drawings.)*

Layering Format

Use the latest AIA version of layering as provided with your Autocad software. If your software does not provide pre-defined layering, use the latest AIA published standard.

Also provide SDOC with any non standard line types, and fonts or shape files, as well as your plotting .ctb file.

Line Type / Styles

Type No.	Line Type / Style
0	Continuous
10	Border
20	Center
21	Center2
30	Dashed2
40	Divide
50	Hidden
51	Hidden2
60	Phantom2

Text Height Guidelines	
Use	**Plotted Height**
Major Titles	.25"
Subtitles	.1875"
Notes, Dimensions, Etc.	.1250"

Text Styles / Fonts			
Style	**Font File**	**Height**	**Use**
Txt	TXT.shx	0	In-house check plots
Monotxt	Monotxt.shx	0	Monospaced text
Romand	Romand.shx	0	Proportional text
Arch	Archstyl.shx	0.125"	Architectural notes
H2N	H2H.shx	0	Schedule headers
Solid2	Solid2.shx	0	Coversheet
Helvfull	Helvfull.shx	0	Coversheet / Title block

Typical Drawing Scales and Variables

The following drawing scales guidelines have been established by the School District to assist the Consultant while maintaining conformity to what are normal industry standard formats.

File and Drawing Nunbering Standards

Drawing Type	Typical Scales
Site, Civil, Landscape	1"=25', 1"=50', 1"=100' 1"=1000'
Floor Plans	1/4"=1'-0", 1/8"=1'-0", 1/16"=1'-0"
Elevations	1/4"=1'-0", 1/8"=1'-0"

Building Sections	*1/4"=1'-0", 1/8"=1'-0"*
Detail Sections	*3/4"=1'-0", 1/2"=1'-0", 1/4"-1'-0" 1/8"=1'-0"*
Details	*3"=1'-0", 1-1/2"=1'-0", 1"=1'-0"*

Scale Factors *- All entitles, blocks shall be scaled accordingly to achieve the desired drawing scale.*

Linetype Scales *- Shall be one-half (1/2) of the corresponding scale factor.*

Dimscale *- The dimscale variable shall correspond 1:1 to the scale factor.*

View Resolution *- Set to 10,000*

Origin / Coordinate System

The AutoCAD User Coordinate System (UCS) must match the geographic coordinate system for the site. Files which are "attached" for Xref purposed shall use the coordinates 0,0,0 as the insertion point.

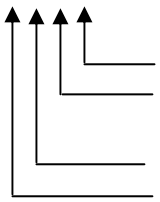
Note: Attached Xref files shall not contain path or directory specific links.

Drawing and File Numbering System

Drawing and file numbering shall comply with the following standards (with the exception of Xref.
Files)

Example

AD2.2.1



Sheet number 1 of a sequential order
Floor level or sub-category as applicable (2 indicates 2nd level)
Structure category (2 for architecture indicates a plan).
Selection / Discipline category (AD - Architectural Demolition sheet).

Note*: Xref files should always begin with the letter "X-" and be followed by a logical naming convention (X-bldg100-1stflr, X-Site, etc.)*

Drawing Section / Discipline Indicator *- First component of the sheet numbering system.*

Section / Discipline	*Description*
CS	*Cover Sheet*
IS	*Information Sheet*
C	*Civil*
L	*Landscape*
S	*Structural*
A	*Architecture*

AF	*Architectural Food Service*
M	*Mechanical*
P	*Plumbing*
FP	*Fire Protection*
E	*Electrical*
**D*	*Modifier used with any of the discipline indicators above to delineate Demolition or Existing condition drawing.*

Drawing Structure Category *- Second component of the sheet numbering system.*

Category Indicator	***Description***
Civil	
0	*Civil Information Sheet, Legends, Symbols. Etc.*
1	*Surveys*
2	*Plans/Profiles*
3	*Utilities*
4	*Drainage*
5	*Structural*
6	*Schedules*
7	*Details*
8	*Open*
Landscape	
0	*L/S Information Sheet, Legends, Symbols. Etc.*
1	*Landscape Plans*
2	*Landscape Schedules*
3	*Details*
4	*Irrigation Plans*
5	*Irrigation Schedules*
6	*Details*
7	*Open*
Architectural	
0	*General Information, Legend, Symbols, Etc.*
1	*Overall, Life safety, Phasing plans, Etc.*
2	*Floor Plans*
3	*Reflected Ceiling Plans*
4	*Roof Plans*
5	*Elevations (Exterior, Interior)*
6	*Sections (Building, Wall)*
7	*Schedules (All)*
8	*Details*
9	*(Open)*
Food Service	
0	*General Information, Legend, Symbols, Etc.*
1	*Overall Plans, Phasing plans, Etc.*
2	*Food Service Plans*
3	*Enlarged Plans*
4	*Schedules*

5	*Details*
6	*(Open)*
Structural	
0	*General Information, Legend, Symbols, Etc.*
1	*Foundations*
2	*Slab Plans*
3	*Framing Plans*
4	*Sections*
5	*Schedules*
6	*Details*
7	*(Open)*
Category Indicator	***Description***
Mechanical	
0	*General Information, Legend, Symbols, Etc.*
1	*Overall Plans, Phasing plans, Etc.*
2	*HVAC Plans*
3	*Enlarged Plans*
4	*Sections*
5	*Schematics*
6	*Details*
7	*Schedules*
8	*Controls / Connections*
9	*(Open)*
Plumbing	
0	*General Information, Legend, Symbols, Etc.*
1	*Overall Plans, Phasing plans, Etc.*
2	*Plumbing Plans*
3	*Enlarged Plans*
4	*Riser Diagrams*
5	*Details*
6	*Schedules*
7	*(open)*
Fire Protection	
0	*General Information, Legend, Symbols, Etc.*
1	*Overall Plans, Phasing plans, Etc.*
2	*Fire Protection Floor Plans*
3	*Enlarge Plans*
4	*Schematics*
5	*Details*
6	*(Open)*
Mechanical	
0	*General Information, Legend, Symbols, Etc.*
1	*Overall Plans, Phasing plans, Etc.*
2	*Power Plans*
3	*Lighting Plans*

4	*Systems Plans*
5	*Lightning Protections Plans*
6	*Panel Schedules*
7	*System Riser Diagrams*
8	*Details*
9	*Enlarged Plans*

Level / Sub-category Indicator *- Third component of the sheet numbering system will indicate the floor level as applicable to the sheet or may be used to designate a sub-category is used with one of the above category indicators.*

Example: *AD-2.2.2 would indicate an Architectural Demolition floor plan on the second level plan.*
A-3.2.1 would indicate an Architectural Reflected ceiling plan on the second level.
A-5.1.1 could be the first sheet of Exterior Elevations, where as
A-5.2.1 could be the first sheet of Interior Elevations.

If a floor level is the indication, the corresponding sheets for other disciplines will also use the level indicator structure.

Example: *A-2.2.1 the Architectural floor plan for a second level area should correspond to*
E-2.2.1 second level power plan, and
E-3.2.1 second level lighting plan, and
second level HVAC
M-2.2.1 plan.

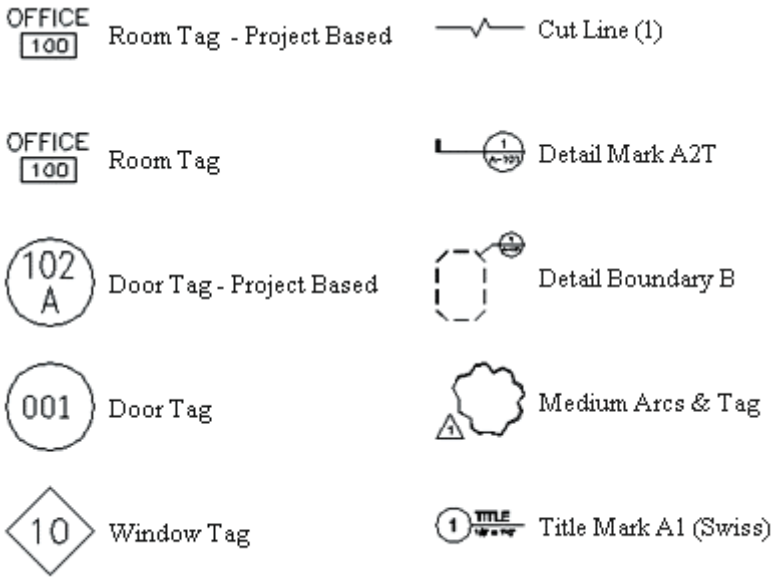
Sequential Modifier *- The final component of the sheet number would be the sequential of the sheet for the section or a sub-section. As the highest number that can be used will be 9, the proper utilization of the Section / Category and the Level / Sub-Level section is necessary.*

All drawings in the package shall be listed in the Drawing Index on the Information

Sheet (IS) under the respective discipline.

Symbol Guidelines

Standard symbols as supplied with Autodesk ADT should be used (see examples below).



1 *Symbols shall be inserted as AutoCAD blocks. They shall use the names and origin points as provided by the Software (ADT)*

2 *Symbols shall be inserted on the appropriate discipline layers.*

3 *Symbols, unless otherwise noted. Shall have an origin point at the symmetrical center of the symbol.*

4 *Text within the symbol shall be sized to achieve a minimum of 0.125" plotted text height.*

Symbol Creation Guidelines - *The following guidelines apply only when creating a new symbol:*

1 *If the symbol is not already included in the ADT library, it's composition and name shall be approved by the Facilities and Construction Department. The design and information (attributes) shall conform to Osceola County text and layering standards.*

2 *Any "text" to be included in the symbol shall be sized to achieve a minimum of 0.125" in plotted text height. Plotted text shall be a minimum of 0.35 solid line weight.*

3 *All symbol entities shall reside on layer (0). Entity colors shall be assigned according to the desired plot product.*

Files and Drawings Provided by Osceola County

Osceola County School District Provided Files - The listing of files below will be provided for your use on all Osceola County School District Jobs. The only allowable modifications to these files are for the addition of your Corporate Logo and information.

Provided Files

"TITLE(xxxx).dwg"	*These are block files with attributes to be inserted on the drawing sheets after the borders have been "Xref'ed". These contain the sheet by sheet variable information, Drawn by, project #. Drawing sheet number, etc. The information in ( ) correspond to the appropriate sheet borders that they are to be inserted in.*
"x-bor(xxxx).dwg"	*These are Osceola County School District "title" sheets, or borders that are to be Xref'ed into your drawings. The information in ( ) indicate the appropriate drawing sheet size. The only allowable modifications to these files are for the addition of your Corporate Logo and information.*

APPENDIX B

QUALITY CONTROL AND SUBMITTAL GUIDELINES

Quality control both in the design and construction stages of a project are important considerations for the Osceola School District. The design professional shall use the following outline as a way of ensuring that maximum quality assurance is achieved. The following items are not intended to indicate the limits of the design professional's responsibilities. All contractual obligations shall be met in addition to all other required professional duties whether explicit or implied.

A. Design

1. Services

   a. Project meets owner's program and requirements
   b. Project complies with owner's design standards.
   c. Provide adequate staff, proper scheduling, early costcontrol/ estimating, and understand project scope.
   d. Respond and plan for any requirements that may be interpreted as a limitation.

2. Schedule

   a. Establish and comply with a realistic design schedule.
   b. Respond to changes in scope that affect schedule and adjust accordingly.

3. Project Team Performance

   a. Establish good client relationships.
   b. Minimize conflicts within project team.
   c. Select consultants carefully.
      1. Screen consultants for competence and ability to provide service in terms of project scope and size.
      2. Consultants should assign adequate amount of staff to project.
      3. Consultants should be financially responsible and carry adequate professional liability insurance.
   d. Appoint a qualified and experienced member of your firm to manage project.
   e. Establish document checking procedures.
   f. Work of less experienced staff should be checked by a principal or other reliable, experienced firm member.

B. Construction

1. Owner's Project Manager's Observations
    a. Participate in coordination meetings.
    b. Be available to architect's representative for problem resolution.
    c. Receive submittals and shop drawings from architect for inspection by Facilities Planning and Construction and Environmental Health and Safety Departments.

2. Project Architect/Resident Inspector's Observations.

    a. Participate in coordination meetings.
    b. Screen shop drawings and submittal for contract compliance before submitting to owner for approval.
    c. Keep logs of all on site observations.
    d. Frequent site visits per contract or additional service authorization. Prefer part time every day versus full time on selected days.
    e. Monitor contractor for compliance with schedule.
    f. Act as owner's agent in protecting owner from unnecessary delays and unreasonable costs on part of contractor.
    g. An agreed upon time limit for the resolution of all conflicts will be established at the beginning of the contract on a job by job basis.
    h. Inspections and Testing Companies shall be employed on a per project case by case basis, to be determined at the time of bidding. The following represent services that may be solicited from independent agencies:

1. Division two - sitework, paving, and earthwork.
    a. Material and systems review.
    b. Material suitability

2. Division three – concrete
    a. Material and mix review
    b. Sampling and testing concrete.
    c. Floor flatness
    d. Placement of reinforcing

3. Division four – masonary

4. Division five - metals
    a. Precast connections
    b. Structural steel
    c. Steel decking

5. Division seven - Moisture protection
    a. Sealants and caulking
    b. Sprayed on fireproofing
    c. Waterproofing
    d. Roofing

6. Division eight - Curtain walls and window framing.
    a. Inspection of frames and glass
    b. Curtain wall connections
    c. Skylights

APPENDIX C

PROJECT TURNOVER PROCEDURE

I. PURPOSE: This procedure briefly outlines responsibilities and authority of the Architect/Engineer, discusses specific coordination procedures, and outlines actions to be taken by the Architect/Engineer in conjunction with substantial completion and closeout of construction contracts.

II. BACKGROUND: The thorough execution of procedures is required at the time of construction contract completion to ensure that the work is completed in an acceptable manner, all administrative matters are resolved, and project information is efficiently transferred to the appropriate department(s) of the district.

Closeout procedures must be completed promptly. It is the goal of the district to accomplish project closeout within (30) days after the Architect, District Project Manager, and Contractor establishes the substantial completion date.

III. POLICY AND PROCEDURES: The following paragraphs describe routine procedures to be taken upon completion of construction projects. The turnover procedure is to be administrated by the Architect in conjunction with District Project Manager and Contractor.

A. Closeout Goal: It is the goal of the Osceola School District to "Contractually Complete" all construction projects within (30) days of substantial completion.

B. Definitions: A project is "substantially complete" when:

1. All building systems are 100% operable.
2. The District Project Manager, Architect and Contractor have inspected/tested and approved the facility and delivered to the Architect/Owner the approval in letter form, all in advance of any furniture, equipment, or personnel being allowed in the building.
3. The facility for all practical purposes can be occupied/used for the designed purposes intended. The District Project Manager, Contractor and Architect may issue the certificate of substantial completion only after all three conditions have been achieved.

Further, as a prerequisite to scheduling the substantial completion inspection, the general contractor is required to prepare, certify and deliver the "As-Built Drawings", maintenance manuals, and warranty information. The required operation and maintenance orientation training to be conducted with the Maintenance Department personnel is also to occur prior to scheduling the substantial completion inspection.

IV. FACILITY TURNOVER PROCEDURES: Specific procedures for facility turnover and warranty repairs are:

A. The Facilities Department will notify the Owner of an upcoming facility turnover date by memo providing the following (see Attachment A):

1. The Occupancy date or Substantial Completion date.
2. The specific length of warranty if other than one year from Substantial Completion date.

3. Special conditions of the warranty and who to contact for warranty work.

4. The name, address, and phone number of the General Contractor along with the name of the contact person and details on requesting warranty work and if applicable, the name, address, phone number, and name of the contact person of each subcontractor if the General contractor wants them contacted directly. The subcontractor's specific areas of responsibilities need to be delineated in the letter (see Attachment A).

5. The name and phone number of the Facilities Planning and Construction Department contact person to reach in case of warranty work disputes and/or problems.

B. The Facilities Planning and Construction Department will provide the Owner a copy of the Substantial Completion Certificate, including deficiency lists, once the Facilities Department has received the signed Substantial Completion Verification, Forms from the Department of Environmental Health and Safety.

C. The Facilities Department will:

1. Not approve work orders to move occupants or equipment into the new facility prior to the Occupancy/Substantial Completion date supplied by the Facilities Department.

2. Accept all work order requests from occupants of said facilities for building repairs and will accept work order requests from all other budget units for outside utilities and grounds problems.

3. Determine if the work should be Facilities Departments responsibility, other budget unit responsibility, or warranty work.

4. Initiate a standard work order if the repairs are Maintenance Department responsibilities.

5. Contact the contractor stating that the request is for warranty work, request an anticipated completion date, and request notification for completion of warranty work.

6. Contact the building occupant after the anticipated completion date to determine if the warranty work was satisfactorily completed.

The training sessions will be conducted by the general contractor's Electrical/Mechanical subcontractors, manufacturer's representatives, and may require the Architect /Engineer's subconsultants to be present to field verify system(s) performance. All tests results are to be provided to the Architect/Engineer by the general contractor. The Architect will be the sole source of responsibility to ensure that all equipment performs in compliance with the initial design criteria.

A project is "physically complete" upon receipt of all required closeout items from the contractor, with Architects approval of the final payment application from the contractor.

A project is "administratively complete" upon completion of all the Facility Planning and Construction Department activities, including the transfer of project closeout data to the Owner and transfer of account records to aninactive file.

D. Substantial Completion/Inspections. Substantial completion inspections involve the development of extensive punch lists. The contractor should be capable of completing the project within a 30 day period before substantial completion should be recommended.

The Architect should ensure that inspection of the phone system, data communications, audio/visual, fire alarms, etc. is arranged and 100% operational prior to Substantial Completion Inspection.

1. Closeout Documentation and Forms: Refer to the General Terms and Conditions, which contains the Substantial Completion form required by the School District of Osceola.

2. Technical and Administrative Data. Particular attention must be devoted to receipt of all technical and administrative data at the time of Substantial Completion. The Architect should not issue the certificate of substantial completion without the technical data. Administrative items should receive nearly the same level of attention as punchlist items. If such attention is not provided, it will become increasingly difficult to obtain necessary items as subcontractors are terminated and payments are made by the prime contractor. As with punch lists, all administrative items should be received prior to acceptance of substantial completion. The following items must be received prior to acceptance of substantial completion:

   a. Complete equipment diagrams, operating instructions, maintenance manuals, parts lists, wiring diagrams, pneumatic and/or electrical control diagrams, test and balance reports, inspection reports, guarantees and warranties, as applicable, for each and every piece of fixed equipment furnished under this contract to be supplied in a ring binder, hard-cover book, properly indexed for ready reference. Also, specific information regarding manufacturer's name and address, nearest distributor and service representative's names, address, office and home phone numbers, make and model numbers, operating design and characteristic, etc., will be required. All information submitted shall be current as of the time of submission.

E. Substantial Completion Acceptance: If the Architect recommends acceptance of substantial completion and the Facilities Planning and Construction Department concurs, the Facilities Planning and Construction Department should be notified immediately in written form.

1. Training: Prior to the date of inspection for substantial completion, the contractor must provide competent and experienced training to Facilities Department personnel in the operation and maintenance of equipment and control systems. This training shallnot occur until "as-built" drawings and maintenance manuals have been received and the Facilities Department has been allowed seven (7) days for their review.

2. Punchlist: The Owner is under no obligation to accept a project before all work is complete. Therefore, punchlist items should be minimized and acceptance of a project with an extensive punchlist should be carefully considered. Emphasis must be placed on prompt completion of the punchlist. Adequate retainage monies must be withheld as required, to ensure that the contractor will devote appropriate resources for completion of this work.

3. Transfer of Custody and Data to the Facilities Department. At acceptance of substantial completion by the Facilities Department, the building will be the responsibility of the Owner and thus custody will be that of the Owner. Effective transfer of a facility and associated technical data to the Facilities Department is of major importance.

   The Architect should take the necessary steps to ensure that the data listing is accurate and that all data is forwarded. It is preferred, though not required, that all "As-Built submittals, O & M manuals, and warranty data, etc. be individually listed to evaluate the completeness of the contractor's submission.

4. Warranty Procedures. At acceptance of substantial completion, theFacilities Department is responsible for contacting contractors with respect to warranty items. The Owner will not normally become involved in such matters. The Architect should become involved whenever there is a question regarding contractor responsibility, should review letters being written to the contractor regarding warranty and should provide assistance whenever the contractor is not responsive to the Facilities Department requests.

F. Final Completion and Final Payment: Final Inspections will normally involve the same departments participating in the Substantial Completion Inspection. The Architect is responsible for making inspection, verifying all known punchlist items are complete and recommending final acceptance to the Owner. This includes, but is not limited to, these final project requirements.

1. Neither final payment nor any remaining retained percentage shall be come due until the Contractor submits to the Architect the following:

a. An affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by the Owner) have been paid or otherwise satisfied.

b. A certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least (30) days' prior written notice has been given to the Owner.

c. A written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents.

d. Consent of surety, if any, to final payment.

e. If required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of claims, security interests, evidence that the required percentage of the Contract Sum has been expended with MBEs identified in the approved plan, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner.

2. The Contractor's application for final payment shall be accompanied by a completed and notarized "Certificate of Contract Completion". Any items required by the Contract Documents not previously submitted shall accompany the application for final payment.

G. Closeout of Contracts without Contractor's Release. Contact the Facilities Planning and Construction department for procedures to be utilized to close contracts when a contractor's final release cannot be obtained.

H. Administrative Completion. Upon completion of all checklist items, the original checklist will be routed to the Facilities Department. The accounting file shall remain active at least the length of the warranty period or as required by Facilities Department directives.

V. WARRANTY DISPUTES: If a dispute or problem occurs with a contractor over warranty work:

A. The Architect/Engineer will immediately contact the Facilities Department Project Manager listed in the turnover letter.

B. The Architect/Engineer will intervene with the contractor and advise the Facilities Department. In the event emergency repairs are required the Facilities Construction Project Manager will determine the action to be taken and a funding source for repairs. An appropriate accounting method will be used to collect the repair cost.

Attachments:

A. Building Turnover Letter
B. Substantial Completion Verification Form

Attachment A
Example of
Building Turnover Letter

Date

M E M O R A N D U M

To: Director of Facilities

From: Architect/Engineer

Subject: New Facility Turnover, Project #-XXX, Project Title

Unless canceled or delayed in writing by the, Architect/Engineer
Substantial Completion of this Facility will occur on _____. Occupancy Date will be _____. (Minimum 5 working days after Substantial Completion.)

All positions of the building are covered by the nominal one year warranty against defects in materials or workmanship. The following items have special warranty:

Item	Specifics	Length of Warranty

For warranty matters, call the person listed below.

Contact name:
Phone no.

Contractor:
Address:

The general contractor has designated the following subcontractors for resolution of warranty items within their areas:

Area/System	Subcontractor; Phone; Address	Contact Name

The District's Project Manager for warranty problems is_____. Contact the District Project Manager if any warranty items are disputed by the contractor.

Attachment B
Example of A
Substantial Completion Verification Form

PROJECT NAME

Substantial Completion Verification Form

Project No. and Title:

Architect/Engineer:

General Contractor:

Contract Substantial Completion Date:

The above project has been inspected in accordance with the Construction Documents by the appropriate members of the Facilities Department and Department of Environmental Health and Safety and is found to be substantially complete. The facility is ready for occupancy by the user and will be finally completed within thirty (30) days from the above Substantial Completion date. The Contract Substantial Completion Certificate will be executed by the Facilities Department and forwarded to the Contractor upon receipt of this form signed by the Directors of the above named departments.

_____
Principal, Architectural Firm

_____
Director, Facilities Planning and Construction Department

APPENDIX D

EXTERIOR AND INTERIOR SIGNAGE

Index

General Information:

Site Identification.....

Color Guidelines

Maintenance Guidelines

Introduction:

The purpose of this manual is to detail and illustrate the District's exterior signage system. The standards established in this signage manual are to be carefully followed to properly identify, direct, inform and control vehicular and pedestrian traffic on each facility.

Existing Signage Groups: (Signage Types)

1. Roadway Signs (Vehicular directional to buildings)

2. Parking Lot Signs (Identifies parking Lots)

3. Pedestrian Signs (Pedestrian directional)

4. Building Signs (Free standing)

5. Building Signs (Fixed on buildings)

6. Bulletin Board Signs (Changeable information)

7. Campus Map Signs (Billboard type)

8. Campus Map Signs (Location type, "You are here")

Signage Concept:

The purpose of the concept is to develop a more coherent signage plan for the District. This concept concentrates on roadway and parking lot signage.

Pathways:

Pathways denote the District roadway system. Each path system is directly related to a particular "gateway" and are color coded to match. Pathways are shown in links which identify intersections.

Building and Parking:

Buildings are shown in a hatch pattern while parking lots are shown as rectangular outlines. Buildings and parking are directly related to a particular pathway and are color coded to match.

Signage Locations:

These locations have been determined by link locations which identify intersections. These locations are color coded to match path systems.

Signage Details:

Geographic progression is used and where possible buildings are identified rather than parking lots. Parking lots are only identified when they are isolated from buildings.

Recommendations:

1. Roadway Signs, use the signage concept described above. Make the adaptations with existing materials.

2. Parking Lot Signs, use the sign type identified in the parking sign graphic which identifies specific areas of permissible parking.

3. Pedestrian Signs, these signs are identified in the signage graphic.

4. Building Signs (Free standing),these signs are identified in the signage graphic.

5. Building Signs, (On buildings),these signs are identified in the signage graphic.

Exterior Signage Rules:

1. The listings of buildings must be in geographic progression.

2. All signs within a signage zone should relate only to those buildings or related parking lots within a particular zone.

3. Building listings take priority over parking lot listings. Parking lots are to be identified using the parking lot signage graphic, which is meant to identify permissible parking.

Exterior Signage Model

Sign Details:

1. All signs are placed in geographic progression.

2. Six (6) panel signs are used because they coincide with the majority of the existing signs.

3. Parking lot signs are used to identify gateways to parking lots.

Implementation Recommendations

1. All lettering must be consistent in font style and size. Upper and lower case letters are to be used to match the database. Garamond Bold is the standard font to be used; the font size will vary with the size of the panel.

BUILDING SIGNS (Free Standing)

Building Signs (Free Standing) are required at each building to directly identify that particular building.

BUILDING SIGNS (On Buildings)

Building Signs (On Buildings) are required at each building to directly identify that particular building.

ROADWAY SIGNS

Roadway Signs are required for traffic control and direction on roadways.

PARKING LOT IDENTIFICATION

Parking lot identification signs are required for traffic control in parking facilities.

PEDESTRIAN DIRECTIONAL

These signs contain information which will help direct people to facility areas, parking lots, and buildings. The signs should be strategically placed to provide the most information and convenient access.

ORIENTATION MAP

The orientation map contains a campus map and a related directory of facilities offices and street addresses and serves as a guide to pedestrians.

BULLETIN BOARD SIGNS

The bulletin board sign is used to relate permanent and changeable information to the viewer.

This free-standing double-sided panel contains, on one side, a cork board. The opposite side contains an open bulletin board on the right half and a cabinet bulletin board with hinged door on the left half.

The bulletin boards placement is determined by pedestrian traffic patterns and is located at major intersections for maximum effectiveness.

SPECIAL MESSAGE SIGNS

These plaques indicate messages pertaining to areas which require special recognition. Reference should be made to sample drawings for specific symbols and colors. Signs should be placed in highly visible areas.

SITE IDENTIFICATION

Site identification is achieved using both primary and secondary signs.

The primary site identification is a free-standing panel displaying the sites name as well as the Facility logo. This sign should be clearly visible to properly identify the building.

Secondary site identification is an exterior wall mounted plaque located at the main entrance of each building. The plaque displays both the building name as well as the building number. The copy and the number on these plaques should be centered as shown on sample drawings.

COLOR GUIDELINES

Color shall be consistent throughout all signs for continuity of format within the system.

MAINTENANCE GUIDELINES

Maintenance for signs should be periodically scheduled to keep materials clean and prolong their usefulness. Local conditions will dictate how often maintenance is required.

Proper care would include:

Permaply with Scothcal lettering should be carefully washed with warm water and a mild liquid detergent. Rinse clean and wipe lightly with soft, clean cloth.

Duranodic aluminum or baked-on aluminum materials including cast letters and plaques, exterior directories, campus sign structure, etc., should be washed with a mild detergent and warm water. Rinse, and rub dry with a soft cloth. For special stains or stubborn accumulation, consult manufacturer for particular problems.

Plexiglass, ES phenolic plastic, and vinyl require a light dusting with a clean, soft cloth. If finger marks or other stubborn dirt does appear, use a light pressure with a soft, clean, damp cloth or an impregnated tack cloth. Do not use solvents, acids, alkalis, polishes, powders, or other cleaning agents that would injure the surface of the material or lettering applied.

Glass doors on directories should be cleaned using regular glass liquid cleaners, and polished clean and free from streak marks.

END OF DOCUMENT