



# **NJSDA Model Schools Program**

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## **Materials and Systems Standards Manual**

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# Materials and Systems Standards Manual

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## Design Requirements

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**Note:** To review the tracked changes version of the Revised Materials and Systems Standards document, please refer to page 323. Revisions are indicated as follows - Additions are shown in **bold and underline text**; deletions are shown in ~~strikethrough~~ and *italics*.

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**STATE OF NEW JERSEY  
SCHOOLS DEVELOPMENT AUTHORITY**

**Issue Date: 9/19/20**

**Revision-5: 12/30/2024**

Note A: Refer to Project Manual for Project specific Performance Specifications.

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**STATE OF NEW JERSEY  
SCHOOLS DEVELOPMENT AUTHORITY**

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Note A: Refer to Project Manual for Project specific Performance Specifications.



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# **Materials and Systems Standards Manual**

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## **Design Requirements**

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# Model Schools: Materials and Systems Standards

## A. Introduction

The NJSDA's Model Schools Program's: "**Materials and Systems Standards Manual**" and "**Construction Details Manual**" have been developed in response to an ongoing internal effort to implement standardized designs for NJSDA projects. The use of standardized design elements has the potential to afford efficiencies in the design and construction of school facilities. Standardized design will facilitate expedited design reviews and code inspections for faster delivery of school projects.

The following is an excerpt from the New Jersey Schools Development Authority's (NJSDA) 2011 Capital Program Report dated March 2, 2011: Section 3: Implementation Approach, which is related to standardized systems & materials:

"In 2011, the NJSDA plans to pursue standardization through three phases". The third phase as stated in the Capital Program Report includes the "**identification of standard systems and materials**".

The NJSDA has proceeded with the continued development of design and construction guidance to assist the Professional Consultant Community. Based upon the directives above, the NJSDA has proceeded with the development of the "**Materials and Systems Standards Manual**" and "**Construction Details Manual**" which "*identify standard materials and systems*" to be implemented in conjunction with other procedures and their respective component parts to establish a "Standardized Model or Prototypical School Design Approach".

## B. Model Schools Program: Materials and Systems Standards & Construction Details Manuals

The NJSDA's "**Materials and Systems Standards Manual** and **Construction Details Manual**" have been prepared for and shall apply to Public School Facilities Projects in the State of New Jersey that are managed by the New Jersey Schools Development Authority (NJSDA) as defined by the "Educational Facilities Construction and Financing Act" (EFCFA).

With the NJSDA's "**Materials and Systems Standards Manual** and **Construction Details Manual**", it is NJSDA's full intent to establish a uniform approach to School Facilities Project design such that we accomplish the following key goals:

- Attain parity amongst all New Jersey Abbott School Districts by the implementation of Model School or prototypical designs thru the use of standardized materials and systems.
- Establish an approach that requires the repeated use of defined materials and systems standards as a cost effective and common sense means of constructing all 21st Century Schools for New Jersey.
- Establish a means for NJSDA managed School Facilities Projects to be built in an educationally appropriate, community focused, cost effective, sustainable, energy efficient, safe, secure, clean, and environmentally friendly manner.

The NJSDA's "**Materials and Systems Standards Manual**" contains "**Design Requirements**" sections which define the materials and systems to be implemented; the "**Construction Details Manual**" contains related select key reference standardized construction details. The development and implementation of these requirements is one key step in establishing a new design and procedural norm for Pre-K through 12 school facilities while simultaneously establishing the NJSDA as one of the nation's key resources for knowledge relative to lessons learned in constructing School Facilities Projects for both urban and suburban areas.

# Model Schools: Materials and Systems Standards

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The NJSDA's *"Materials and Systems Standards Manual and Construction Details Manual"* are living documents that will be updated and issued in phases as NJSDA project teams learn more efficient and effective ways to design and construct School Facilities Projects for New Jersey in the face of the specific environmental and site challenges that exist within the NJSDA Program. The development and issuance of "NJSDA's *"Materials and Systems Standards Manual and Construction Details Manual"* are centered around NJSDA's commitment to build on the Best Practices and lessons learned from our program, as well as the experiences of others throughout the nation, who have implemented the design of pre-K through 12 schools. Thus the related goals are to achieve cutting edge School Facilities Project design and to implement proven standards that have met the test of time.

NJSDA has integrated the goals and criteria above and has developed the *"Materials and Systems Standards Manual and Construction Details Manual"* to encourage design creativity. The manuals simultaneously provide guidance for uniformity in the overall approach to materials and systems selection during the design phases of a project. By implementing the elements included within the *"Materials and Systems Standards Manual and Construction Details Manual"*, the Project Team will be taking a significant step forward in creating the physical conditions in which the learning process can thrive. This, in essence, is a key component of what defines a 21st Century School for New Jersey.

### C. Organization of this document: Refer also to the Table of Contents and Sections herein

1. The *"Design Requirements"* sections which follow in the *"Materials and Systems Standards Manual"* utilize The Construction Specifications Institute's (CSI) *"UniFormat: A Uniform Classification of Construction Systems and Assemblies, Levels 1-4"* for their organization. Uniformat is a nationally recognized organizational format for construction materials and products grouped by assemblies, systems and component parts.
2. The *"Construction Details Manual"* contains select key *"Standardized Construction Details"* for the Materials and Systems recommended in the other manual. The construction details are also referenced with the same respective UniFormat section designations as the Design Requirements. These construction details are for reference only and are to be reviewed by the Design Consultant and its Sub-Consultants for applicability prior to inclusion in the construction documents for any respective project.

### D. Content

1. The focus of the "NJSDA *"Materials and Systems Standards Manual"* is to require the Design Consultant and its Sub-Consultants to choose materials and systems defined therein. These standards have been developed around the requirements of NJSDA and New Jersey school districts by selecting high quality, durable products, and materials and systems which are easy to maintain, and reflect the budgetary constraints of a relatively low initial cost. The NJSDA's *"Construction Details Manual"*, is a newly developed technical reference for the Design Consultant and its Sub-Consultants.
2. The materials and systems to be used in the design and construction of School Facilities Projects shall typically be limited to those materials and systems which are defined in these sections of the NJSDA's *"Material and System Standards Manual"* and associated *"Design Requirements"* sections.
3. All Design Consultants and their Sub-Consultants shall adhere to these NJSDA Model Schools: *"Materials and Systems Standards Manual"* and utilize the associated *"Construction Details Manual"* as a reference source, as applicable, in the design of contractually assigned specific School Facilities Projects. The standards herein apply to all Sub-Consultants, employees, and others retained by the Design Consultant; The Design Consultant shall be responsible for all actions of its Sub-Consultants and other team members in accordance with these standards.

# Model Schools: Materials and Systems Standards

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## Design Requirements

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4. ALL MATERIALS AND SYSTEMS INDICATED AS “SUBJECT TO APPROVAL BY THE NJSDA” MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION DOCUMENTS.

5. In the event of a conflict between the Materials and Systems Standards and other guidance documents such as, the Education Specifications, the NJSDA’s Kit of Parts content, Bridging Documents also known as the Design Builder’s Information Package, and presiding codes shall take precedence.

6. This document does not contain a complete or comprehensive reference to any ASTM, UL, or other standard testing methods, nor does it contain a complete listing of ASTM and other quality assurance reference standards for any of the Materials or Systems Standards specifically defined herein.

7. In the event that the Design Consultant or District requests substitution of a material or system other than those defined within the NJSDA Model Schools “*Materials and Systems Standards Manual*,” and associated technical “Construction Details Manual”, it is the Design Consultant and / or the District’s responsibility to demonstrate to the NJSDA, utilizing the Variance Request Process defined below, that their suggested substitution is justifiable. The use of any materials and / or systems not identified in this document is subject to approval by the NJSDA.

### E. Disclaimer

1. The drawings, details, tables, data, and other information in this product have been obtained from many sources, including government organizations, trade associations, suppliers of building materials, and professional Design Consultants or architectural firms and professional organizations. The NJSDA has made every reasonable effort to make this reference work accurate and authoritative, but does not warrant, and assumes no liability for, the accuracy or completeness of the content or its fitness for any particular purpose. It is the responsibility of the Design Consultant and its Sub-Consultants to apply their professional knowledge in the use of information contained in this product, to consult the original sources for additional information when appropriate.

### F. General Requirements

1. As a general rule, Design Consultants and its Sub-Consultants shall conform to NJSDA’s Design Requirements and the content herein.

2. The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards () and all other Federal, State, County, Municipal, and Local codes, ordinances, laws, requirements, etc. having jurisdiction over this project. Renovations and restorations shall meet the requirements of the NJUCC and its Rehabilitation Sub-code and relevant amendments. In addition, the Design Consultant and their Sub-Consultants shall comply with all existing presiding requirements of the Department of Education, The Office of School Facilities; () and related New Jersey Administrative Code (N.J. A.C.) Title 6A:26.

3. The Design Consultant and its Sub-Consultants shall only include in the Construction Documents products that meet ‘Made in America’ criteria as defined by the Federal Trade Commission.

4. All ‘new’, ‘alteration’, ‘reconstruction’, renovation and/or ‘change of use’ of Instructional Spaces, as defined by the NJDOE facilities efficiency standards, shall meet the maximum noise levels, minimum Reverberation Time (RT), and Sound Transmission Coefficients (STC) requirements as described in ANSI / ASA Standard S12.60 (current version), “Acoustical Performance Criteria, Design Requirements

# Model Schools: Materials and Systems Standards

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## Design Requirements

## Introduction & General Requirements

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and Guidelines for Schools” as applicable or as modified by the contractually related version of the 21st Century Schools Design Manual: Design Criteria 1, “Acoustic Comfort”.

### G. The Variance Request Process

1. In limited, defensible, special situations as defined below, if either the District or the Design Consultant proposes a design that varies from NJSDA's “*Design Requirements*” in the “*Materials and Systems Standards Manual*” and the “*Construction Details Manual*” and the content herein, approval must be obtained from the NJSDA by the Variance Request Process and shall meet the requirements listed below. The Design Consultant shall submit the required Variance Request Form (Refer to “Appendix B”) and all support data and information as soon as possible but no later than end of the Design Development phase. The Design Consultant shall not incorporate the material, system, or technology in their construction documents until NJSDA approval has been granted.

2. The NJSDA will consider a proposal for a Variance Request under any or all of the following circumstances:

- a. The proposed product, material, or system provides equal or better performance of all comparable characteristics at a savings, equal cost, or at a minimal incremental greater cost.
- b. The proposed product is a new material, system, or technology that has better performance characteristics.
- c. The proposed product is a new material, system or technology and is a standard product used by the district consistently in their schools and meets the requirements of a. above.

Note: The Variance Request Process does not apply to proprietary product requests which are addressed below in Section: I below.

3. In order for the NJSDA to review a proposal for a Variance Request the following information must be provided by the District or the Design Consultant

- a. A completed Variance Request Form found in Appendix “B”.
- b. A report or comparison with all justification, product performance data, literature, and analysis demonstrating how and why the proposed material or system alternative provides improved performance
- c. If the proposed product is a new material, system or technology that has better performance characteristics, provide information about how long it has been available for application, where it has been used (preferably in other schools), and any resulting performance testing of the product in situ.
- d. The total cost impact of this material, system, or technology as it applies to the specific school facilities project. A detailed construction cost estimate reflecting the level of development of the design solution should be presented in UniFormat 2011 or MasterFormat 2011 to facilitate comparison between the baseline alternative and various options selected.

4. The NJSDA shall, in its sole discretion, approve or reject the Variance Request in writing within 30 days. The Design Consultant shall not incorporate the material, system, or technology in their construction documents until NJSDA approval has been granted.



# Model Schools: Materials and Systems Standards

5. Completion and submission of a Variance Request Form and inclusion of a substituted material or system into the Contract Documents is the Design Consultant's sole responsibility and shall be accomplished at no cost to the NJSDA for professional services associated with the Variance Request Process.

## **H. Sustainable/Green Design Criteria**

1. The Design Consultant and its Sub-Consultants shall comply with the NJSDA's Sustainable/Green/USGBC LEED Design requirements and goals. Revised NJSDA Sustainable Design Guidance is currently under development. For new Design Consultant procurements refer to the respective contract for professional scope of services for Sustainable/Green/LEED Design Criteria and associated requirements. For earlier Design Consultant procurements refer to the associated contract and NJSDA guidance to Design Consultants for these requirements.

2. The focus of the content herein does not currently define specific materials' and systems' requirements or features with regard to sustainability and green design. However, the materials and systems defined herein may inherently have such features by the nature of their specified typical composition, components, use, assembly, application, or the requirements described herein.

## **I. Requirements for Specifications and Proprietary Specifications**

1. The Design Consultant and its Sub-Consultants shall use the current version of MasterFormat (currently 2011) in the development of their School Facilities Projects' technical specifications.

2. The use of proprietary specifications is prohibited; therefore, whenever a "brand name" item is specified, the specification must list, by name, at least three (3) comparable manufacturers followed by the words "or approved equal". If these comparable "equal" manufacturers are not available, NJSDA must have previously approved the specifications prior to issuance for bids.

3. To ensure that the word "equal" cannot be misinterpreted in the course of bidding, the Design Consultant and their Sub-Consultants must thoroughly describe in the technical specifications all essential performance and/or physical features which must be incorporated into the specified item or system to meet its minimum functional needs and space limitations. Minor features of the preferred products that do not have an impact upon the product performance for this use shall not be specified as required criteria for bidding. Accessories and/or minor component associated with systems and/or assemblies, as defined by the current version of MasterFormat's designated specifications sections, may be identified as a single manufacturer followed by the words "or approved equal". The listed manufacturer of a minor product must not void any warranty offered by a company for a comprehensive system, not decrease performance or quality, and shall be compatible with the system or assembly which it may be part of.

4. Variances from this requirement may be granted, including restricting bids to certain select manufacturers, subject to the following stipulations:

a. No known readily available products, other than the specified, are capable of providing the salient physical, functional, and/or other characteristics, including cost, essential to the minimal needs of the Client School District.

b. Where existing systems are being extended (fire alarm, etc.) and single-system integrity can only be preserved or compatibility assured by resorting to the designated products. This applies

# Model Schools: Materials and Systems Standards

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## Design Requirements

## Introduction & General Requirements

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to new construction, additions to existing buildings and when major renovations to an existing building are planned, if the School District has a 'District-Wide' system where the single system integrity would be lost by adding an incompatible generic system. Focus for an exception to the requirement of a non-proprietary system should be prioritized by importance. Importance factors (from highest): Fire/Life Safety systems, Occupant Safety and Security, followed by long-term ease of building Operations and Maintenance.

c. The Design Consultant and its Sub-Consultants as well as the School District must request in writing to the NJSDA, a request for variance from the proprietary specification requirements at least thirty (30) days before inclusion in the Construction Documents. This request shall include a draft version of the proposed specification sections, any associated product cuts, data sheets, diagrams, pictures, or additional technical information necessary to completely describe the material or system for which the variance is requested and the relevant justification for this action.

d. Within ten (10) days of receipt, the request will be reviewed, and if approved, the NJSDA Project Manager will grant authorization in writing to proceed. Upon receipt of authorization, the Design Consultant shall include in the Construction Documents the name of the desired manufacturer to be used by the contractor in its base bid.





# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section A: Substructure**

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# Model Schools: Materials and Systems Standards

## A Sub Structure

### A. General Requirements

1. The design and selection of materials and systems, as well as the resulting assemblies and detailing reflected in the Construction Documents shall comply with all presiding codes.
2. When applicable, the Design Consultant shall consult with a Geo-technical Engineer and the Licensed Site Remediation Professional (LSRP), and Structural Engineer and each shall review the Geo-technical Report to determine soil types and groundwater levels as well as their effect on drainage waterproofing methods as well as footing, slab, and foundation system design. If a Geo-technical report exists, follow the report's recommendations for dampproofing and/or waterproofing requirements, excavation, backfill material, and subgrade drainage, and compaction. Consult a waterproofing specialist to determine a specific design approach for problem soils, contaminated soils, or other atypical conditions.
3. All School Facilities Projects shall comply with the presiding NJ Uniform Construction Code, Radon Hazard Sub-Code: Subchapter 10 when applicable.

### B. Materials

1. Choice of materials must be guided by building budget and the following requirements:
  - a. The materials to be used in the design and construction of the school's exterior facades, interiors, and below grade conditions shall typically be limited to those materials which are specified in the Authority's Standards and the parameters established herein.
2. ALL MATERIALS AND SYSTEMS INDICATED AS "SUBJECT TO APPROVAL BY THE NJSDA" MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION DOCUMENTS.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section A10: Foundations**

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# Model Schools: Materials and Systems Standards

## A10 Foundations

### A. General Requirements

1. The foundation design shall be based on the recommendations in the geotechnical engineering report prepared for the project.
2. Specify and detail code compliant thermal resistance and continuity of the thermal envelope around all exterior below grade foundation walls / wall / roof assemblies.
3. For all sites and particularly contaminated sites, clearly specify and detail the passive/active vapor barrier/venting system on the construction documents. This system shall be in compliance with all presiding codes and subcodes.

### A1010 Standard Foundations

#### A. General Requirements (Refer to A1010.10 Below)

#### A1010.10 Standard Wall Foundations

##### A. General Requirements

1. Standard foundation wall construction shall include a properly reinforced concrete continuous footing and walls constructed of either reinforced concrete or concrete masonry units, reinforced with appropriately sized reinforcing bars and grout filled when required. The foundation shall be sized to resist all lateral and vertical forces acting upon it and designed to meet all presiding code requirements. If soil bearing capacity is not acceptable to utilize conventional spread footings, special foundation system alternatives shall be investigated and analyzed based upon the following: lowest first cost, existing site soils type(s), code requirements and any related water table issues. The alternative system shall be selected and designed accordingly. Refer to A10 Foundations, A1020 Special Foundations for additional information.

##### B. Related Standardized Details:

1. Refer to the following details for additional information: (Details are for reference only).
  - a. B2010-11-02 Section @ Foundation: Brick Exterior Cavity Wall w/ CMU Backup
  - b. B2010-11-07 Section @ Foundation: Brick Veneer/CMU Backup: w/ Basement
  - c. B2010-11-10 Section @ Foundation: CMU Exterior Cavity Wall w/ CMU Backup
  - d. B2010-11-15 Section @ Foundation: Brick CMU Veneer /CMU Backup: w/Basement
  - e. B2010-11-27 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - f. B2010-11-31 Section @ Foundation: CMU Exterior Cavity Wall w/ Metal Stud Backup

# Model Schools: Materials and Systems Standards

## **A1010.30 Standard Column Foundations**

### **A. General Requirements**

1. Standard column foundations shall consist of a reinforced concrete footings concentrically located below its supported column. Anchor bolts for steel columns or reinforcing dowels for concrete or masonry columns shall be embedded in the footing prior to concrete placement. Steel columns whose footing top is located more than 1'-0 below the slab on grade above shall bear on a pedestal of reinforced concrete or reinforced concrete masonry to support it. Footings shall be sized to support all vertical and lateral loads, including uplift and overturning moment.

## **A1010.90 Standard Foundation Supplementary Components**

### **A1010.90.1 Dampproofing**

#### **A. General Requirements**

1. Where a slab-on-grade, standard footings and foundations are provided, or other conditions where waterproofing is not required, and a high water table is not present, provide dampproofing on the outside of wall surfaces of the foundation walls and other below-grade elements. Provide a drainage panel on the exterior of all walls to the bottom of footing to reduce build-up of hydrostatic pressure from saturated soils. At pervious areas, provide perforated pipe at the footing elevation connected to the storm system to collect water and carry it away from the building.

#### **B. Dampproofing**

##### **1. Dampproofing Alternatives**

###### **a. Volatile Solvents-based Dampproofing**

- 1.) Brush or spray application: Asbestos-free solvent based, asphalt compound with fibers (ASTM D4479 Type 1).
- 2.) Trowel mastic application: Heavy bodied, asbestos-free, solvent based, asphalt compound (ASTM D4586 Type 1).

###### **b. Non-volatile Emulsion Based Dampproofing**

- 1.) Brush or spray application: Asbestos-free emulsion manufactured with asphalt, clay emulsifiers, and fibers (ASTM D1227 Type 2, Class 1 and ASTM D1187 Type 1).
- 2.) Trowel mastic application: Heavy bodied, asbestos-free emulsion manufactured with asphalt, clay emulsifiers, and fibers (ASTM D1227 Type 2, Class 1 and ASTM D1187 Type 1).

###### **c. Protection Board**

- 1.) Mineral-fortified asphalt core formed between two outside layers of asphalt-impregnated reinforced mats (ASTM D6506 Class A, Type 2) placed over the dampproofing.

- 2.) Perimeter insulation may not be used as protection board.

# Model Schools: Materials and Systems Standards

## A1020 Special Foundations

### A. General Requirements

1. Where soil conditions do not warrant the use of standard concrete spread column footings or continuous wall footings bearing on the in-situ soil or structural fill, special foundations shall be utilized.
2. Acceptable systems:
  - a. Drilled shafts of concrete with or without a permanent casing extending below grade to a suitable bearing stratum and/or to a depth to develop the required load capacity through skin friction. Grade beams of reinforced concrete or concrete-encased steel beams may be utilized to transfer vertical and lateral loads to the drilled shafts as deemed necessary and to support masonry and concrete walls.
  - b. Micropiles consisting of hollow steel sections drilled into the soil and filled with concrete and reinforcing bars as required to develop the load capacity specified through socketing in the underlying bedrock and/or through skin friction. Grade beams of reinforced concrete or concrete-encased steel beams or concrete pile caps may be utilized to transfer vertical and lateral loads to the piles as deemed necessary and to support masonry and concrete walls. A number of additional piles shall be installed to verify the load capacity through load testing. The design of this system shall be by a licensed engineer engaged by the foundation subcontractor.
  - c. Helical piles consisting of hollow or solid steel shafts with helical bearing plates that are installed by rotating the shaft into the soil to a depth to suitable to develop the specified load capacity. Grade beams of reinforced concrete or concrete-encased steel beams or concrete pile caps may be utilized to transfer vertical and lateral loads to the drilled shafts as deemed necessary and to support masonry and concrete walls. A number of additional piles shall be installed to verify the load capacity through load testing. The design of this system shall be by a licensed engineer engaged by the foundation subcontractor.
  - d. Driven timber, concrete, or steel sheet piles are permitted when the vibration produced by the procedure for driving the piles is not a major concern. Special care shall be taken when there are surrounding and or adjacent structures. When these systems are used and there are adjacent structures or structures in close enough proximity to the project site to be of concern a detailed existing conditions survey shall be produced. This detailed survey shall include all buildings that may be impacted by this process. This documentation should include, but not be limited to, a photographic survey.
  - e. Concrete mat foundation consisting of a continuous slab of concrete of appropriate thickness to distribute the vertical and lateral loads to the underlying soil so as to not exceed the soil's bearing capacity.
3. Unacceptable systems:
  - a. Rammed earth aggregate footings.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section A20: Subgrade Enclosures**

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# Model Schools: Materials and Systems Standards

## A20 Subgrade Enclosures

### A. General Requirements

1. The design and selection of materials and systems, as well as the resulting assemblies and detailing reflected in the Construction Documents shall comply with all presiding codes.
2. Structures are to be designed for the appropriate hydrostatic pressure and waterproofed for a design water table elevation three feet above the highest level given on the borings as a minimum. The geo-technical engineers are to study the historic data for the area, prepare an analysis, and determine if the design ground water elevation needs to be greater than three feet above the highest actual level shown on the borings.

### B. Materials

1. Choice of materials must be guided by building budget and the following requirements:
  - a. The materials to be used in the design and construction of the school's exterior facades, interiors, and below grade conditions shall typically be limited to those materials which are specified in the NJSDA's Standards and the parameters established herein.
2. ALL MATERIALS AND SYSTEMS INDICATED AS "SUBJECT TO APPROVAL BY THE NJSDA" MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION DOCUMENTS.

### C. Related Standardized Details:

1. Refer to the following details for additional information: **(Details are for reference only).**
  - a. B2010-11-07 Section @ Foundation: Brick Veneer/CMU Backup: w/ Basement
  - b. B2010-11-15 Section @ Foundation: Brick CMU Veneer /CMU Backup: w/Basement

## A2010 Walls for Subgrade Enclosures

- ### A. General Requirements (Refer to Section A10 Foundations and Section A1010)

## A2010.10 Subgrade Enclosure Wall Construction

### A. General Requirements

1. The majority of NJSDA projects do not contain basements and are typically slab-on grade with below-grade foundation walls and reinforced concrete footings. For those projects which contain basements or provide other below-grade facilities, waterproofing the exterior walls is critical if within a high water table. In addition; many NJSDA School Facilities Projects contain other slab-on-grade below-grade penetrations such as elevator pits, concrete enclosed pits for science room acid neutralization tanks, grease pits, etc. some of which also require waterproofing. The Design Consultant shall determine which below-grade components require waterproofing and which of the recommended systems are appropriate based upon the related site geo-technical conditions and other factors.



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2. In certain instances, other soil or surrounding site conditions may require the selection of a vapor mitigation membrane system. Refer to A10 Foundations A2010.90 Standard Wall Supplementary Components and Vapor Mitigation Systems for further information.

## **A2010.10.1 Typical Basement Wall Construction**

### **A. General Requirements**

1. Typical basement wall construction includes a properly reinforced concrete spread footing, and walls made of either reinforced concrete or concrete masonry units reinforced with appropriately sized reinforcing bars and grout filled, sized to resist all lateral and vertical forces acting upon it and to meet presiding code requirements or concrete masonry units unfilled. If standard soil bearing capacity is not available to utilize conventional spread footings, special foundation system alternatives shall be investigated, analyzed based upon lowest first cost, soil types, water table issues, and selected and designed accordingly.

2. Provide adequate storm water drainage and waterproofing of walls to protect below grade slabs from water intrusion.

3. Provide adequate sub-surface drainage to transport water to discharging in storm drains or other appropriate detention.

## **A2010.90 Subgrade Enclosure Wall Supplementary Components**

### **A2010.90.1 Dampproofing**

1. For basement walls, concrete footings, and slabs which do not require waterproofing refer to Section A1010.90 Standard Foundations Supplementary Components; Dampproofing for further information.

### **A2010.90.2 Below Grade Waterproofing**

**A. General Requirements:** Guidelines for Waterproofing Design for Basement Walls in High Water Table Areas. These guidelines shall apply to basement footings and slabs as well as walls in high water table areas.

1. The preferred method of waterproofing is by positive-side application, consisting of a sheet membrane waterproofing system; however, the alternatives listed below are also acceptable if defensible by the Design Consultant, Geo-technical or Environmental Engineer or their report, or a waterproofing specialist and they are compatible with the project budget. Selection of an alternative system requires approval by the NJSDA. Utilities are to be designed such that they run within the building space (preferred) or are encased and placed above the waterproofing to avoid penetrations in the waterproofing to the greatest extent possible. Provide water stops at all joints.

2. Provide a mud-mat for concrete slabs over a six (6) inches minimum in thickness as a working surface for the installation of the waterproof system on a horizontal surface before the slab is poured. Utilize sand, pea gravel, or compacted earth as a working surface to facilitate installation of the waterproofing at horizontal applications for thinner slab.

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3. Surfaces subject to constant water, such as elevator and sump pits are to have a waterproofing application consisting of a "crystalline" type waterproofing on the Interior side. This is in addition to the positive side application required for high water table.

**B. Waterproofing Alternatives:** Refer to related selected manufacturer's recommendations and product data for a complete system and its proper application. When appropriate for the soils and water table conditions utilize both the vertical and horizontal applications of these systems.

1. Provide a complete system consisting of self adhering sheet membrane waterproofing composed of a rubberized-asphalt sheet system typically with cross-laminated polyethylene film permanently bonded to the outer surface or buytl rubber and all related accessories and other auxiliary components.

2. Provide a complete system utilizing a slab sheet membrane waterproofing (Also for blind side formwork application) consisting of cold applied composite sheet of high density polyethylene film, synthetic adhesive and protective coating or buytl rubber and all related accessories and other auxiliary components. Material is placed so that concrete is cast against the protective coating.

3. Provide a complete system utilizing a roller applied waterproof membrane consisting of a water based asphalt emulsion modified with a blend of synthetic rubbers and special adhesives, reinforcing fabric, and all related accessories and other auxiliary components.

4. Provide a complete system utilizing a cold fluid applied single component, moisture cured, elastomeric, coal tar free, modified polyurethane waterproof membrane which cures to form a flexible monolithic waterproof membrane on vertical and horizontal surfaces above and below grade. Provide all related accessories and other auxiliary components.

5. Provide a complete system utilizing Bentonite clay waterproofing using corrugated cardboard panels with Bentonite clay material filling the corrugated voids. Provide at least a 6 mil polyethylene vapor barrier between the mud slab and gravel base to provide additional protection against water penetration.

6. For plaza / roof decks above building spaces: Provide a complete protected fabric-reinforced fluid-applied waterproof assembly including surface conditioner, a monolithic rubberized asphalt membrane, separator/protection course, drainage panels, geo-textile filter fabric, rigid insulation, and flashings.

7. Provide a complete system utilizing a crystalline or metal oxide waterproofing system which is chemically re-active when placed on concrete and creates a crystalline structure preventing the passage of water. This product is applied to the inside surfaces of the space to be waterproofed such as elevator pits. Provide proper pretreatment of surfaces before application.

**C. Other Key Auxiliary Components and Accessories:** Protect membrane waterproofing or coatings during construction and backfilling. Protection materials include the following (select according to soil, climate, and other requirements)

# Model Schools: Materials and Systems Standards

## Design Requirements

## Subgrade Enclosures – Section A20

1. Drainage Board/Mat: Prefabricated composite drainage panels, manufactured with a permeable geo-textile facing laminated to a non-biodegradable molded plastic sheet drainage core with high strength backing. Composite protection board may also act as the protection course.
2. Protection Course / Board: Formed from an inert material such as fiberglass reinforced, asphalt treated asbestos free fiberboard that will not react with waterproofing meeting ASTM D6506, Class A, type 2. Other options include: extruded polystyrene board insulation, ASTM C578 Type VI vertical surfaces or VII for horizontal outdoor spaces), 1.8-lb/cu.ft. minimum density and 40 psi minimum compressive strength, 2 inch minimum thickness. Semi rigid sheets of fiberglass or mineral reinforced asphaltic core pressure laminate between two asphalt-saturated fibrous liners.
3. Provide prefabricated rubber gasket type or injectable hose-type water stops at all below grade construction joint breaks in the foundation system of habitable spaces and equipment spaces such as concrete footing to concrete wall foundation conditions, concrete slab to concrete wall conditions, etc.
4. Footing drains are required when groundwater level may rise above top of floor slab or when the foundation is subject to hydrostatic pressure after heavy rain. Composite drainage material conveys water to the drain tile, thus reducing hydrostatic pressure. Provide filter fabric over the top of the perimeter drain tile and seat in a soil shaped to form a gutter. Assure the perimeter drainage system is tied to the storm sewer system for the rest of the building and site.
5. Gravel: Provide gravel over the drainage tile and filter fabric. Provide additional gravel for additional drainage up vertically to grade when required per Geo-technical report and or Structural Engineers recommendations.
6. Provide a rigid, non-biodegradable cant at the intersection of the footing and foundation walls when perimeter drains are provided.
7. Grout, packed around pipes penetrating the foundation, should have a mixture of iron oxide. Iron oxide chemically alters the grout to be more water-resistant
8. Provide all other materials and accessories to make a complete system including but not limited to: Surface cleaners and conditioners, primers, sheet joint reinforcing strips, substrate patching membrane, protection sheets, flashing, filter fabrics, mastic, adhesives, tapes, termination bars, two part liquid membranes, joint sealants, backer rods, expansion joints, reglet bars, etc. per manufacturer's requirements for a complete system installation.



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## **Design Requirements**

### **Section A40: Slabs on Grade**

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# Model Schools: Materials and Systems Standards

## A40 Slabs on Grade

### A4010 Standard Slab on Grade

#### A. General Requirements

1. The typical project's grade condition includes a minimum of 4" cast-in-place concrete slab-on-grade reinforced with welded wire fabric. Typically, below that is a vapor barrier of not less than 6 mil polyethylene or polyvinyl chloride sheet on top of a minimum of 4- 6" clean gravel. A two foot (2'-0") or four foot (4'-0") section of 2" thick rigid vertical and horizontal perimeter insulation shall be provided under the slab and on the inside vertical surface of the foundation wall depending on the N.J. ASHRAE zone. The slab edge and or haunch shall be supported by the typical foundation wall composed of either reinforced concrete masonry units or poured in-place reinforced concrete.
2. The cast-in-place concrete slab-on-grade with welded wire fabric for reinforcement shall be determined by the Design Consultant and their Sub-Consultants to meet all requirements in response to soil conditions, loading, and other presiding code requirements.

#### B. Related Standardized Details:

1. Refer to the following details for additional information: (Details are for reference only).
  - a. B2010-11-02 Section @ Foundation: Brick Exterior Cavity Wall w/ CMU Backup
  - b. B2010-11-07 Section @ Foundation: Brick Veneer/CMU Backup: w/ Basement
  - c. B2010-11-10 Section @ Foundation: CMU Exterior Cavity Wall w/ CMU Backup
  - d. B2010-11-15 Section @ Foundation: Brick CMU Veneer /CMU Backup: w/Basement
  - e. B2010-11-27 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - f. B2010-11-31 Section @ Foundation: CMU Exterior Cavity Wall w/ Metal Stud Backup

## A4040 Pits and Bases

#### A. General Requirements

1. The typical project's requirements for pits shall be for subgrade depressions that service and/or structurally support mechanical equipment. Construction is to be of concrete sides and base, reinforced as appropriate, and consist of any of the following:
  - a. Elevators or handicap lifts – depth per manufacturer's requirements. The base slab shall be designed to resist the manufacturer's specified loading, including impact and lateral. A sump pit shall be provided in elevator pits complete with cover.
  - b. Other equipment, such as kitchen freezers (see A4090.10 for insulation) and floor trenches.
2. Bases shall be concrete protrusions, reinforced as appropriate, above elevated or slabs on grade to support and/or elevate any of the following:
  - a. Mechanical and electrical equipment that requires a pad for structural support, base separation from adjacent maintenance activities or water, or additional mass for vibration control.

# Model Schools: Materials and Systems Standards

Design Requirements

Slabs on Grade – Section A40

## **A4090 Slab-On-Grade Supplementary Components**

### **A4090.1 Under Slab Drainage**

1. Refer to the Section A10 Foundations and the referenced details for the typical under slab drainage requirements.

### **A4090.10 Perimeter Insulation**

#### **A. Under Slab Insulation**

1. Refer to the above General Requirements and the referenced details for the typical under slab insulation requirement.

### **A4090.20 Vapor Retarder**

#### **A. Vapor Mitigation Alternatives (Refer to above A4010.A.1. and Section A6020)**

### **A4090.30 Waterproofing (Refer to A2010.90.2 Below Grade Waterproofing)**

### **A4090.60 Sub Base Layer**

1. Refer to the above General Requirements and the referenced details for the typical under slab sub base requirement.



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## **Design Requirements**

### **Section A60: Water and Gas Mitigation**

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# Model Schools: Materials and Systems Standards

## Section A60 Water and Gas Mitigation

### A. General Requirements

1. The New Jersey Department of Environmental Protection (NJDEP) (<http://www.state.nj.us/dep/>) provides Vapor Intrusion Guidance, and the NJSDA has developed Best Practices to mitigate potential exposure to vapor intrusion at School Facilities Projects.

### A6010 Building Sub-Drainage

#### A6010.10 Foundation Drainage

##### A. Sub Base Layer

1. Refer to the above General Requirements and the referenced details for the typical under slab sub-base requirements in Section A40. The Design Consultant shall determine if any atypical geotechnical or environmental conditions exist requiring modification to this standard based upon the recommendations for mitigation by the NJSDA's Licensed Site Remediation Professional (LSRP) and other related consulting technical expertise.

#### A6010.20 Underslab Drainage

##### A. Sub Base Layer

1. Refer to the above in A6010.10. A.1

### A6020 Off-Gassing Mitigation

1. Vapor intrusion is generally defined as the underground migration of volatile organic compounds (VOCs) into overlying buildings. Common contaminants that may create a vapor intrusion concern include gasoline components (benzene) and dry cleaning and degreasing solvents. Common dry cleaning and degreasing solvents include perchloroethylene (PCE), and trichloroethylene (TCE). The presence of such contaminants does not always present a vapor intrusion concern. Physical factors, such as soil chemistry, groundwater conditions, subsurface features, and weather conditions play a factor in whether vapor intrusion occurs.

2. If environmental testing identifies the presence of a vapor intrusion concern, a recommendation for mitigation by the Licensed Site Remediation Professional (LSRP) will be included in the Remedial Action Work Plan (RAWP) for the site. The Design Consultant and their Sub-Consultants shall include the design for the recommended alternative in their Construction Documents. Depending on the site conditions, the design may include, but not be limited to the following:

- a. No mitigation is required if VOCs do not exceed health based screening levels.
- b. Design of a passive ventilation system, such as a passive radon mitigation system / sub-slab ventilation system (see project specific performance specifications).
- c. Design of a passive ventilation system, such as a passive radon mitigation system, in conjunction with a chemical vapor barrier.



# Model Schools: Materials and Systems Standards

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d. Design of an active sub-slab depressurization system in conjunction with a chemical vapor barrier.

#### 4. Chemical Vapor Barrier

a. If directed by the NJSDA or recommended by the Design Consultant and the LSRP, provide a complete installation utilizing a cold spray applied, water based, no VOC, seamless, impermeable 60 mil minimum thickness membrane system when recommended by the Design Consultant and the LSRP. Assure all approvals are in place (NJSDA and Office of the State Controller) for use of a proprietary system if three manufacturers of this system type cannot be found.

b. The use of a comparable sheet membrane system, if recommended by the Design Consultant and the LSRP, shall be permitted, but is subject to approval by the NJSDA. Prior to approval by the NJSDA, the LSRP or Design Consultant shall demonstrate that the use of an alternative chemical vapor barrier system is necessary, technically correct, and cost effective.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section B: Shell**

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# Model Schools: Materials and Systems Standards

## **B Shell**

### **A. General Requirements**

1. The design and selection of material and systems, and the resulting assemblies and detailing reflected in the Construction Documents, shall comply with all presiding codes.
2. The Design Consultant of Record shall review the current adopted State of New Jersey's presiding Energy Conservation Codes which define requirements for compliance of all required building systems and components. The presiding energy conservation codes also define procedures for demonstrating compliance with their respective requirements. All material and systems selections shall be informed by the associated compliance criteria.
3. The Design Consultant of Record shall review the current adopted International Energy Conservation Code 2021 (IECC) and ASHRAE 90.1-2019 (or current versions) requirements to define and establish the maximum percentage of window glazing to opaque wall for the building so that the minimum requirements of the IECC are met or exceeded.
3. Material and system selection shall place an emphasis on materials and systems that are durable, and easy to maintain.

### **B. Exterior Materials and Systems: General Requirements**

1. Provide code compliant thermal resistance and continuity of the thermal envelope around all exterior basement foundation walls / wall / roof assemblies.
2. For all sites and particularly contaminated sites, clearly detail the passive/active vapor barrier/venting system on the Drawings. This system shall be in compliance with all presiding codes and subcodes.
3. Electrical and Low Voltage Items
  - a. All electrical and low voltage items such as, but not limited to, horns, bells cameras, speakers and alarms shall be located and coordinated with all building elements and features as inconspicuously as possible on exterior building elevations.
4. Wall hydrants
  - a. Wall hydrants and hose bibs shall be provided on facades as required by code and for general maintenance purposes.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section B10: Superstructure**

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# Model Schools: Materials and Systems Standards

## **B10 Superstructure**

### **A. General Requirements**

1. The design and selection of materials and systems, as well as the resulting assemblies and detailing reflected in the Construction Documents shall comply with all presiding codes. Acceptable systems are listed in the subsections below and may be used interchangeably. The proposed use of unacceptable systems requires an SDA variance approval.
2. Provide structural elements, above grade and within basements, capable of supporting all anticipated loads without failure or damage.
3. The superstructure comprises:
  - a. Floor construction (B1010): Floor construction above grade and within basements, including balcony, mezzanine, and ramp floors, floors elevated for access, stair construction (B1080) if part of the structure, and roof decks intended for occupant live load; and the elements required for their support, insulation, and fireproofing.
  - b. Roofs (B1020): Roof construction, including canopies, and elements required for their support, insulation, and fireproofing.
4. Where superstructure elements also must function as elements defined within another element group, comply with requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section B - Shell.

### **B. Amenity and Comfort**

1. Vibration: Isolate structure from sources of vibration.

### **C. Health and Safety**

1. Fire: Provide members with combustibility, flame spread, and smoke generation characteristics not greater than allowed by code.
2. Fire Resistance: Provide materials with fire resistance in accordance with code and the current versions of the following:
  - a. Determine fire resistance rating by testing in accordance with ASTM E119-24.
  - b. Determine flame spread index by testing in accordance with ASTM E 84-23d.
  - c. Determine smoke developed index by testing in accordance with ASTM E84-23d.
  - d. Where fire resistance integrity of superstructure assemblies is impaired by subsequent installation of other construction elements, restore fire resistance using identical materials or other materials tested under ASTM E 814-24.
  - e. Provide fire-stopping at openings in fire-rated superstructure elements that is rated at not less than the required fire resistance of the penetrated element.

# Model Schools: Materials and Systems Standards

## **D. Durability**

1. Moisture Resistance of Load-Bearing Members: Use materials that are not damaged by contact with water or moisture vapor.
2. Impact Resistance of Load-Bearing Members: Use materials that are not easily damaged by common hand tools.
3. Applied Fireproofing Materials:
  - a. In Locations where concealed by Permanent Construction:
    - 1.) Density: 10 lb. / cu. ft. minimum.
    - 2.) Impact Strength: Passing ASTM E760/e760m-92(2023) or current version.
  - b. Exterior Locations, Where Exposed to Air but Out of Reach of Occupants (Above 10 ft. from Ground):

## **E. Material Requirements / Quality Assurance**

1. Concrete
  - a. Design of concrete to comply with ACI 318-19(22) (or current version), "Building Code Requirements for Structural Concrete". Design of precast plank to also comply with PCI MNL 120-17, "PCI Design Handbook--Precast and Pre-stressed Concrete."
  - b. Minimum design compressive strength  $f'_c$  to be 3000 psi at 28 days.
2. Concrete masonry units
  - a. Design of concrete masonry to comply with ACI 530/530.1-13 (or current version), "Building Code Requirements for Masonry Structures".
3. Structural steel
  - a. Design of structural steel to comply with AISC 360-22 (or current version), "Standard Specifications for Structural Steel Buildings".
  - b. Design structural steel floor beams to comply with AISC Design Guide 11, "Floor Vibrations Due to Human Activity".
4. Open-web steel joists
  - a. Design of open-web steel joists, joist girders, and long span steel joists to comply with
  - b. SJI K-1.1, SJI JG-1.1, and SJI LH/DLH-1.1, "2016 American Institute of Steel Construction Specification for Structural Steel Buildings".
  - c. Design open-web steel floor joists to comply with SJI Technical Digest 5, "Vibration of Steel Joist-Concrete Slab Floors".

# Model Schools: Materials and Systems Standards

## 5. Steel Deck

- a. Design of non-composite floor and roof deck to comply with the current versions of ANSI/SDI NC-2017 and ANSI/SDI RD-2017, respectively, AISI S100-16 “Specification for the Design of Cold Formed Steel Structural Members”, SDI “Floor Deck Design Manual” and ADI “Roof Deck Design Manual”.

### B1010 Floor Construction

#### A. General Requirements

1. Floor construction shall meet all the code requirements for structural load capacity, serviceability (vertical and horizontal deflection and vibration), and fire resistance.
  - a. Maximum deflection due to loading per code requirements, except as follows:
    - 1.) Members vertically supporting concrete masonry – the lesser of member span / 600 or 0.3” due to dead plus live loads.
2. Provide all floor construction above grade and within basements, including balcony, mezzanine, and ramp floors, floors elevated for access, stair construction if part of the structure, and roof decks intended for occupant live load; and the elements required for their support, insulation, and fireproofing, as well as finishing, if an integral part of the floor construction.
3. Where floor elements also must function as elements defined within another element group, meet requirements of both element groups.
4. In addition to the requirements of this section, comply with all applicable requirements of Section B - Shell, and Section B10 - Superstructure.

#### B. Durability

1. Exposed Interior Structural Floor Surfaces: Comply with requirements for floor finishes specified in Section C.
2. Exposed Exterior Structural Floor Surfaces: Comply with requirements for pavement finishes.

### B1010.10 Floor Structural Frame

#### A. Acceptable Systems

1. Vertical Gravity Load Support Elements
  - a. Load-bearing walls of reinforced concrete or reinforced/unreinforced concrete masonry.
  - b. Columns of structural steel, reinforced concrete, or reinforced concrete masonry.
2. Horizontal Gravity Load Support Elements

# Model Schools: Materials and Systems Standards

- a. Beams of structural steel (composite or non-composite), reinforced concrete, or open-web steel joists.

### 3. Lateral Load Support Elements

- a. Building frames of reinforced concrete or structural steel with rigid joints to resist wind and seismic loads (moment frames).
- b. Building frames of structural steel with diagonal bracing to resist wind and seismic loads (braced frames).
- c. Shear walls of reinforced concrete and reinforced/unreinforced concrete masonry.

## B. Unacceptable Systems

### 1. Vertical Gravity Load Support Elements

- a. Load-bearing walls of wood or cold-formed steel framing.
- b. Columns of built-up cold-formed steel or wood framing.
- c. Pre-engineered metal building frames.

### 2. Horizontal Gravity Load Support Elements

- a. Beams, joists, or trusses of cold-formed steel or wood framing.
- b. Pre-engineered metal building joists.

### 3. Lateral Load Support Elements

- a. Shear walls of cold-formed steel framing or wood studs and plywood.

## B1010.20 Floor Decks, Slabs, and Toppings

### A. Acceptable Systems

- 1. Concrete-filled steel deck.
- 2. Concrete-filled composite steel deck, minimum 2½ inches concrete thickness from top of steel deck.
- 3. Cast-in-place reinforced concrete slabs.
- 4. Precast concrete hollow core slabs covered with minimum 1-1/2 inches concrete.

### B. Unacceptable Systems

- 1. Plywood sheathing.



# Model Schools: Materials and Systems Standards

## B1020 Roof Construction

### A. General Requirements

1. Provide all roof construction, including canopies, and elements required for their support, insulation, fireproofing, and fire-stopping.
2. Where roof elements also must function as elements defined within another element group, meet requirements of both element groups.
3. In addition to the requirements of this section, comply with all applicable requirements of Section B - Shell, and Section B10 - Superstructure.
4. The Design Consultant and their Sub-Consultants shall include an allowance of an additional minimum of ten (10) pounds per square foot (lbs. / psf.), above and beyond all other presiding code and other requirements, in the structural design of the roof structure. This additional allowance is for the application of photovoltaic panels to the roof surface and structure. If the Design Consultant and their Sub-Consultants determine that the minimum allowance of an additional ten (10) lbs. / psf. is not sufficient for the support and application of photovoltaic panels to the roof surface and structure written justification and associated support documentation shall be provided to the NJSDA for review and approval of the requested increase in loading criteria.

### B. Health and Safety

1. Column-Beam Fire Resistance: Per Code.
2. Load-Bearing Wall Fire Resistance: Per Code.
3. Roof-Ceiling Fire Resistance: Per Code.
4. Other Members Fire Resistance: Per Code.

### C. Durability

1. Exposed Roof Deck Surfaces: Comply with requirements for roofing weather barrier specified in Section B3010.
2. Vapor Retarder Under Deck: Continuous separate membrane located on the warm side of the winter dew point.
  - a. Vapor Permeance: 1 perm, maximum when tested in accordance with ASTM E96/E 96M-24 (or current version).
  - b. Provide materials in accordance with ASTM E 1677-23 (or current version), including appendices, and ASTM C 755-20 (or current version).

## B1020.10 Roof Structural Frame

### A. Acceptable Systems

1. Vertical Gravity Load Support Elements

# Model Schools: Materials and Systems Standards

a. Load-bearing walls of reinforced concrete or reinforced/unreinforced concrete masonry.

b. Columns of structural steel, reinforced concrete, or reinforced concrete masonry.

## 2. Horizontal Gravity Load Support Elements

a. Beams of structural steel (composite or non-composite), reinforced concrete, or open-web steel joists.

## 3. Lateral Load Support Elements

a. Building frames of reinforced concrete or structural steel with rigid joints to resist wind and seismic loads (moment frames).

b. Building frames of structural steel with diagonal bracing to resist wind and seismic loads (braced frames).

c. Shear walls of reinforced concrete and reinforced/unreinforced concrete masonry.

## B. Unacceptable Systems

### 1. Vertical Gravity Load Support Elements

a. Load-bearing walls of wood or cold-formed steel framing.

b. Columns of built-up cold-formed steel or wood framing.

c. Pre-engineered metal building frames.

### 2. Horizontal Gravity Load Support Elements

a. Beams of cold-formed steel or wood framing.

b. Pre-engineered metal building joists.

### 3. Lateral Load Support Elements

a. Shear walls of cold-formed steel or wood studs and plywood.

## B1020.20 Roof Decks, Slabs, and Sheathing

### A. Acceptable Systems

1. Concrete-filled steel deck.

2. Concrete-filled composite steel deck, minimum 2½ inches concrete thickness from top of steel deck.

# Model Schools: Materials and Systems Standards

3. Cast-in-place reinforced concrete slabs.
4. Precast concrete hollow core slabs.
5. Steel roof deck.

## **B. Unacceptable Systems**

1. Plywood sheathing

### **B1020.21 Flat Roof Construction (Reserved)**

### **B1020.22 Pitched Roof Construction (Reserved)**

### **B1020.23 Canopies**

#### **A. Canopies: General Requirements**

1. A canopy or a building overhang may be desired to provide protection for the building entrance immediately preceding the entrance doors. Such canopies, when provided, shall typically be an integral part of the building.
2. The use of prefabricated canopy structures may be considered in addition to custom designed structures.
3. Canopies and other structures of shelter from the elements attached to the building's facades shall be sloped to drain water away from or parallel to all building surfaces. Canopy structures that include roof surfaces that direct the flow of water towards the exterior vertical surfaces of the building facade are not permitted.
4. The area of a canopy shall be limited and kept to a minimum required to serve their associated purpose.
5. All canopy types, materials, sizes and locations are subject to approval by the Authority.

### **B1080 Stairs**

#### **A. General Requirements**

1. Stair construction shall meet all the code requirements for structural load capacity and serviceability (vertical and horizontal deflection and vibration). Stairs are to be self-supporting with landings and stringers supported on posts or bearing on stair walls or wholly or partially supported by a floor or roof structure. Any structural elements of a floor or roof providing support for stair framing are to be fireproofed to the code-required rating.

# Model Schools: Materials and Systems Standards

## **B1080.10 Stair Construction**

### **A. Acceptable Systems**

#### **1. Interior stairs**

- a. Metal Stairs of steel stringers and landing support framing with closed-riser, gage steel pan treads and landings with a minimum 2" concrete topping for treads, 3" for landings.
- b. Cast-in-place reinforced concrete.
- c. Precast concrete.

#### **2. Exterior stairs**

- a. Metal stairs of galvanized steel or aluminum stringers and landing support framing with galvanized grating or diamond-plate treads with a non-slip finish. Do not use dissimilar metals.
- b. Cast-in-place reinforced concrete with a non-slip finish.
- c. Precast concrete with a non-slip finish.

### **B. Unacceptable Systems**

- 1. Interior and exterior: Alternating tread or spiral stairs.
- 2. Wood- or cold-formed steel-framed stairs.

## **B1080.50 Stair Railings**

### **A. Acceptable Systems**

- 1. Metal railings, guards, and posts (galvanized for exterior use if not aluminum or stainless steel).

### **B. Unacceptable Systems**

- 1. Interior and exterior: Wood- or cold-formed steel



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section B20: Exterior Vertical Enclosure**

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# Model Schools: Materials and Systems Standards

## **B20 Exterior Vertical Enclosures**

### **A. General Description/Design Approach**

1. Building Facade – New Buildings and Additions: The aesthetic, scale, proportion and detail of building facades shall manifest the educational, social, cultural and civic importance of a neighborhood school, its community and be appropriate for the age of the student population as well as the context of the site.

### **B. General Requirements**

1. Choice of materials must be guided by building construction budget and the following requirements:

a. The materials to be used in the design and construction of the school's exterior facades shall typically be limited to those materials which are specified in the NJSDA's Standards and the parameters established herein.

b. All masonry dimensions shall be based upon modular masonry dimensions, preferably of four (4") and eight (8") inch increments. The intended result is to minimize the amount of irregular conditions and the amount of cutting required during construction.

c. Whenever possible per height and presiding codes, a typical all masonry cavity wall shall be 1'-4" thick composed of a four inch (4") outer wythe of masonry veneer, a four inch (4") cavity including the rigid insulation and air barrier, and eight inch (8") concrete masonry unit backup system of the appropriate required type and density. Utilize a thicker concrete masonry unit, and of the appropriate type and density when required by code and or proper structural design of the wall. Provide horizontal and or vertical reinforcing when required. No additional wiring, conduit, or other communication related items are allowed within the cavity wall.

d. A typical vertical cavity wall shall preferably consist of materials with the same general composition and similar coefficients of expansion, shrinkage, and contraction, particularly within the exterior vertical wythe. Minimize differential movement between dissimilar materials. Specify and detail proper separation and control /expansion jointing of dissimilar materials when necessary.

e. Specify and detail all required end dams, door and window heads and sills so that the cavity wall can breathe. Properly detail conditions of differential expansion and contraction at all relieving angles, bond beams, and lintels.

f. Specify and document required expansion and construction joint systems of veneer wall, at interior partition systems, at running lengths of walls, windows, doors, inside and outside corners, roof, and ceilings where movement occurs and with proper consideration of distances between joints, joint type, sealant type, and depth. Provide associated schedules when applicable.

g. All masonry systems shall be designed with proper reinforcing in accordance with all loading and presiding code requirements.

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h. ALL MATERIALS AND SYSTEMS INDICATED AS “SUBJECT TO APPROVAL BY THE NJSDA” MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION DOCUMENTS.

## C. Related Standardized Details

1. Refer to the following details for additional information:

- a. B2010-11-01 Section: Brick Exterior Cavity Wall w/ CMU Backup
- b. B2010-11-02 Section @ Foundation: Brick Exterior Cavity Wall w/ CMU Backup
- c. B2010-11-03 Section @ Spandrel: Brick/CMU: Masonry Openings 8'-0" or Less
- d. B2010-11-04 Section @ Parapet: Brick/CMU Cavity Wall
- e. B2010-11-05 Section @ Spandrel: Brick/CMU Cavity Wall: High Windows
- f. B2010-11-06 Section @ Spandrel: Brick/CMU Cavity Wall: Relieving Angle
- g. B2010-11-07 Section @ Foundation: Brick Veneer/CMU Backup: w/ Basement
- h. B2010-11-08 Section @ Roof: Brick/CMU Cavity Wall: Curb: Built up Roof @ Wall
- i. B2010-11-09 Section: CMU Exterior Cavity Wall w/ CMU Backup
- j. B2010-11-10 Section @ Foundation: CMU Exterior Cavity Wall w/ CMU Backup
- k. B2010-11-11 Section @ Spandrel: CMU Veneer /CMU: Masonry Openings 8'-0" or Less
- l. B2010-11-12 Section @ Parapet: CMU Veneer/CMU Cavity Wall
- m. B2010-11-13 Section @ Spandrel: CMU Veneer/CMU Cavity Wall: High Windows
- n. B2010-11-14 Section @ Spandrel: Brick/CMU Cavity Wall: Relieving Angle
- o. B2010-11-15 Section @ Foundation: Brick CMU Veneer /CMU Backup: w/Basement
- p. B2010-11-16 Section @ Roof: CMU Veneer/CMU Cavity Wall: Curb: Built up Roof @ Wall
- q. B2010-11-17 Part Plan: Brick/CMU Veneer/ CMU Cavity Wall
- r. B2010-11-18 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Typical
- s. B2010-11-19 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Exterior Corner
- u. B2010-11-20 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Interior Column
- v. B2010-11-21 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Typical GWB Enclosure
- w. B2010-11-22 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Exterior Corner: GWB Enclosure
- x. B2010-11-23 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Interior Corner: GWB Enclosure
- y. B2010-11-24 Partial Section: Brick or CMU Veneer: Coping Stone Detail
- z. B2010-11-25 Section: Brick Exterior Cavity Wall w/ Metal Stud Backup
- aa. B2010-11-26 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Stud Backup
- bb. B2010-11-27 Section @ Spandrel: Brick/Metal Stud: Masonry Openings 8'-0" or Less
- cc. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
- dd. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
- ee. B2010-11-30 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Backup
- ff. B2010-11-31 Section @ Spandrel: Brick/Metal Stud: Masonry Openings 8'-0" or Less
- gg. B2010-11-32 Section @ Parapet: Brick/Metal Stud Cavity Wall

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## **B2010 Exterior Walls**

### **B2010.10 Exterior Wall Veneer**

#### **A. Masonry Materials: General Description/Design Approach**

1. Brick and/or concrete block shall be the typical and predominant material for all exterior cavity walls of the building.
2. Brick / Block Bond Pattern:
  - a. Typical brick / concrete masonry unit bond pattern/coursing shall be running bond.
  - b. Use of other masonry pattern/coursing to enhance building elements as well as the overall building aesthetic is acceptable but is subject to approval by the NJSDA.
  - c. Avoid changing between masonry products with different properties of expansion and contraction within the same vertical plane(s) of the exterior wall whenever possible. Provide proper control joints both horizontally and vertically when this condition is unavoidable. Coordinate locations with parapet and expansion joints and fenestration.
3. Brick and Concrete Masonry Unit type:
  - a. Brick and block types shall be that which is specified by the NJSDA's Standards.
  - b. Color and texture of all masonry products exposed to view is subject to approval by the NJSDA.
  - c. Definition and approval of shapes and sizes to be used: Special sizes and shapes are subject to approval by the NJSDA with the exception of masonry units used as sills or corners and lip bricks or blocks which are required to be utilized. Cutting lip bricks in the field during construction is not permitted.
  - d. Solid units shall be used where unsupported projection of masonry is 1/3" or greater and or the masonry core is visible.

#### **B. Masonry Materials**

1. Brick Veneer
  - a. Type FBX brick has tighter tolerance requirements as compared to the type FBS brick. The specifications shall call for Type FBX brick for the utility brick (or larger sizes) due to the tighter tolerances on the size of the masonry, as the greater variances of the Type FBS are exaggerated with the larger brick. The designer is to carefully research the brick selected with the manufacturer to ensure that the brick selected meets the FBX requirements.



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b. Certain bricks have a stone face or rustic appearance, which would fall in the FBA category. If the brick selected to meet a certain aesthetic is Type FBS or FBA, notify the NJSDA and if approved, modify the specification appropriately. Some FBS and FBA brick, depending on their qualities, may be acceptable to the NJSDA.

## 2. Concrete Masonry Units (CMU)

a. Concrete Masonry Units, Unglazed; will be permitted for use as an exterior wythe of masonry only if provided with an integral waterproofing agent.

b. The use of split face CMU, ribbed split-face CMU, or other extremely rough surfaced masonry units is not permitted on any portions of the exterior façade which may be subject to the application of graffiti.

c. On all construction, split faced CMU, ribbed split-face CMU, or other extremely rough surfaced masonry units may be used on addition /renovations and historic buildings to match existing features.

d. The use of split faced CMU, ribbed split-face CMU, or other extremely rough surfaced masonry units and its application is subject to approval by the NJSDA. The proposed type, color, finishes, and application of this material is subject to approval by the NJSDA.

### e. Ground Face Masonry Unit

1). Use of Ground face masonry units for exterior wythe of masonry will be permitted, provided they meet the above criteria 2.b.

### f. Sound Absorbing Masonry Units

1.) The use of sound absorbing masonry units shall be permitted as part of the cavity wall's back up system only when they occur in spaces requiring acoustical dampening such as a gymnasium or music room (Choral or Orchestra/Band, etc.)

### g. Polished Face Masonry Units

1.) Use of polished face masonry units will be permitted as a material for the building base and in small quantities as an accent provided they meet the above criteria in 2.b. The use of this material is subject to approval by the NJSDA.

## 3. Glazed Masonry Units

a. Use of glazed masonry units (brick or CMU) for large expanses or entire planes of a wall is not permitted. The use of glazed masonry units will be permitted as a material in small quantities as an accent. The use of this material is subject to the approval by the NJSDA.

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## 4. Concrete Brick

### a. General Requirements:

1.) Concrete brick, typically made from Portland cement, water, and suitable mineral aggregates with or without the inclusion of other materials is permitted. Materials to be used in the manufacture of brick include Portland cement, limestone, hydraulic cement, pozzolan, blast furnace slag cement, aggregates, and other constituents like air-entraining agents, coloring pigments, integral water repellents, and finely ground silica.

### b. Quality Assurance

1.) The use of concrete brick composed of solid, dry-cast, concrete building brick intended for exterior use in constructing structural masonry and meeting current versions of ASTM C55-23, C1634, and C426 is permitted.

2.) All units shall be sound and free of cracks or other defects that interfere with the proper placement of the units or significantly impair the strength or permanence of the construction.

## C. Other Masonry Materials

1. The following masonry material choices shall only be used in rare instances and utilized in limited quantities. The Design Consultant must present adequate justification for the use of these materials. The use of any of the following materials is subject to approval by the NJSDA.

### a. Calcium Silicate Masonry Unit (CSMU)

1.) Use of calcium silicate masonry units will be permitted as a material for the building base. The use of this material is subject to approval by the NJSDA.

### b. Cast Stone

1.) Cast Stone, as specified in the NJSDA's Standards, can typically be used to accent components and features of the exterior building elevations, in limited use as decorative accents, window sills, window heads, and water table definition.

2.) The use of this material is subject to approval by the NJSDA.

### c. Exterior Cut Stone

1.) Exterior cut stone, as specified in the NJSDA' Standards shall only be used on existing buildings to match features of the building's exterior, such as; coping stones, cornices, bands, fascias, window sills, window heads and water tables.

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2.) Use of exterior cut stone on stand-alone new building projects will not be permitted.

3.) Exception:

a.) Possible use of exterior cut stone on Addition Projects, to match features of the existing building, is subject to approval by the NJSDA.

e. Terra-Cotta

1.) Terra-cotta, as specified in the NJSDA's Standards shall only be used on existing buildings, to match exterior building elements.

2.) In rare instances on an addition project where matching an ornamental cornice feature is required, terra-cotta or another product, such as fiberglass, may be used after consultation with and approval by the NJSDA.

3.) The use of terra-cotta in other forms besides ornamental shapes will not be permitted.

4.) Terra-cotta is not as abuse resistant as "cast stone" and its use as such should be limited to areas that are more than 10' above the adjacent grade level.

5.) Special sizes and shapes may require custom anchors and/or attachment details.

**D. Other Exterior Wythe Materials**

1. The following other exterior wythe wall material choices shall only be used in rare instances and utilized in limited quantities. The Design Consultant must present adequate justification for the use of these materials. The use of any of the following materials is subject to approval by the NJSDA.

a. Glass Fiber Reinforced Concrete

1.) NJSDA's Standards include Glass Fiber Reinforced Concrete (GFRC), and Polymer-modified Glass Fiber Reinforced Concrete (P-GFRC).

2.) GFRC is typically used as a substitute for terra-cotta or cut stone. It may be used in limited quantities on stand-alone new buildings.

3.) In existing buildings, GFRC is typically used for large overhanging cornices where lighter weight may be an added value and the cornice can be hung from substrate.

4.) In rare instances on an addition project where matching an ornamental cornice feature is required.

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## Design Requirements

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5.) GFRC and P-GFRC may be permitted when used for column enclosures, and base, soffits and fascias may be permitted in limited quantities.

6.) The use of simulated masonry in other forms besides ornamental shapes will be permitted.

### b. Metal Panels

1.) Metal panels will be permitted for use in lieu of an exterior wythe of masonry if utilized in a proper application. Metal panels without back-up walls will not be acceptable. Utilize a rain-screen design approach to the construction documentation details for a metal panel system. Metal panels may not be used in locations where they are subject to damage, problems arising from vandalism, or ground contact.

2.) Use of insulated metal panels as part of the Vertical or horizontal enclosure is subject to approval by the NJSDA. Areas of such insulated metal panel(s) shall be included in the building's fenestration area to avoid the need for project specific Energy Modeling.

3.) A dry seal system is preferred with a rain screen metal panel system. Wet seal systems are typically not associated with pressure equalized and compartmentalized systems as well as with drained systems. Dry seal systems are typically associated with open rain screen or ventilated systems. The high cladding back ventilation rates also provide removal of condensed moisture from interior sources particularly with metal composite panel systems where the vapor barrier characteristics of metal composite panels and wet seals can be problematic.

## B2010.20 Exterior Wall Construction

### A. Wall Construction: General Requirements

1. Composite wall systems shall be cavity walls.

2. Cavities behind veneers shall not extend below grade.

3. Typical exterior masonry wall construction shall be a masonry cavity wall consisting of an exterior wythe of utility size face brick (4" X 4" X 12" ((Thickness X face dimension)) nominal) as a minimum size or concrete masonry units (4" X 8" X 16" ((Thickness X face dimension)) nominal) or larger. The cavity wall system shall also consist of a 8" nominal concrete masonry unit back-up system with a minimum 2" nominal clear air cavity, a minimum of 1 1/2" thick rigid insulation with in a four inch (4") cavity over a spray or roller applied air/vapor barrier applied to the exterior side of the backup block of the cavity wall system. No additional wiring, conduit, or other communication related items are allowed within the cavity wall.

4. A back-up wall comprised of properly structurally sized galvanized metal studs, moisture and mold proof, fiberglass coated, gypsum board sheathing including taping and sealing of joints per manufacturers' recommendations, an air / vapor barrier and minimum of 1 1/2" rigid insulation within the four inch (4") cavity and applied to the

# Model Schools: Materials and Systems Standards

## Design Requirements

## Exterior Vertical Enclosures – Section B20

moisture and mold proof, fiberglass coated, gypsum board sheathing may be substituted for a concrete block back up system. The joints and any penetrations through the rigid insulation shall be taped or properly sealed to form a continuous insulating envelope.

5. The Design Consultant may utilize both types of backup systems, an 8" (or larger as required per wall height) nominal concrete masonry unit back-up system and the system described in #4 above of properly sized light gauge galvanized metal studs, etc. within the contract documents of a single school facilities project. The Design Consultant shall select the proper back up system appropriate for the functional use of the space(s) the wall falls within.

6. Do not specify paper faced sheathing products on exterior or interior walls. Specify only mold and moisture resistant, fiberglass faced, wallboard for all sheathing products where a potential of moisture may be present.

7. Interior side of exterior walls facing circulation spaces i.e. corridor, lobby, vestibule, if not block, shall receive double layer of 5/8" moisture and mold resistant gypsum board, the outer layer shall be abuse resistant. Refer also to Section C10 Interior Construction.

8. The Designer is to carefully layout the brick bond patterns during the design to ensure that the patterns of the 4" X 4" X 12" brick or 4" X 8" X 16" CMU or other size selected will be aesthetically acceptable.

9. All NJSDA school facility projects shall have control and / or expansion joints at spacing suitable to accommodate expected movement. Joints for expansion, contraction, shrinkage, and building movement shall be sealed to prevent weather and water from penetrating to the interior of the building. All vertical and horizontal joints and cavities shall be drained to daylight above all horizontal surfaces. Provisions for vertical and horizontal expansion, contraction, and movement in accordance with BIA Technical Notes shall be included. Wherever possible provide control joints in transitions in masonry color.

11. Provide expansion and control joints as a function of length and material property differences.

12. Specify code compliant thermal resistance and continuity of the thermal envelope around all exterior basement foundation walls / vaults / wall / roof assemblies.

13. A graffiti resistant coating is to be used on all exposed exterior masonry surfaces up to 10'-0" high. Refer also to Section B2010.80.O Graffiti Control for additional requirements.

14. Deflection Criteria: Comply with all presiding codes and regulations, ACI 530/ASCE 5/TMS 402, and its accompanying masonry specification, ACI 530.1/ASCE 6/TMS 602 as well as the masonry standard: "*Building Code Requirements for Masonry Structures*" (ACI 530/ASCE 5/TMS 402) and the "*Specification for Masonry Structures*" (ACI 530.1/ASCE 6/TMS 602). Limit deflection criteria as applicable per Brick Industry Association; Technical Notes found at: <http://www.gobrick.com/resources/technical-notes> such as Note 28B December 2005 "Brick Veneer and Steel Stud Walls", and other applicable standards unless the presiding codes are more restrictive.

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## B. Quality Assurance

1. All concrete masonry and brick work shall be performed in accordance with the recommendations, standard details, and technical notes of the National Concrete Masonry Association (NCMA), (<https://www.masonryandhardscapes.org/technical-resources/#concrete-masonry-tech>), International Masonry Institute (IMI) (<http://www.imiweb.org/>), and the Brick Industry Association (BIA), (<https://www.gobrick.com>).
2. Thermal breaks, expansion joints, control joints, horizontal soft joints, galvanic reactions and accumulated moisture require outlets at bottom of the wall. In addition to the above in B.1. use recommendations from: Sheet Metal and Air Conditioning Contractors National Association (SMACNA) (<http://www.smacna.org/>), American Institute of Steel Construction, Steel Construction Manual, (<http://www.aisc.org/>) American Concrete Institute (ACI) (<https://www.concrete.org/topicsinconcrete.aspx>) as applicable.
3. Single source responsibility for decorative masonry Units: On a project, all decorative masonry block units shall be from a single source and by a single manufacturer, for each different product required.
4. At least one mock-up of the exterior wall is required and shall be properly documented in the drawings and specifications.
  - a. The content of the mockup(s) minimally shall display as many typical exterior cavity wall and or special interior wall construction conditions in a single panel not exceeding 6'-0" x 10'-0". Include a window opening when possible, showing the head and sill conditions, leaving an end dam / flashing, lintel, sill, etc. exposed for inspection. Leave small sections of the exterior wall out to facilitate viewing other conditions normally hidden from view, may be inspected, such as wall ties, mortar net, flashing, termination bars, etc. Locate the mock-up location to depict a wide range of typical exterior materials and joint conditions.
  - b. The mock-up must be approved in writing by the Design Consultant before construction can proceed on the masonry work of the exterior envelope and approved by the NJSDA. Define additional in-situ mock-ups for review and approval in the Contract Documents if appropriate or deemed necessary.
  - c. The use of more than one on site mockup must be defensible by the Design Consultant and is subject to approval by the NJSDA.

### B2010.30 Exterior Wall Interior Skin

#### A. General Description/Design Approach

1. If the inside surface and backup system of exterior cavity wall is comprised of primarily 8" nominal concrete masonry units:
  - a. Whenever possible apply the appropriate block filler, primer and paint finish coats.

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- b. The additional application of galvanized furring strips and a layer of primed, painted, mold, moisture, and abuse resistant gypsum board shall be used when required to provide consistent surfaces on all walls within a room or space.
2. If a back-up wall is comprised of properly structurally sized galvanized metal studs:
  - a. The inside surface shall be primed and painted, moisture, mold, and abuse resistant, gypsum board.
3. Refer to Section C20 Interior Finishes for additional information.

## **B2010.50 Parapets**

### **A. General Description/Design Approach**

1. Parapets when required shall serve the purpose of being a “protective guard” at the roof and/or provide the required exterior wall fire-resistive rating.
2. Parapets shall be provided as determined to be required by presiding codes or other justifiable protective purpose.

## **B2010.80 Exterior Wall Supplementary Components**

### **A. Mortar and Grout**

1. Mortar color may either match, complement, or contrast the associated adjacent masonry product selections.
2. No single type of mortar is best suited for all purposes, but there are several rules for selecting mortar type. Generally, do not use a mortar that is stronger in compression than needed by the structural requirements. Always select the mortar weakest in compression provides the best bond strength, and that is consistent with the performance requirements of the project. However, this guideline should be coupled with good engineering judgment; for example, it would be uneconomical and unwise to change mortar types in various parts of a structure.
3. Following are the recommended uses for different types of mortar:
  - a. Type N mortar: A medium-strength mortar suitable for general use in exposed masonry above grade and recommended specifically where high compressive or transverse masonry strengths are not required.
  - b. Type S mortar: A high-strength mortar suitable for general use and specifically for circumstances where high transverse strength of masonry is desired; for reinforced masonry, where mortar bonds the facing and backing; and for areas subject to winds greater than 80 mph (130 kph).
  - c. Type M mortar: A high-strength mortar suitable for general use and recommended specifically for masonry below grade or in contact with earth, such as foundations, retaining walls, or paving.



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d. Type O mortar: A low-strength mortar suitable for use in non-load bearing applications in walls of low axial compressive strength and where masonry is not subject to severe weathering.

#### 4. Quality Assurance

##### a. Mortar

1.) All mortar selection and composition shall comply with presiding codes. Mortar selection shall be advised by the requirements of Building Code Requirements for Masonry Structures (ACI 530/ASCE 5/TMS 402 latest version).

2.) Mortar and grout selection shall also be advised by the Brick Industry Association's "Technical Notes for Brick Construction" and the International Masonry Institutes, "Technical Briefs" as they relate to this issue.

##### b. Grout:

1.) Grout should be mixed thoroughly in a plastic mix suitable for placement without separation of the constituents. Add enough water to achieve a slump of 8 to 11 in. (200 to 275 mm). The compressive strength of the grout should match that of the brick masonry but must have a minimum compressive strength of 2000 psi (13.9 MPa).

2.) Fine grout: Can be used for grouting interior vertical spaces between two wythes of masonry or aligned, unobstructed vertical spaces in hollow masonry units. See the "Grout Spacing Requirements" table for grout space requirements.

3.) Coarse grout: May be used when the grout space exceeds 2 in. (50 mm) in width. If the minimum grout space dimension exceeds 6 in. (150 mm), a larger aggregate size may be specified.

#### B. Insulation

1. Insulation within the cavity wall may be extruded or expanded rigid polystyrene board insulation, rigid cellular polystyrene thermal insulation or foil faced and or glass fiber reinforced rigid cellular polyisocyanurate thermal insulation.

2. The selection of the in cavity insulation material and related thickness must comply with presiding codes.

3. Tape or caulk all joints per manufacturer's recommendations.

4. Batt or spray on foamed insulation in the outer cavity walls shall only be provided if required to meet presiding codes or other NJSDA requirements.

5. Masonry Cell Insulation: Insulation within masonry cells may be granular perlite or molded polystyrene units.



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## 6. Quality Assurance

### a. Warranty:

- 1.) Specify a fifteen year (15) limited thermal warranty for rigid cellular polyisocyanurate.
- 2.) Specify a fifty year (50) limited thermal warranty for expanded rigid polystyrene board.

## C. Air / Vapor Barrier

1. The preferred system for the masonry exterior walls with concrete masonry back up shall be a fluid / spray applied or troweled on air vapor barrier applied from the base flashing to the top of wall or coping and should seal everything including veneer ties. The barrier shall lap and perform in conjunction with or similar to the weep system at the bottom of cavity walls. All applied stainless steel masonry anchors shall be imbedded or mechanically attached to the wall prior to the coating or as per manufacturer's specification and sealed accordingly.

### 2. Air Vapor Barrier Alternatives:

- a. Specify a complete system based upon a two component, synthetic rubber cold vulcanized producing a resilient, fully bonded, monolithic, elastomeric sheet
- b. Specify a complete system based upon a water based asphalt emulsion modified with a blend of synthetic polymers and special additives
- c. Specify a complete system based upon a SBS rubberized asphaltic sheet applied system may be considered. The Design Consultant must demonstrate this selection to be appropriate for its application and budget tolerance. This choice is subject to approval by the NJSDA.

3. The preferred system for the exterior masonry walls with galvanized metal back up and mold and moisture proof fiberglass sheathing shall be a commercial quality wrap made of flash spun bonded polyolefin, non- woven, non- perforated secondary weather resistant barrier. Specify a complete system including, seam tape, fasteners, etc.

- a. Specify a complete system based upon a fluid-applied, monolithic elastomeric membrane continuously over exterior wall sheathing to mitigate air and water migration while permitting the passage of water vapor.

4. Specify a complete system based upon a SBS rubberized asphaltic sheet applied system may be considered. The Design Consultant must demonstrate this selection to be appropriate for its application and budget tolerant. This choice is subject to approval by the NJSDA.

## 5. Quality Assurance

- a. The air/vapor barrier shall meet the air barrier requirements of ICC-ES AC-38, the ASTM E1677 Standard Specification for a Type I air barrier and passes the

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ASTM E2357 standard test method for determining air leakage of air barrier assemblies. The air/vapor barrier shall also meet the Massachusetts Commercial Energy Code and the presiding NJ Energy Code: ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings.

b. Warranty: Specify a five (5) year manufacturers' standard warranty.

## **D. Flashing**

1. Flashing may be stainless steel, cold rolled copper, copper laminates, EPDM, or self-adhering butyl or cross laminated high density polyethylene sheet.
2. Select flashing materials so that they are compatible with all adjacent materials. Consideration should be given to compatibility with adjacent sealants, delamination due to moisture penetration and movement of the wall system.
3. Asphalt –impregnated building felt and polyethylene sheeting are not permitted.

## **E. End Dams**

1. Use prefabricated flashing pans with pre-formed end dam systems whenever possible.
2. Properly detail and specify all required end dams, door and window heads and sills so that the cavity can breathe.
3. Properly detail conditions of differential expansion and contraction at all relieving angles and lintels.

## **F. Termination Bars**

1. Termination bars shall be stainless steel with stainless steel fasteners.
2. The practice of terminating flashing within the nearest or next highest horizontal mortar joint is acceptable provided the flashing does not compromise the bond strength of the wall

## **G. Ties, Anchors, and Reinforcement**

1. All masonry ties shall be 2 part, and made of hot dipped galvanized steel or stainless steel.
2. Ties which are surface mounted in the cavity wall to a CMU or galvanized, light gauge, metal stud back up system and attached by screws or other fasteners shall always be stainless steel including the respective fasteners. Any ties subject to damage of the hot dipped galvanized coating due to their location, installation procedures, movement of systems, etc. shall be stainless steel.
3. Horizontal joint reinforcement shall be either stainless steel unless there are budgetary restrictions; in those instances, hot dipped galvanized steel ties may be used.
4. Corrugated ties are not permitted for use within and exterior wall or other location where moisture may be present.

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## **H. Lintels**

1. All loose lintels exposed to the exterior elements shall be galvanized steel. Dual lintels back to back on hangers from the structure shall be used when appropriate. All exposed galvanized steel shall be painted with an appropriate paint type for an exterior application.
2. Pre-cast concrete or concrete bond beams filled with grout may be used in the backup system wythe only and shall be designed by the Structural Engineer to include reinforcing steel bars appropriate for the span of the opening are permitted. Inserts to hold the exterior loose lintels shall be cast into the pre-cast concrete.

## **I. Bottom of Cavity Drainage Material**

1. Properly detail all cavity walls to include "mortar net" or "mesh" or a similar product that will catch mortar droppings while keeping the cavity clear to allow water to weep out to the exterior.
2. Mortar mesh shall extend at least two courses higher than the bottom of flashing below. Include 'mortar mesh' in the specifications. The elevation of the top of the mesh in the cavity shall vary to further reduce the probability of the continuous collection of mortar
3. The use of pea gravel to catch mortar droppings is not permitted.

## **J. Weep Vents**

1. Weep joints / vents shall be achieved by omitting mortar in all or part of the vertical head joint and by using plastic (polyester, polypropylene, polyethylene mesh) or metal prefabricated weep vents that are the full vertical height of the adjacent bricks and 90% open, and the full width of the joint.
2. Prefabricated weeps shall be recessed  $\frac{1}{4}$ " from the outside face of the wall and the full depth of the outside wythe of masonry.
3. Specify plastic or metal weeps in brick veneer as well as weeps in brick veneer at relieving angles and bearing of lintels at wall openings.
4. Vent the top of wall cavities with plastic or metal weeps described above when deemed necessary for pressure equalization and moisture differential below parapets, etc.

## **K. Control Joint Gaskets**

1. Shall be pre-formed styrene-butadiene-rubber, and be designed to fit standard sash block and maintain lateral stability in masonry walls.

## **L. Compressible filler**

1. Pre-molded filler strips formulated from neoprene, urethane, or PVC.

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## **M. Bond-Breaker Strips**

1. Asphalt saturated, organic felt strips min. #15 felt. To be included at all interface conditions in which differing masonry materials are matched unless otherwise addressed by other movement isolation methods/materials.

## **N. Masonry Cleaners/ Efflorescence Removal**

1. All efforts to eliminate efflorescence on exterior masonry walls shall be taken. Proper storage of the masonry product(s) (CMU, brick, etc.) must be defined in the contract documents by the Design Consultant including dry and covered storage at the manufacturing plant, distributor's site, on-site storage, while construction is in progress, and on the entire building when applicable, until final occupancy.
2. The development of efflorescence requires the presence of soluble salts and moisture. To prevent or minimize efflorescence, the elimination of either will suffice. Design, detailing, and construction practices that promote resistance to water penetration are the most effective methods of preventing efflorescence. Minimize the selection of brick, mortar, and grout components that contain soluble salts.
3. Soluble salts in soil are dissolved by water that percolates through the ground. Consequently, most ground water contains a high concentration of these salts. When masonry is in contact with the earth, ground water may be absorbed by the masonry and may rise through capillary action several feet above the ground. An accumulation of salts in the masonry are then possible. To eliminate these salts as sources of efflorescence, waterproof the masonry that extends below grade and install flashing a few courses above grade. The waterproofing prevents the masonry from absorbing dissolved salts from the adjacent soil and the flashing acts as a capillary break, preventing any absorbed salts from rising higher in the wall. Another solution is to detail the below grade condition so that masonry does not extend below grade.
4. Efflorescence: If present requires removal. The first step in removal is to identify the type of efflorescence salts present. If water soluble, this type can be removed with water and using a dry, stiff bristle brush and or the application of a mild soap. If the salts are not water soluble, use an acidic cleaners of the standard or appropriate strength specifically developed for this purpose. Follow the manufacturer's recommendations.
5. Require the use of masonry stain removers specifically developed for the surfaces they are cleaning if any type of staining is present. Require final masonry cleaning using specialized masonry cleaners when appropriate.
6. After the final wash down of any wall, no efflorescence will be accepted. The Design Consultant shall require that the contractor and their subcontractor(s) will be responsible for monitoring and removing any efflorescence or staining on any wall for a period of five years from project completion and occupancy. The Design Consultant shall specify that the contractor and their subcontractor(s) shall be responsible for all costs associated with any efflorescence removal during this warranty period.

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## **O. Graffiti Control: Description/Design Approach**

1. A graffiti resistant coating is to be used on all exposed exterior masonry surfaces up to 10'-0" high.
2. For new construction: use clear, matte finish sacrificial coating. As the coating may discolor the basic material, the designer should provide a break in the façade such as a string course to define the area being coated. An alternative approach to the sacrificial coating may include an ASTM C744 compliant brick/block being utilized to meet this standard.
3. For existing buildings, graffiti should be removed and a sacrificial graffiti resistant coating applied. If the graffiti "shadow" cannot be removed without damage to the surface, the masonry walls should be painted, and then the graffiti resistant coating should be applied.
4. Removal of graffiti should always follow coating manufacturers' recommendations, because many anti-graffiti coatings are intended to be used with a particular removal method or cleaning product. As anti-graffiti coatings provide a barrier to paint and other staining, they also provide a barrier to water evaporation through the outer face of the brick, similar to that of glazed brick. Therefore, most of the drying of the brickwork occurs by evaporation through the back face of the brick, into the air space. It is important that when an anti-graffiti coating is used, the cavity behind the brick be vented at top and bottom to help remove the excess moisture in the air space created by this evaporation. For new construction vents at the top of the wall area should be below any relieving angles or other restriction to the vertical flow of air in the cavity.
5. For existing buildings of solid masonry construction and buildings without weep holes, the bottom two brick course should remain unpainted and uncoated to allow the wall to breathe.

## **P. Masonry Repair, Repointing, and Restoration**

1. Applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places and buildings classified by the New Jersey State Historic Preservation Office (SHPO) (<http://www.nj.gov/dep/hpo/>) as New Jersey State or other Federal Landmark status. The following criteria also apply to all other renovations and restorations where brick mortar removal and repointing is required. The applications of these criteria are subject to the approval of all presiding Authorities.
2. Mortar Removal: Existing mortar is to be removed from historic masonry surfaces using hand held non-power tools for all joints or a combination of power tools/handheld-non-power tools for horizontal joints & hand held non-power tools for vertical joints. Perimeters of brick replacement areas are to be cut in a similar manner prior to brick removal to ensure adjacent bricks to remain are not damaged.
3. Repointing will be appropriate provided it occurs only where mortar is missing or deteriorated, and the new mortar matches the original in color, texture, tooling, size and profile of joint. It is most important to ensure that the work does not significantly alter the building's appearance by reversing or otherwise offsetting the visible mortar to brick ratio. This is traditionally addressed by limiting repointing only to areas where needed

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(at grade, downspouts, parapets etc.) However, if total or extensive repointing is required to ensure a watertight envelope, the specifications must ensure the original appearance is maintained, and brick is not damaged unnecessarily.

4. New mortar shall attempt to be similar to existing mortars, however, the following will dictate: The original mortar shall be tested to determine its composition. Historic Mortars are often soft because of their high lime content and lack of Portland cement. New mortar should be soft enough to prevent damage to historic masonry materials. If a mortar analysis is not performed, a Type O Mortar may be used:

- a. 1 part white Portland cement
- b. 2 parts Type S hydrated lime
- c. 7 parts sand with no admixtures

5. When repointing at parapets, at grade, or at other areas exposed to harsh weathering conditions, it may be appropriate to use a more durable new mortar. If a mortar analysis is not performed, the following mortar mix should be used:

- a. 2 parts white Portland cement
- b. 3 parts Type S hydrated lime
- c. 6 parts sand with no admixtures

## 6. Masonry Cleaning and Removal of Existing Coatings

a. The goal of cleaning a historic structure is not to make it look entirely new. Removal of the last 15% of the grime or coatings will also remove some of the masonry material.

b. Harsh chemicals or high pressure washing can damage historic masonry. Cleaning should remove surface dirt using the gentlest methods possible. Work will be appropriate provided only non-ionic neutral pH detergents (not chemicals), non-metallic, natural bristle brushes or scrapers, and water pressure no greater than 150 psi are used. Vortex systems will be approved only for use on limestone. If proposed for use on brick, testing (with before and after microscopic surveys) will be required.

c. Chemical paint removal systems, particularly “peel-away” systems where lead is an issue, are subject to NJ State Standards. Only approved “peel-away” systems may be used, and, only following a procedure recommended by its manufacturer and compliant with the NJDCA State lead paint protocols. Adequate oversight to ensure proper and prompt removal of the blanket is critical to prevent drying of the material which would then necessitate scraping and the potential to damage the brick.

## 7. Masonry Coatings

a. Use of any masonry coating must be addressed by analysis and, if necessary, testing of each specific problem and material prior to application.

b. Moisture trapped under masonry coatings can cause excessive damage in freeze-thaw cycles. These coatings prevent the natural passage of moisture from within the wall and aggravate many existing moisture problem. Acrylic

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sealers, cementitious paints, and other non-breathable coatings shall not be applied to historic masonry surfaces.

c. Although a more sacrificial coating is preferred, a breathable coating may be approved if the proposal is supported by sufficient information concerning the reason for its use and its permeability.

## B2020 Exterior Windows

### A. General Description/Design Approach

1. The arrangement and design of windows (fenestration) shall be in scale and proportion to the building's elevations, massing, volume, and coordinated with all building systems.
2. The windows (fenestration) must be appropriate for the use of the space for which the windows are being provided. Fenestration includes any exterior aluminum framed cladding system such as a window system, aluminum entrance system, storefront system, curtain wall system, or other similar system.
3. The percentage of fenestration and associated ventilation requirements shall meet the requirements of all presiding codes and regulations.
4. Exterior glazing shall be comprised of 1" sealed insulating units, laminated, tempered, etc. and where required comply with presiding codes and other requirements including but not limited to: NJ Division of Community Affairs, Department of Codes and Standards: "Best Practices Standards for Schools Under Construction or Being Planned for Construction".

### B. General Requirements

1. Choice of materials must be guided by building budget and the following requirements:
  - a. The materials to be used in the design and construction of the school's exterior facades shall typically be limited to those materials which are specified in the NJSDA's Standards and the parameters established herein.
2. Outward projecting windows or awnings are not permitted when they are near or encroaching upon any exterior path of travel such as a sidewalk, or located at the perimeter of an outdoor paved space where a person can become injured.
3. Projection of hopper windows beyond the adjacent interior wall surface or the outer most interior facing vertical plane of permanently installed furnishings or equipment shall not be permitted.
4. Steel frames are permitted where required to provide fire ratings.
5. Sill heights: Coordinate with adjacent furniture and equipment heights. Typical sill height is minimum 2'-8" or 3'-4" above the finished floor (AFF) to top of the sill location. Minimum height of sill above finished floor shall coordinate with masonry coursing.



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6. Fixed transom units are permitted at entrances and other limited locations.

7. Insulated metal panels and spandrel glass, gasketed into the fenestration system are permitted in limited conditions. Spandrel panels may be composed of a single layer of the appropriate type of spandrel glass with insulation behind it or composed of an insulating glass unit with a sandwich panel composed of metal studs and mold and moisture resistant gypsum board behind the spandrel glass. Both approaches should allow for the spandrel condition to be weeped and vented. Insulated metal panels and spandrel panels shall be installed by the fenestration manufacturer or by an installer acceptable to the fenestration manufacturer. The use of insulated metal panels within the fenestration shall only be used if the fenestration systems manufacturer's warranty will remain unaffected by their application. The use of insulated metal panels requires justification by the Design Consultant and is subject to approval by the NJSDA.

8. Fixed windows (fenestration) shall permit re-glazing without removal of the window master or vent frame.

## **C. Quality Assurance**

1. The entire fenestration assembly shall comply with all applicable Fenestration & Glazing Industry Alliance (FGIA) (<https://fgiaonline.org/>), Commercial or Heavy Commercial and Architectural Grade rating standards. The entire window (fenestration) assembly shall comply with all applicable sections and requirements of ANSI/WDMA/CSA 101/I.S.2/A440-08 (or current) "Voluntary Specifications for Aluminum, Vinyl (PVC), Wood Windows, and Glass Doors.

2. Source Limitations: Obtain aluminum windows through one source from a single manufacturer. Use an installer approved by the aluminum window, storefront or curtain wall manufacturer for installation of the window (fenestration) units required.

3. The Design Consultant and their Sub-Consultants shall design and specify performance criteria which meet or exceed the presiding codes for all systems described herein to prevent system failure. This shall include but not be limited to the following:

- a. Deflection of framing members
- b. Structural performance testing to comply with all codes including but not limited to wind loads, uniform loading, and seismic when applicable
- c. Wind-borne debris impact resistance
- d. Air infiltration
- e. Water Resistance including penetration under static pressure
- f. Water Resistance including penetration under dynamic pressure
- g. Thermal resistance and movements
- h. Condensation resistance
- i. Thermal conductance



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- j. Sound transmission
  - k. Strength of structural sealants including their joints
4. The minimum STC value for all aluminum framed exterior fenestration shall be STC 35 when tested for laboratory sound transmission loss according to ASTM E90 and as determined by ASTM E413.
5. All exterior and interior coatings applied to aluminum extrusions, plates, and sheets shall be factory applied by the fenestration manufacturer.
6. All integral window, curtain wall, or storefront system components such as window frames and vents requiring factory assembly shall be assembled by the window (fenestration) manufacturer.

## **E. Related Standardized Details**

1. Refer to the following details for additional information:
- a. B2010-11-01 Section: Brick Exterior Cavity Wall w/ CMU Backup
  - b. B2010-11-02 Section @ Foundation: Brick Exterior Cavity Wall w/ CMU Backup
  - c. B2010-11-03 Section @ Spandrel: Brick/CMU: Masonry Openings 8'-0" or Less
  - d. B2010-11-04 Section @ Parapet: Brick/CMU Cavity Wall
  - e. B2010-11-05 Section @ Spandrel: Brick/CMU Cavity Wall: High Windows
  - f. B2010-11-09 Section: CMU Exterior Cavity Wall w/ CMU Backup
  - g. B2010-11-10 Section @ Foundation: CMU Exterior Cavity Wall w/ CMU Backup
  - h. B2010-11-11 Section @ Spandrel: CMU Veneer /CMU: Masonry Openings 8'-0" or Less
  - i. B2010-11-12 Section @ Parapet: CMU Veneer/CMU Cavity Wall
  - j. B2010-11-13 Section @ Spandrel: CMU Veneer/CMU Cavity Wall: High Windows
  - k. B2010-11-17 Part Plan: Brick/CMU Veneer/ CMU Cavity Wall
  - l. B2010-11-25 Section: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - m. B2010-11-26 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - n. B2010-11-27 Section @ Spandrel: Brick/Metal Stud: Masonry Openings 8'-0" or Less
  - o. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
  - p. B2010-11-29 Section: CMU Exterior Cavity Wall w/ Metal Stud Backup
  - q. B2010-11-30 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Backup
  - r. B2010-11-31 Section @ Spandrel: Brick/Metal Stud: Masonry Openings 8'-0" or Less
  - s. B2010-11-32 Section @ Parapet: Brick/Metal Stud Cavity Wall

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## **B2020 Exterior Windows**

### **B2020.10 Exterior Operating Windows & B2020.20 Exterior Fixed Windows**

#### **A. General Requirements**

1. All window (fenestration) openings shall be coordinated with masonry unit sizes and design to align with masonry coursing, patterns, control joints, and other features, and to eliminate unnecessary cutting of masonry units.
2. For the specific window type chosen; specify window stops that limit openings to 4". All windows shall be provided with window stops limit the window openings so that the stops prevent students from falling out of the school facilities windows. Removal of stops shall require the use of special tools.
3. Intermediate mullions may be provided for aesthetic reasons, to divide panels into sections so as to not exceed size limitations of the glazing type used, to include operable panels for natural ventilation, and mullions shall be provided where essential to align with existing conditions. If provided, mullions shall be permanently installed and shall be of the same material as the window frame.

#### **B. Window Types: Materials**

1. Windows for new buildings shall typically be aluminum frame, integrally concealed, low-conductance structural thermally broken, hopper/awning (projecting inward / outward respectively), casement windows, and / or fixed windows.
2. Commercial-grade, aluminum windows, with an integrally concealed, low-conductance structural thermal break(s), with fixed and / or operable sash, with minimum 1" thick insulating glass are permitted when code compliant.
3. Heavy duty commercial-grade aluminum windows, with an integrally concealed, low-conductance structural thermal break(s), with fixed and /or operable sash are permitted, when their use is justifiable by the Design Consultant.
4. Use of windows other than those listed above for new buildings or additions shall be approved by the NJSDA
5. Exterior sills shall be either extruded aluminum, fabricated, and provided by the window manufacturer or cast stone.
6. Extruded aluminum shall be 6063-T6 alloy and tempered.
7. All window units shall be factory glazed by the manufacturer.

#### **C. Window Size**

1. View window: Sill height to top of window stool or sill: Provide a minimum 2'-8" or 3'-4" above finished floor (AFF) to top of sill height. A sill height of 2'-8" AFF to top of sill height is preferred, particularly for exterior walls with a concrete masonry unit back up system to align with block coursing. The window head shall be located at a minimum of

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8'-0" AFF. Comply with presiding codes and regulations with regard to daylight and ventilation requirements.

2. Day-lighting window: Provide a day-lighting window from the head of the view window (7'-4") to the ceiling (Optional). The intermediate window head may be lower than 7'-4" to accommodate the addition of a day-lighting window.

### D. Quality Assurance

#### 1. Weather Stripping and Sealing

a. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

b. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.

c. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440-08 (or current version).

d. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702-23 (or current version).

1.) Weather Seals: Provide weather stripping with integral barrier fin or fins of semi rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

e. Replaceable Weather Seals: Comply with AAMA 701/702.

f. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement

#### 2. Fasteners

a. All fasteners shall be either aluminum, nonmagnetic stainless steel, epoxy adhesive coated, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

b. All fasteners must be concealed except where unavoidable for application of hardware.

c. For application of hardware, where required, use non-magnetic stainless steel Phillips machine screws.

#### 3. Anchors, Clips, and Accessories

a. All anchors, clips, and accessories shall be aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe

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service conditions; provide sufficient strength to withstand design pressure indicated. All anchors, clips, shall be anchored to the back-up wall system when possible.

#### 4. Manufacturer's Warranties: Aluminum Windows

a. Aluminum Windows: Manufacturer's Standard Form Warranty in which the manufacturer agrees to repair or replace aluminum windows and screens that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

- 1.) Failure to meet performance criteria
- 2.) Structural Failures including excessive deflection
- 3.) Water leakage and air infiltration
- 4.) Faulty operation of movable sash and or hardware
- 5.) Deterioration of metals, metal finishes, and other materials beyond normal weathering.

b. Warranty Period: Manufacturer's Standard Form Warranty for two year against defects in material or workmanship under normal use from the date of Substantial Completion and remain operable for 10 years.

#### E. Replacement Window Installations

1. Window types and conditions listed for new construction shall be used wherever possible. Additions/Renovations may require windows other than those listed above for reasons of aesthetic and or historic compatibility.

2. Where other window types are required to align with existing conditions, written justification and approval by the NJSDA as early as possible during the development of the design of the exterior of the building.

### B2020.30 Exterior Window Wall

#### B2020.30.1 Curtain Wall

##### A. General Description/ Design Approach

1. Curtain wall shall generally not be used on the NJSDA's projects. In new construction projects, the use of curtain wall must be justified by the Design Consultant and must be approved by the NJSDA as early as possible during the development of the design of the exterior of the building.

2. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Curtain wall may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior

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curtain wall building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.

3. In instances, on a project that is a renovation and or addition to an existing building which contains curtain wall and matching a feature is required, curtain wall may be used after consultation with and approval of the NJSDA.

## **B2020.30.2 Exterior Aluminum Framed Entrances and Storefront Systems**

### **A. General Description/Design Approach**

1. For new construction, the use and application of exterior aluminum framed entrances and storefront systems are permitted for the school facilities project. Refer to Section B2050 Exterior Doors and B2050.10.1 Glazed Doors and Entrances for information on related exterior door systems.

2. For new construction projects, any additional proposed use of exterior aluminum framed entrances and storefront systems must be justified by the Design Consultant and must be approved by the NJSDA as early as possible during the development of the design of the exterior of the building.

3. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Exterior aluminum framed entrances and storefront systems may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior aluminum framed entrances and storefront system building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.

4. In rare instances, on a project that is an addition to an existing building which contains existing exterior aluminum framed entrances and or a storefront system and matching those features is required, exterior aluminum framed entrances and or a storefront system may be used after consultation with and approval of the NJSDA as early as possible during the development of the design of the exterior of the building.

### **B. Quality Assurance**

1. Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

- a. Movements of supporting structure indicated on the drawings and or in the specifications including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
- b. Dimensional tolerances of building frame and other adjacent construction.
- c. Failure includes the following:
  - 1.) Deflection exceeding specified limits.

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- 2.) Thermal stresses transferring to building structure.
- 3.) Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
- 4.) Glazing-to-glazing contact.
- 5.) Noise or vibration created by wind and by thermal and structural movements.
- 6.) Loosening or weakening of fasteners, attachments, and other components.
- 7.) Finish or sealant failure.
- 8.) Failure of operating units.

## 2. Materials

a. Framing Members: Utilize the manufacturer's standard extruded aluminum framing members structural thermal barrier of thickness required and reinforced as required to support imposed loads based upon presiding codes. Refer to Section B2050.10.1 Glazed Doors and Entrances for additional information.

b. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

- 1.) Sheet and Plate: ASTM B 209
- 2.) Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221M-21
- 3.) Extruded Structural Pipe and Tubes: ASTM B 429.
- 4.) Structural Profiles: ASTM B 308/B 308M.
- 5.) Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

c. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to the recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

- 1.) Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
- 2.) Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
- 3.) Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

d. The aluminum framed entrance or storefront system selected and specified may be either screw spline, shear block or stick built and shall be outside glazed. The glazing system shall be retained with gaskets on four sides.

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**C. Window Size**

1. Refer to Section B2020.10 Exterior WindowsC.1 General Requirements: Sill Heights

**D. Brackets and Reinforcements:**

1. Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

**E. Fasteners and Accessories**

1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
3. Reinforce members as required to receive fastener threads.
4. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

**F. Concrete and Masonry Inserts**

1. Quality Assurance
  - a. Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M

**G. Concealed Flashing**

1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

**H. Framing System Gaskets and Sealants**

1. Manufacturer's standard, recommended by manufacturer for joint type.
  - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

**I. Quality Assurance**

1. Manufacturer's Warranties: Aluminum-Framed Entrances and Storefronts
  - a. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.



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1.) Failures include, but are not limited to, the following:

- a.) Structural failures including, but not limited to, excessive deflection.
- b.) Noise or vibration caused by thermal movements.
- c.) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- d.) Adhesive or cohesive sealant failures.
- e.) Water leakage through fixed glazing and framing areas.
- f.) Failure of operating components.

b. Warranty Period: Two years from date of Substantial Completion.

## **B2020.90 Exterior Window Supplementary Components:**

### **A. Exterior Aluminum and Steel Frame Windows, Entrances, and Storefront: Materials**

#### **1. Frame: Aluminum Extrusions**

- a. All exterior aluminum frame fenestration shall be composed of the manufacturer's standard aluminum extrusions with a structural, thermal barrier. A structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions. No thermal short circuits shall occur between the exterior and interior.
- b. Extruded aluminum shall be alloy and tempered by the manufacturer for type of use and finish.
- c. All aluminum frame and vent extrusions shall have a minimum wall thickness of .125" (3 mm).
- d. Depth of all aluminum frames and vents shall not be less than 4" (50 mm).
- e. Window materials other than aluminum or steel require written justification and approval by the NJSDA as early as possible during the development of the design of the exterior of the building.

#### **2. Glazing**

- a. Exterior glazing shall be comprised of 1" minimum, sealed insulating units, laminated, tempered, etc. and where required comply with presiding codes and other requirements including but not limited to: NJ Division of Community Affairs Department of Codes and Standards: "Best Practices Standards for Schools Under Construction or Being Planned for Construction".



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## Design Requirements

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- b. Glazing treatments such as tinted, fritted, frosted, sandblasted, opaque and other special surface treated or coated glass require justification by the Design Consultant and are subject to approval by the NJSDA.
- c. Single glazing is not permitted on the building exterior.
- d. Conditions requiring fire rated exterior glazing are to be avoided.
- e. All glazing shall be installed by the exterior aluminum frame windows, entrances, and storefront manufacturer or a manufacturer approved installer.
- f. All units shall be glazed with the manufacturer's standard sealant process provided the glass is held in place by a removable, extruded aluminum, glazing beads. The glazing bead shall be isolated from the glazing material by a gasket.
- g. The use of triple glazing requires justification by the Design Consultant and is subject to approval by the NJSDA.

### h. Quality Assurance

#### 1.) Warranty Requirements: For insulating glass units:

a.) Provide manufacturers standard written warranty against visual obstruction from dust or film formation or moisture collection between internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship excluding that caused by glass breakage or abuse by others.

b.) Warranty Period: Ten (10) Years from the date of Substantial Completion.

2.) Comply with published recommendations of glass manufacturers and the National Glass Association (NGA) GANA Glazing Manual unless more stringent requirements are indicated.

### 3. Window Screens

#### a. Insect Screens

1.) General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on inside or outside of window, depending on configuration. Provide insect screens on all operable sash windows.

#### b. Quality Assurance

1.) Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with Screen Manufacturer's Association 6001-2021 (or current). Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

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2.) Extruded-Aluminum Tubular Framing Sections and Cross Braces:

a.) Not less than 0.050-inch (1.3-mm) wall thickness.

b.) Finish: Match other extruded aluminum members.

3.) Glass-Fiber Mesh Fabric:

a.) 18-by-16 (1.0-by-1.1-mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; in the following color. Comply with ASTM D 3656.

b.) Mesh Color: Charcoal gray.

4.) Screen mounting holes shall be factory drilled

4. Finishes

a. The following are acceptable finishes for exterior aluminum frame windows, entrances, storefront systems and security screens:

1.) Anodic: The aluminum window, entrance, or storefront manufacturer shall factory apply the specified anodic finish to all exposed areas of aluminum windows and components with electrolytically deposited color in accordance with Aluminum Association Designations.

a.) Utilize composite standard Aluminum Association Designations for all anodic finishes.

b.) Colors shall be selected from the manufacturers' full range of standard colors.

2.) Organic: Finish all exposed areas of aluminum windows, entrance, or storefront components with a two (2) or three (3) coat high performance fluoropolymer coatings including an appropriate durable, compatible primer.

3.) Baked Enamel: Provide a factory spray applied thermosetting, modified acrylic enamel primer/topcoat system complying with AAMA 2603 to all exposed areas of aluminum windows and components.

4.) Acrylic Polyurethane: Finish all exposed areas of steel windows and components with a factory applied, cathodic, epoxy primer and a spray coat of oven baked acrylic polyurethane as a finish coat. An intermediate powder coat or urethane polyester and or clear finish coat may be added in locations subject to adverse environmental conditions.

5.) De-burring, cleaning, pre-treatment, and priming of metal surfaces are required as applicable but are not described in detail herein. Follow manufacturer's recommendations.

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b. Colors shall be selected from the manufacturers' full range of standard colors.

c. The use and selection of a custom color(s) or special coating(s) not included in the manufacturers' full range of standard colors is subject to approval by the NJSDA.

d. The types and thickness of coatings shall be selected based upon type of coating selected, location, and prevailing environmental conditions. For example: The exterior coatings of a school facilities project located near the ocean would be exposed to air that has a higher salinity content and sand that is wind driven, thus a thicker anodized coating(s) or protective clear coat shall be specified. Similarly; for organic fluoropolymer coating(s) a protective clear coat and special primer shall be provided in certain locations, environmental conditions or with the selection of certain colors which have a tendency to fade or weather more easily than others.

e. Quality Assurance

1.) Comply with NAAMM's "Metal finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes. Comply as applicable with the following:

a.) For Anodic coatings: Comply with the requirements of anodizing specification, MIL-A-8625, which defines three types of aluminum anodization as applicable. The types and thickness of coatings shall be selected based upon location and environmental

1.) AAMA 2603: "Voluntary Specification Performance Requirements and Testing Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels"

2.) AAMA 2604: "Voluntary Specification Performance Requirements and Testing Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels"

3.) AAMA 2605: "Voluntary Specification Performance Requirements and Testing Procedures for Superior Organic Coatings on Aluminum Extrusions and Panels"

2.) Warranty Requirements: Vary depending upon finish type: Provide the following as a minimum:

a.) Anodic Coating Warranty: Manufacturer's standard written warranty in which manufacturer agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated.

1.) Warranty Period: Twenty (20) years from date of Substantial Completion.



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b.) Organic Fluoropolymer Coating Warranty: Manufacturer's standard written warranty in which manufacturer agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated.

1.)) Exposed Coating: Deterioration includes but is not limited to:

a.)) Color fading in excess of 5 Delta E Hunter units per ASTM D 2244.

b.)) Peeling, checking, or cracking of coating adhesion to metal.

c.)) Chalking in excess of a No. 8 per ASTM D 4214, when tested per Method D 659.

d.)) Corrosion of substrate in excess of a No. 6 on cut edges and a No. 8 on field surfaces, when measured per ASTM D 1654.

2.)) Warranty Period: Twenty (20) years, and twenty five (25) years for coatings meeting current AAMA-2605-22 from date of Substantial Completion.

c.) Baked Enamel Warranty: Manufacturer's standard written limited warranty in which the manufacturer agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated

1.)) Warranty Period: Ten (10) years from Substantial Completion.

d.) Acrylic Polyurethane Warranty: Steel Window  
Manufacturer's standard written limited warranty in which manufacturer agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated

1.)) Warranty Period: Ten (10) years from Substantial Completion.

## 6. Hardware

a. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907-23 (or current), or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.

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- b. Locks, Key, or Special Tool, and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
- c. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable window hardware more than 72 inches (1800 mm) above floor.
- d. Projecting Windows:
  - 1.) Hinges: Operating hardware shall be concealed stainless steel four or six bar friction hinge with adjustable-slide friction shoe; two per ventilator. Friction hinge shall be of nylon or other nonabrasive, non-staining, noncorrosive, durable material, and adjustable. Provide at least two per ventilator.
  - 2.) Lock: Cam-action, white bronze sweep lock handle with strike (two per ventilator over 42" wide).
  - 3.) Lock: Provide pole-operated automatic white bronze locks on inward acting ventilators, where the distance to the operating hardware exceeds six feet above the floor.
- e. For other window types the Design Consultant shall select hardware to meet all above referenced standards, presiding codes and regulations.

## B2050 Exterior Doors and Grilles

### A. General Description/Design Approach

#### 1. Use and Application

- a. The exterior entrance doors shall have vision lights as large as possible and that will permit the installation of required exit devices, provided the required level of security, all other performance requirements, and code requirements are met. Side lights and transoms may also be provided when compliant with the same criteria. Exterior exit doors may be solid without glazing but must also be compliant with the same criteria contained herein.
  - b. The proposed entrance design, including door and frame material, vision panel material and size, and the type of security screen (if any) shall be finalized for the NJSDA's approval must be approved by the NJSDA as early as possible during the design phases but prior to fifty percent (50%) complete construction documents.
2. All door(s) and frame(s) design in new construction, additions, renovations, and emergent projects shall comply with the presiding codes, including but not limited to the New Jersey Energy Subcode, ASHRAE 90.1-2019 (or current) and the NJDOE Title 6A

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Chapter 26-6.3 Educational Facility Standards for special supplementary requirements, and the ICC 117.1 for Accessibility Standards.

3. New Construction and Additions: The Design Consultant shall typically design doors to meet but not be limited to the following general guidelines and criteria:

- a. All doors shall be specified as to locations, door width, door leaf/quantity, and shall meet the presiding code requirements for handicapped accessibility, fire, and life safety egress requirements.
- b. All doors shall meet the required fire rating for opening protection, exit load capacities, and be located in partitions such that they provide safe egress travel distance to an exit and discharge to a right of way.
- c. All doors designed as means of egress shall be designed such that they swing in the required direction of egress to provide safe means of egress without obstruction to stair landing or handicapped refuge, lead directly to an unobstructed right of way, and have a vision panel.
- d. All egress doors with a required vision panel shall have the required type of vision glass, size, and location to provide visual and fire safety for the respective age group of occupants of the school.

4. Existing Construction (Including Repairs, Renovations, Alterations, and Reconstructions): The Design Consultant shall typically design doors in existing construction according to but limited to the following:

- a. If doors and frames are replaced to meet new egress or life safety requirements they shall be installed according to unit of egress widths of 22" and shall meet capacity calculation methods required by the NJUCC Rehabilitation Code.
- b. Comply with the all applicable chapters of the NJUCC Rehabilitation Sub-Code.

## **B. Quality Assurance**

1. The entire fenestration assembly shall comply with all applicable Fenestration & Glazing Industry Alliance (FGIA) (<https://fgiaonline.org/>) Commercial or Heavy Commercial and Architectural Grade rating standards. The entire window (fenestration) assembly shall comply with all applicable sections and requirements of ANSI/AAMA/NWDA 101/I.S.2 (or current) "Voluntary Specifications for Aluminum, Vinyl (PVC), Wood Windows, and Glass Doors.

2. All Doors and Frames in this section, in addition to meeting all presiding codes and regulations, shall meet all standards as established by the following listings unless more restrictive requirements are specified:

- a. Door and Hardware Preparation ANSI/BHMA A156.115 (or current version).
- b. Life Safety Codes NFPA-101 (Latest edition).
- c. Fire Doors and Windows NFPA-80 (Latest edition).

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- d. UL 10B Fire test of Door Assemblies and UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.
  - e. For Steel Doors only: Steel Door Institute ANSI/SDI A250.8 (SDI-100) Recommended Specifications: "Standard Steel Doors and Frames" (Latest edition) ([www.steeldoor.org/](http://www.steeldoor.org/)). Hardware reinforcements are to be in accordance with the minimum standard gages as listed in SDI-100.
  - f. For Steel Doors and Frames only: Steel Doors and frames shall be manufactured to high quality standards in manufacturing facilities with annual certified conformance to ISO9001.
3. The Design Consultant and their Sub-Consultants shall design and specify performance criteria which meet or exceed the presiding codes for all systems described herein to prevent system failure. This shall include but not be limited to the following:
- a. Deflection of framing members.
  - b. Structural test performance including seismic when applicable.
  - c. Wind-Borne debris impact resistance.
  - d. Air infiltration.
  - e. Water resistance.
  - f. Water penetration under static pressure and under dynamic pressure.
  - g. Indoor air quality testing.
  - h. Hurricane test standards as applicable.
  - i. Swinging door cycle test and cycle slam test methods.
  - j. Thermal movements and conductance.
  - k. Condensation resistance.
  - l. Salt Spray, Exterior Doors and Frames.
  - m. Surface Burning Characteristics, including Class A Option On Interior Faces of FRP Exterior Panels.
  - n. Sound transmission.
  - o. Impact strength, tensile strength, and flexural strength.
  - p. Water Absorption.
  - q. Indentation Hardness.



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- r. Abrasion resistance, stain resistance, and chemical resistance.
- s. Testing of door core for compressive strength, compressive modulus, tensile adhesion, and thermal and humid aging.
- t. Strength of structural sealants including their joints.

#### 4. Fire-Rated Door Assemblies:

a. Where fire-rated assemblies are indicated or required, provide assemblies that comply with National Fire Protection Association (NFPA) “Standard for Fire Doors and Windows”, ([www.nfpa.org/](http://www.nfpa.org/)), and have been tested, listed, and labeled in accordance with ASTM E252 “Standard Methods of Fire Tests of Door Assemblies” for each class of opening by UL, FM, or other nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction over this project.

b. All fire-rated assemblies including all doors and frames shall be labeled. The label shall meet the requirements of the specification and all presiding codes and regulations. Identify each door and frame with metal UL, or Warnock Hersey Inc. labels indicating applicable fire class of the unit. Rivet or weld labels on the hinge edge of door and jamb rabbet of frame. The assembly shall include:

- 1.) The door must have an hourly rating tag.
- 2.) The frame may be of the same or different certifying agency as the door but must be consist with the label of the door.
- 3.) Hardware and related components may be of a different manufacture but shall not diminish the door rating.

c. Fire doors or shutters in ‘fire protected openings’ shall be labeled to withstand temperatures to afford service and safe passage consistent with hourly ratings listed below. It is the Design Consultants’ obligation to validate or modify all opening protection requirements listed below based on the requirements of their design and the prevailing presiding codes:

- 1.) Opening protection of 1-1/2 to 3hrs. are required for the following:  
Fire walls or Fire barriers having a fire resistance rating of greater than 1hr. located in fire resistive interior partition assemblies of 1-1/2 to 4hr. rating.
- 2.) Opening protection of 3 /4 to 1hr. is required for the following:  
  
Fire barriers having a required fire resistance rating of 1hr., such as for shafts, exit enclosures, smoke barriers, exit passageway, as well as for other fire barrier assemblies, located in fire resistive interior partition assemblies of 1 hr. rating.
- 3.) Opening protection of 1/3 to 3 /4 hr. are required for the following:



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For Fire partitions for either .5 hr or 1hr for corridor, or other fire partitions area separations walls, including 1hr. smoke barriers located in fire resistive interior partitions of .5 to 1hr. rating.

5. Smoke and draft control doors shall meet testing and be labeled complying with NFPA 105 or UL 1784.

6. Fire door and related fire shutters shall be tested for the passage of flame and smoke consistent with testing requirements of side hinged or pivoted swing doors in accordance with NFPA 252 or UL10C and if the opening protection is a 'fire shutter', it shall be in according to NFPA 252 10B.

7. All components of a "fire door" assembly are interdependent on the use of consistent labeling for products for all components such as for hollow metal frame material, vision panels, and hardware. Any component that reduces the rating will subsequently reduce the rating of the overall assembly.

8. Oversize Assemblies: For assemblies required to be fire-rated and exceeding sizes of tested assemblies, provide certificate or label from an approved independent testing and inspection agency, indicating that assembly conforms to the requirements of design, materials and construction as established by individual listings for tested assemblies.

9. Source Limitations: Obtain each generic type of door, frame, and all other component parts such as tracks, motors, accessories, etc. through one source from a single Manufacturer, whenever possible. obtain aluminum framed entrances; storefront, and curtain wall and their respective doors and frames were permitted, through one source from a single manufacturer. Use an installer acceptable to the door, frame and aluminum entrance and storefront manufacturer for installation of their products.

10. Refer to Section B2020.90 Exterior Windows Supplemental Components: Finishes for additional information on acceptable finishes for Exterior Doors and Frames.

### **B2050.10 Exterior Entrance Doors, Glazed Doors and Frames**

#### **A. General Requirements**

1. Hollow metal frames designed to accept pairs of doors with exit hardware shall have a lockable vertical removable mullion between the doors. Main delivery doors in the loading and 'back of house' shall have no mullion to facilitate moving larger objects and shall have full astragal seals with overlap where necessary.

2. Steel Doors and steel hollow metal frames are to be cleaned, and chemically treated to insure maximum finish paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer. The finish shall meet the requirements for acceptance stated in ANSI A224.1 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces."

3. Vision Panels:

a. Vision panels, if provided, in rated stair exit doors shall comply with all presiding codes and regulations.

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b. No vision panels shall be provided for doors to mechanical and/or storage spaces.

### 4. Electrical Requirements:

a. General: Coordinate electrical requirements including low voltage requirements, for doors and frames such as electrical door power assists for handicapped doors, electrical hold open, closing, electric strikes or similar devices.

b. Doors shall typically be standard size 7 foot (7'-0") or 7 foot two inches (7'-2") high doors in standard 2" increment widths. Make provisions for installation of electrical items arranged so that wiring can be readily removed and replaced.

### c. Doors with Electric Hinges:

1.) General: Furnish conduit raceway to permit wiring from electric door hardware.

2.) Hinge Locations: Provide electric hinge at intermediate or center location. Top or bottom electric hinge locations are not acceptable.

5. Doors shall typically be standard size 7ft or 7 foot 2 inches high doors in standard 2" increment widths. This requirement does not apply to overhead coiling doors.

6. Reinforcement for steel doors shall be as indicated in the specifications and standard details.

7. All exterior doors shall have a minimum Sound Transmission Co-efficient (STC) rating of 30. Mineral wool shall be used in the core of the doors for sound deadening.

8. Insure the exterior slab pavement adjacent to exterior doorways are properly designed to drain away from the door threshold, so as not to heave due to freeze thaw and thus inhibit the operation of out-swing doors.

9. Specify proper in/out-swinging door hardware with code compliant panic hardware that can be exposed to the elements as well as specifying weather seals and ADA accessible thresholds in the design of doors at interior courtyards.

### 10. Types: Materials

a. Glazed entrance doors and entrances with adjacent vision lights shall constructed of one of the following:

## **B2050.10.1 Exterior Fiberglass Reinforced Polyester (FRP) Glazed Flush Doors**

### **A. General Description/Design Approach**

#### 1. Use and Application

a. Exterior FRP doors may be used as the exterior entrance doors and shall have vision lights as large as possible and that will permit the installation of



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required exit devices, provided the required level of security, all other performance requirements, and code requirements are met. Side lights and transoms may also be provided when compliant with the same criteria.

### B. Quality Assurance

1. Material: fiberglass reinforced polyester (FRP) face sheets
2. Door Construction and Thickness: Flush type fiberglass reinforced polyester (FRP) doors, sizes indicated by 1-3/4" thick. Material thickness: Minimum: 0.120-inch thickness with a finish color throughout and an abuse-resistant engineered surface.
3. Reinforcements: Manufacturer's extruded aluminum sub-frame of 6063-T5 alloy, including stiles and rails where feasible; otherwise, provide non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A123-17 (or current version). Provide steel reinforcement for closers. Furnish standard reinforcement for each type of hardware required, 0.125" thickness minimum.
4. Corners: Mitered
5. Provide joinery of 3/8-inch diameter full-width tie rods and reinforcing plates through extruded splines top and bottom to reinforce the door. Standard tubular shaped stiles and rails shall be reinforced to accept hardware as specified.
6. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
7. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
8. Extrude top and bottom rail legs for interlocking continuous weather bar. Provide for weather seals on meeting stiles and weather stripping on bottom of door.
9. Core: Poured-in-place polyurethane foam.
  - a.) Density: Minimum of 5 pounds per cubic foot.
  - b.) R-Value: Minimum of 9.
10. Fasteners: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
  - a.) Compatibility: Compatible with items to be fastened.
  - b.) Exposed Fasteners: Screws with finish matching items to be fastened
11. Cutouts: Manufacture doors with cutouts for required vision lights and louvers. Factory installed vision lights, which shall be mechanically fastened and accessible from inside only by removable aluminum stops.
- 12.) Finish: Finish color is throughout the FRP sheet. Color to be selected by the Design Consultant from a full range of manufacturers' standard colors.

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13.) Glazing: See below.

14. Warranty: Submit warranty signed by manufacturer and Contractor, agreeing to replace assemblies which fail in materials, performance or workmanship within the specified warranty period.

a.) Warranty Period: Ten (10) years from date of Substantial Completion.

## **B2050.10.2 Exterior Glazed Steel Doors**

### **A. General Description/Design Approach**

#### **1. Use and Application**

- a. Exterior glazed steel doors may be used as the exterior entrance doors and shall have vision lights as large as possible and that will permit the installation of required exit devices, provided the required level of security, all other performance requirements, and code requirements are met. Side lights and transoms may also be provided when compliant with the same criteria.

### **B. Quality Assurance**

1. Material: Sheets are to be made of commercial quality hot dipped zinc coated steel that complies with ASTM A924 G90 and ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed or Galvalume) by the Hot-Dip Process.
2. Door Construction and Thickness: Doors: Heavy Duty or Extra Heavy Duty, Flush design doors, seamless construction, hollow construction with mineral wool, fiberglass, urethane, styrene, or other acceptable fill depending upon application, 1-3/4" thick unless specifically noted otherwise. Minimum 14-gauge
3. Doors shall be constructed with smooth, flush surfaces without visible joints or seams on exposed faces and stile edges, except around glass and louver panels. On mortise face of door, vertical joints shall be continuously MIG or ARC welded and ground smooth and coated with zinc-rich primer.
4. Provide reinforcement for surface sheet, edge, hardware, stops, and other provisions, of size and gage.
5. Provide bottom channel and top channel and closure,
6. Hinge Reinforcements: shall be not less than 10 gage 1-1/4" x six inches longer than the hinge. If a continuous hinge the reinforcement shall be the full height of the door. The reinforcement will be drilled and tapped in the field for a Roton type hinge.
7. Lock reinforcements: minimum 16 gage, 0.053" (1.3mm).
8. Closer reinforcements: minimum 14 gage, 0.067" (1.7mm), coordinate length to exceed closer size and industry standards.

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## Design Requirements

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9. Reinforce tops and bottoms of all doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel shall have a steel closure channel welded in place so the web of the channel is flush with the top of the face sheets of the door. Plastic fillers are not acceptable.

### 10. Stile and Rail Doors

a.) Tubular stile and rail construction, 1-3/4" (45 mm) thick and fabricated from not less than 16 gage (1.3 mm) from commercial quality carbon steel, galvanized, galvanealed or galvalumed steel. Provide stiles that extend the full height of the door. Rails are internally welded or permanently mechanically joined to the stiles forming a neat seam on the face. Hot-dip galvanealed steel stiles and rails conforming to ASTM A 653, Class A60, 16 gage: 0.053" (1.3mm); formed to rectangular tube shape.

b.) Provide Hinge Stile and Lock Stile, Top Rail, Intermediate Rail(s), Bottom Rail per manufacturers' standards for the type of doors selected.

11. Glazing: See Supplementary components below.

12. Finish: Factory -applied primed and field painted.

a.) Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

b.) Primer, galvanized surfaces: Zinc oxide primer.

13. Submit warranty signed by manufacturer and Contractor, agreeing to replace acoustic rated assemblies which fail in materials, performance or workmanship within the specified warranty period.

a.) Warranty Period: 1 year from date of Substantial Completion.

### **B2050.10.3 Exterior Glazed Aluminum Doors**

#### **A. General Description/Design Approach**

##### 1. Use and Application

a. Exterior glazed aluminum doors may be used as the exterior entrance doors and shall have vision lights as large as possible and that will permit the installation of required exit devices, provided the required level of security, all other performance requirements, and code requirements are met. Side lights and transoms may also be provided when compliant with the same criteria.

#### **B. Quality Assurance**

1. Aluminum Frames Sidelights and Transoms: Refer to Design Requirements B2020.30 Exterior Window Wall for additional information.

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## Design Requirements

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2. Material: Extruded tubular aluminum shall be 6063-T6 alloy and tempered framing with integrally concealed, low-conductance structural thermal break(s).
3. Door Construction and Thickness: Wide Stile-and-Rail Type Thermal Aluminum Doors with 0.125" thick walls and a minimum of 1" sealed insulating glazing units
4. Heavy Duty Doors: Face dimensions, door thickness: minimum two inches (2") thick with wide stiles: five inches (5") nominal width, and a minimum ten inch (12") bottom rail.
5. Frame: Tubular members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods or J-bolts, supplemented by welding.
6. Brackets and Reinforcement: High-Strength aluminum, nonmagnetic stainless steel, or hot-dip galvanized steel, ASTM A123/123M.
7. System design shall be such that raw edges will not be visible at joints.
8. Fasteners: Noncorrosive and compatible with aluminum components, anchors and other components.
  - a.) Reinforcement: Where fasteners anchor into aluminum less than 0.125 inch thick, and otherwise as required by system design and specified performance, reinforce with aluminum or nonmagnetic stainless steel to receive screw threads, or provide noncorrosive pressed-in splined grommet nuts.
  - b.) Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For the application of hardware, use flat-head machine screws that match the finish of member or hardware.
9. Compression Weather stripping: Replaceable, compressible weather stripping gaskets; molded neoprene ASTM D2000 or molded PVC, ASTM D2287-19 (or current version).
10. Sliding Weather stripping: Replaceable weather stripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, AAMA 701/702-11 being fastened.
11. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops; anchor exterior stops for non-removal. Minimum thickness: 0.125 thick
12. Glazing: minimum of 1" sealed insulating glazing units. See below. Muntins are optional, but if added shall not compromise the thermal characteristics of the door.
13. Finish: Anodized or an organic fluoropolymer coating. Doors are capable of having separate interior and exterior finishes and/or colors
14. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems including doors that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

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a.) Failures include, but are not limited to, the following:

- 1.) Structural failures including, but not limited to, excessive deflection.
- 2.) Noise or vibration caused by thermal movements.
- 3.) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- 4.) Adhesive or cohesive sealant failures.
- 5.) Water leakage through fixed glazing and framing
- 6.) Failure of operating components.

b.) Warranty Period: Three (3) years from date of Substantial Completion.

## **B2050.10.4 Revolving Doors**

### **A. General Description/Design Approach**

#### **1. Use and Application**

a. Revolving doors shall generally not be used on the NJSDA's projects. In new construction projects, the use of revolving doors must be justified by the Design Consultant and must be approved by the NJSDA as early in the Design Phase(s) as possible.

b. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Revolving doors may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior revolving door building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.

c. In rare instances, on a project that is a renovation and or addition to an existing building which contains exterior revolving doors and matching a feature is required, exterior revolving doors may be used after consultation with and approval of the NJSDA.

## **B2050.20 Exterior Utility Doors: Solid Doors and Frames**

### **A. General Description/Design Approach**

#### **1. Use and Application**

a. Exterior solid doors and frames may be used but not limited to exterior exit doors, utility / maintenance room doors, storage room doors, etc. and shall be configured to permit the installation of required exit devices, provided the



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required level of security, other performance requirements, and code requirements are met.

2. Refer to applicable requirements in Sections B2050 Exterior Doors and Grilles and B2050.90 Exterior Doors Supplementary Components for additional information.

## **B. Solid Exterior Doors and Frame Types**

1. Materials: The following materials and door types are acceptable for exterior solid doors:

### **B2050.20.1 Exterior Utility Doors: Solid Fiberglass Reinforced Polyester (FRP) Flush Doors**

#### **A. Quality Assurance**

1. Material: fiberglass reinforced polyester (FRP) face sheets

2. Door Construction and Thickness: Flush type fiberglass reinforced polyester (FRP) doors, sizes indicated by 1-3/4" thick. Material thickness: 0.120-inch thickness, finish color throughout and an abuse-resistant engineered surface.

3. Reinforcements: Manufacturer's extruded aluminum sub-frame of 6063-T5 alloy, including stiles and rails where feasible; otherwise, provide non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A123-17. Provide steel reinforcement for closers. Furnish standard reinforcement for each type of hardware required, 0.125" thickness minimum.

4. Corners: Mitered.

5. Provide joinery of 3/8-inch diameter full-width tie rods and reinforcing plates through extruded splines top and bottom to reinforce the door. Standard tubular shaped stiles and rails shall be reinforced to accept hardware as specified.

6. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.

7. Furnish extruded rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.

8. Extrude top and bottom rail legs for interlocking continuous weather bar. Provide for weather-seals on meeting stiles and weather stripping on bottom of door.

9. Core: Poured-in-place polyurethane foam.

a. Density: Minimum of 5 pounds per cubic foot.

b. R-Value: Minimum of 9.

10. Fasteners: Aluminum, 18-8 stainless steel, or other noncorrosive metal.

a. Compatibility: Compatible with items to be fastened.



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b. Exposed Fasteners: Screws with finish matching items to be fastened

11. Finish: Finish color is throughout the FRP sheet. Color to be selected by the Design Consultant from a full range of manufacturers' standard colors.

12. Glazing: See B2050.90 Exterior Door Supplementary Components

13. Warranty: Submit warranty signed by manufacturer and Contractor, agreeing to replace assemblies which fail in materials, performance or workmanship within the specified warranty period.

a. Warranty Period: Ten (10) years from date of Substantial Completion

## **B2050.20.2 Exterior Utility Doors: Solid Steel Doors**

### **A. Quality Assurance**

1. Material: Sheets are to be made of commercial quality hot dipped zinc coated steel that complies with ASTM A924/A924M, G90 and ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed or Galvalume) by the Hot-Dip Process.

2. Door Construction and Thickness: Doors: Heavy Duty or Extra Heavy Duty, Flush design doors, seamless construction, hollow construction with mineral wool, fiberglass, urethane, styrene, or other acceptable fill depending upon application, 1-3/4" thick unless specifically noted otherwise. Minimum 14-gauge

3. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces and stile edges, except around glass and louver panels. On mortise face of door, vertical joints shall be continuously MIG or ARC welded and ground smooth and coated with zinc-rich primer.

4. Provide reinforcement for surface sheet, edge, hardware, stops, and other provisions, of size and gage.

5. Provide bottom channel and top channel and closure,

6. Hinge Reinforcements: shall be not less than 10 gage 1-1/4" X six inches longer than the hinge. If a continuous hinge the reinforcement shall be the full height of the door. The reinforcement will be drilled and tapped in the field for a Roton type hinge.

7. Lock reinforcements: Minimum 16 gage 0.053" (1.3mm).

8. Closer reinforcements: Minimum 14 gage, 0.067" (1.7mm),

9. Reinforce tops and bottoms of all doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel shall have a steel closure channel welded in place so the web of the channel is flush with the top of the face sheets of the door. Plastic fillers are not acceptable.

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10. Finish: Factory-applied primer and field painted.

a.) Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

b.) Primer, galvanized surfaces: Zinc oxide primer.

11. Submit warranty signed by manufacturer and Contractor, agreeing to replace acoustic rated assemblies which fail in materials, performance or workmanship within the specified warranty period.

a.) Warranty Period: 1 year from date of Substantial Completion.

## **B2050.20.3 Exterior Utility Doors: Aluminum or Stainless Steel Clad Doors**

### **A. General Description/Design Approach**

1. Exterior aluminum or stainless steel clad doors shall generally not be used on the NJSDA's projects except as permitted below. In new construction projects, the use of exterior aluminum or stainless steel clad doors must be justified by the Design Consultant and must be approved by the NJSDA as early in the Design Phase(s) as possible.

2. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Exterior aluminum or stainless steel clad doors may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior aluminum or stainless steel clad door building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.

3. In rare instances, on a project that is a renovation and or addition to an existing building which contains exterior aluminum or stainless steel clad doors and matching a feature is required, exterior aluminum or stainless steel clad doors may be used after consultation with and approval of the NJSDA.

## **B2050.30 Exterior Utility Doors: Oversized Doors and Frames**

### **B2050.30.1 Exterior Utility Doors: Overhead Coiling Doors and Frames**

#### **A. General Description/Design Approach**

1. Use and Application

a. Exterior overhead coiling doors and frames may be used but not limited to exterior openings for loading areas, docks, service and maintenance storage rooms or structures, specialty classrooms such as vocational shops as vehicle repair and maintenance classrooms, etc. provided the required level of security, all other performance requirements, and code requirements are met. Glazing may be provided when required based upon the function of the space and the door. Glazing shall be based upon a manufacturer's standard glazing solutions

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but shall be modified to comply with all presiding codes and other programmatic requirements.

## **B. Quality Assurance**

1. All exterior overhead coiling doors shall comply with ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors ([www.ansi.org/](http://www.ansi.org/)).
2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to NJSDA having jurisdiction as suitable for purpose specified.
3. Materials: Exterior overhead coiling doors and frames shall be composed of one of the following:

### **B2050.30.2 Exterior Utility Doors: Steel Slat Rolling and Sectional Overhead Doors**

## **A. Quality Assurance**

1. Materials: Sheets are to be made of commercial quality zinc coated, cold rolled, structural steel that complies with ASTM A 653/A 653M G90-coating designation in Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed or Galvalume) by the Hot-Dip Process.
2. Door Construction and Thickness: zinc coated, cold rolled, structural steel / foam/ zinc coated, cold rolled, structural steel G90, insulated sandwich panel construction.
3. Panel Thickness: Minimum: 1-3/8 inches (35 mm).
4. Interlocking Steel Slats or Sections: Minimum Exterior Skin: 20 gauge (0.036 inch minimum thickness) hot dip galvanized; G90. Insulated, type per manufacturers' standard choices.
5. End Stiles: Minimum: 20 gauge.
6. Insulation: Manufacturers standard CFC-free and HCFC-free polyurethane or rigid cellular polystyrene foam type fully encapsulated insulation. Maximum flame spread and smoke developed indexes of 75 and 450 respectively according to ASTM E84 or presiding codes whichever is more stringent.
7. Thermal Values: Select doors' thermal values in compliance with presiding codes, including the New Jersey Energy Conservation Code
8. Partial Glazing of Steel Panels: Design Consultant to select a code compliant glazing option based upon the manufacturers' standard choices for the door(s) selected and projects' other performance criteria.
9. Track: Provide track as recommended by manufacturer to suit loading required and clearances available. Provide a counterbalance system.

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10. Hardware:

- a. Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
- b. Push Pull Handles: Galvanized Steel lifting handles on each side
- c. Slide Bolt: Engage thru slots in track for locking with a padlock, located on both the left and right jamb sides, operable from coil side.
- d. Locking Device Assembly: Lock, spring loaded dead bolt, operating handle, cam plate and adjustable locking bar to engage thru slots in tracks. Provide lock cylinder coordinated with School District requirements.

11. Chain Lock Keeper: Suitable for a padlock for Emergency operations.

12. Power Operated Door Control: Keyed safety interlock switch to disengage power supply when door is locked.

13. Manual Operation: Chain hoist.

14. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325 requirements for continuous monitoring of safety devices.

- a. Motor shall have factory pre-wired motor controls, starter, gear reduction unit, solenoid-operated brake, clutch, remote control stations, control devices, integral gearing for locking door and accessories. Comply with NFPA 70.

- b. Disconnect Switch: Hand operated for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount to be accessible from floor level. Provide interlock device to automatically prevent motor from operating when emergency operator is engaged.

- c. Door Operator type: Wall hood or bracket mounted unit with electric motor gear head reduction drive, and chain and sprocket secondary drive.

- d. Entrapment Protection: Required for momentary contact, includes radio control operation.

- e. Pneumatic, electric, or photoelectric sensing edge up to 18 feet (5.5 m) wide. Sensing edge shall be constant contact only complying with UL 325. Activation of sensor immediately stops and reverses downward door travel.

- f. Operator Controls:

- 1.) Key operated control stations with open, close, and stop buttons.

15. End locks: Lateral movement of the slats to be contained by code compliant means.

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## 16. Finish Factory-applied primer and finish coats

- a. Primer: Rust-inhibitive enamel or epoxy paint, either air-drying or baking, suitable as a base for specified finish paints.
- b. Primer, galvanized surfaces: Zinc oxide or epoxy primer
- c. Factory applied two coats of baked-on polyester powder coat. Color to be selected by the Design Consultant from a full range of manufacturers' standard colors

## 17. Warranty

- a. Door Sections: Door manufacturer shall warrant the door sections against defects in material and workmanship and deterioration due to rust. Window components are warranted against defects in material and workmanship. Sections are warranted to be free from delamination of the polyurethane insulation and its exterior and interior steel skins.
- b. Hardware & Spring Components: Door manufacturer shall warrant all hardware and spring components against defects in material and workmanship.
- c. Under the terms of this limited warranty, for any door components that are found to be defective upon inspection by authorized door manufacturers' personnel, the door manufacturer will, at its option, repair or replace the defective door components. Labor charges for installations or repairs shall be the responsibility of the consumer and must be performed by a manufacturers' authorized Dealer. This warranty applies only to doors that are professionally installed by a manufacturers' authorized Dealer.
- d. This warranty extends only to the original purchaser. This warranty is not transferable.
- e. This warranty does not apply to any damage or deterioration caused by abuse, applied paint failure or failure to provide reasonable and necessary maintenance.
- f. Warranty Period: One (1) year for all components except sections are warranted against delamination of the polyurethane insulation and its exterior and interior steel skins for ten (10) years.

### **B2050.30.3 Exterior Utility Doors: Steel Sectional Overhead Fire Rated Coiling Doors**

#### **A. Quality Assurance**

- 1. Install Fire Rated doors to comply with NFPA 80.
- 2. Refer to the information above in B2050.30.2 Exterior Steel Slat Rolling and Sectional Overhead Doors for requirements listed: "As above". The following requirements are in addition to those above:
- 3. Fire Resistance Rating: Three-hour rating, tested and listed by Factory Mutual (FM) or Four-hour rating, tested and listed by Underwriters Laboratories (UL)

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4. Door Construction and Thickness: As above
5. Panel Thickness: As above
6. Interlocking Steel Slats or Sections: As above
7. Thermal Values: As above
8. Enclosures:
  - a. Hood: Round hood enclosure.
  - b. Head plate Cover: 24 gauge steel finish-painted to match curtain.
  - c. Flame Baffle: Provide flame baffle to comply with listing agency.
9. Release System:
  - a. Descent Control: Rolling fire door operation mechanism shall be disengaged during automatic closing of the door. Descent of door under fire conditions shall be controlled by either a mechanical oscillating governor, viscous governor (weight counterbalance only) or centrifugal governor.
  - b. Release Type: Automatic closing of rolling fire door under fire conditions to be initiated by either: Fusible Links, Thermo-Manual Links, Electro-Thermal Manual Links with Junction Box, Electro-Thermal Manual, Links without Junction Box, Fire Shield (weight counterbalance only). Design Consultant to select a code compliant alternative for the associated application.
  - c. Detection Type: Device used in conjunction with the release type to initiate the automatic closing of rolling fire door. Design Consultant to select either: an ionization smoke detector or photo electronic smoke detector with heat sensor detector.
  - d. Track: Provide track as recommended by manufacturer to suit loading and other requirements for a fire shutter and clearances available. Provide a presiding code compliant counterbalance system based upon manufacturers' standards.
10. Hardware: Design Consultant to select presiding code compliant hardware based upon manufacturers standard options.
11. Chain Lock Keeper: As above
12. Power Operated Door Control: Design Consultant to select presiding code compliant power operated door controller based upon manufacturer's standard options.
13. Manual Operation: Solid or Jackshaft with manual chain hoist
14. Electric Motor Operation: Solid or Jackshaft type basic motor with solid state motor controller or other manufacturers' standard with relay style motor controller.

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## Design Requirements

## Exterior Vertical Enclosures – Section B20

15. End locks: Lateral movement of the slats to be contained by code compliant means.
16. Bottom Bar and Seal: Two roll-formed galvanized steel angles. Structural angle bottom bar to receive one coat of rust-inhibitive primer.
17. Weather-Stripping: Rolling fire door may be provided with guide brush seal if code compliant.
18. Finish Factory-applied primer and finish coats: As above
19. Warranty:
  - a. Door Sections: Door manufacturer shall warrant the door and its component parts against defects in material and workmanship.
  - b. Hardware & Spring Components: Door manufacturer shall warrant all hardware and spring components against defects in material and workmanship.
  - c. Under the terms of this limited warranty, for any door components that are found to be defective upon inspection by authorized door manufacturers' personnel, the door manufacturer will, at its option, repair or replace the defective door components. Labor charges for installations or repairs shall be the responsibility of the consumer and must be performed by a manufacturers' authorized Dealer. This warranty applies only to doors that are professionally installed by a manufacturers' authorized Dealer.
  - d. This warranty does not apply to any damage or deterioration caused by abuse, applied paint failure or failure to provide reasonable and necessary maintenance.

### B2050.30.4 Exterior Utility Doors: Aluminum Sectional Overhead Doors

#### A. General Requirements

1. The use of Aluminum Sectional Overhead Doors may be used on the NJSDA's projects provided comparable both in cost and performance criteria are specified to the products listed above. In new construction projects, the use of exterior aluminum sectional overhead doors must be demonstrated as equal by the Design Consultant and must be approved by the NJSDA as early in the Design Phase(s) as possible.
2. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Exterior aluminum sectional overhead doors may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior aluminum sectional overhead door building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.
3. In rare instances, on a project that is a renovation and or addition to an existing building which contains exterior aluminum sectional overhead doors and matching a



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feature is required, an exterior aluminum sectional overhead door may be used after consultation with and approval of the NJSDA.

## **B2050.90 Exterior Door Supplementary Components**

### **A. Exterior Door Frames: Glazed Sidelights, Borrowed lights, and Transoms: Materials**

1. Exterior Glazed Aluminum Frames Sidelights and Transoms for both Fiberglass Reinforced Polyester and Aluminum Doors: Refer to Design Requirements Section B2020.30 Exterior Window Wall and B2020.90 Exterior Window Supplementary Components for additional information.
2. Materials: Extruded tubular aluminum framing with an integrally concealed, low-conductance structural thermal break(s) when applicable,
3. Frame Construction and Thickness: All aluminum frame and vent extrusions shall have a minimum wall thickness of .125" (3 mm)
4. Aluminum Sills: Thermally broken, 0.125" extruded aluminum sills; finish to match storefront system.
5. Finish to shall match doors.

### **B. Hollow Metal Steel Frames: Materials**

#### **1. Quality Assurance**

- a. Material: Steel, hot dipped zinc coated steel that complies with ASTM designations A924/A924M, G90.Galvanized, Galvalume, or Galvaneal, welded and internally reinforced.
- b. Frame Construction and Thickness: Minimum 12 –gage.
- c. Supports and Anchors: Not less than 16 gauge galvanized sheet metal. Hollow metal frames shall, typically, in new construction have a minimum of three anchors per side of door in masonry openings and shall have slip on drywall type anchors for drywall openings. Floor anchors shall be provided at each jamb.
- d. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A153/A153M, Class C or D as applicable.
- e. Knock down type frames are not acceptable except in renovations, restorations, and emergent projects where welded frames are difficult to install.
- f. All frames are to be assembled so that the face miter seam is "closed and tight". Weld the face seam and the full web of the frame corner or intersection. Grind and dress the weld area smooth. Apply a zinc rich primer over the grinding area, and finish with a matching prime paint.



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g. Hinge Reinforcements: A minimum of 10 gage steel.

h. Finish: Factory-applied primer and field painted.

1.) Primer: Rust-inhibitive enamel or paint, either by air-drying or baking, suitable as a base for specified finish paints.

2.) Primer, galvanized surfaces: Zinc oxide primer.

i. Thresholds: Barrier-free, thermally broken thresholds shall be provided at all exterior doors and shall be detailed to drain water to the exterior of the building.

## **C. Glazing: Exterior Vision Lights, Sidelights, Borrowed Lights, and Transoms**

### **1. Quality Assurance**

a. Exterior glazing shall be comprised of 1" sealed insulating units, laminated, tempered, etc. and where required comply with presiding codes and other requirements including but not limited to: NJ Division of Community Affairs, Department of Codes and Standards: "Best Practices Standards for Schools Under Construction or Being Planned for Construction".

b. Glazing treatments such as low-e, tinted, fritted, coated glass require justification by the Design Consultant and are subject to approval by the NJSDA.

c. Single glazing is not permitted on the building exterior.

d. Conditions requiring fire rated exterior glazing are to be avoided whenever possible.

e. Comply with published recommendations of glass manufacturers and the National Glass Association's GANA Glazing Manual unless more stringent requirements are indicated.

f. All glazing shall be installed by the exterior aluminum frame door, entrance system or storefront manufacturer or a manufacturer approved installer.

g. All units shall be glazed with the manufacturer's standard sealant process provided the glass is held in place by a removable, galvanized steel or extruded aluminum, glazing beads. The glazing bead shall be removable and shall be isolated from the glazing material by a gasket.

h. Glazing Stops and Beads: Whenever possible for ease of glass replacement and security of steel and aluminum doors respectively; provide fixed galvanized steel or aluminum glazing stops on the outside of exterior doors and removable stops of tubular or solid galvanized steel or aluminum beads on the inside of the door. Form corners with butted hairline joints. Coordinate width of rabbet between fixed stop and removable bead and depth of rabbet with type of glass and glazing required. B2050.90 Exterior Door Supplementary Components workmanship excluding that caused by glass breakage or abuse by others.

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i. The use of triple glazing requires justification by the Design Consultant and is subject to approval by the NJSDA.

j. Warranty Requirements: For insulating glass units:

1.) Provide manufacturers standard written warranty against visual obstruction from dust or film formation or moisture collection between internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship excluding that caused by glass breakage or abuse by others.

2.) Warranty Period: Ten (10) Years from the date of Substantial Completion.

k. Vision Panels:

1.) Vision panels, if provided, in rated stair exit doors shall comply with all presiding codes and regulations.

2.) No vision panels shall be provided for doors to mechanical and/or storage spaces.

### **D. Finishes**

1. Refer to Section B2020.90 Exterior Window Supplementary Components: Finishes above for finishes for all Exterior Doors and Frames.

### **E. Hardware**

1. The Design Consultant shall specify and review all hardware to insure that the quality, type of door hinges, bearing weight, and grades of finishes are consistent with the hardware manufacturers' and are compatible with the door manufacturer's specifications and District requirements so that the intended use of the door and hardware are compatible with each other and that neither warranties are violated. The Design Consultant shall consider using a qualified hardware consultant to specify all hardware if in house expertise cannot be provided by the Design Consultant.

2. All egress fire doors shall have panic hardware with positive latching and closing devices for occupancies in excess of 49 occupants and for assembly use.

3. Provide fluid dampers on hardware devices to absorb shock and noise when serving instructional spaces.

4. Specify only the highest quality exit devices for safety, and long term cost savings to school maintenance departments.

5. Smoke or other rated doors in the stage shall have closers that are consistent with ICC A117.1-2017 and the prevailing ADA accessible standards.

6. All door closers where required by code shall be a parallel arm type rated for heavy use, supplied by a single manufacturer, and shall be surface mounted to

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the non-public side of the door. Door hinges shall be fitted with ball bearing type hinges to maintain ease of use by handicapped.

7. The Design Consultant and hardware consultant must be thorough when specifying hardware such as but not limited to: closer travel arm limit stops, coordinators for pairs of doors wall stops and related bumpers to prevent damage by doors against adjoining surfaces in high traffic locations.

8. Do not use cross bar arm type panic devices as they will result in pinching of fingers, instead use a touch pad with 'T' design to not extend full width for safety. All panic hardware shall be dead latching types with roller strikes.

9. Pre-machine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

10. Pre-machine and reinforce insert frame members for hardware in accordance with manufacturer's standards and hardware schedule

11. Provide stainless steel or aluminum continuous "Roton" type hinges on all high traffic exterior doors.

12. Doors to be mortised, reinforced, and function holes provided at the factory in accordance with the hardware schedule and templates by the hardware supplier. Trough bolt holes, attachment holes, or drilling and tapping for surface hardware, to be done by others.

## **F. Window Guards and Security Screens**

1. In school facility locations where compliance with the requirements of Best Practices for Schools Under Construction or Being Planned for Construction is demonstrated to not be adequate to properly secure the school facility the Design Consultant shall provide security screens/window guards on all required accessible building openings. The Design Consultant shall analyze and define the associated threat level and specify a security screen system able to deter the defined threat level.

2. Security screens on main entrance doors are discouraged and may be provided by the NJSDA only if requested in writing by the school district.

3. Specify security screen(s) that install within the window reveal of a window and are designed similar to a "pre-hung" door. The door portion shall have a heavy steel or aluminum frame that holds stainless steel wire cloth or a steel perforated panel/ or mesh and hinges to a subframe. The subframe is to be securely attached into the window reveal and shall include fitting pieces to make the subframe appear to be part of the original window opening.

4. Specify high strength aluminum or steel tubular design elements with welded frame corners.

5. Security screens, when provided, shall be placed on exterior side of glazing and shall be not less than one of the following:

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## Design Requirements

## Exterior Vertical Enclosures – Section B20

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- a. Perforated galvanized 12-gage steel with 48% to 63% open area and a powder coat finish or,
  - b. Stainless steel woven rod and cable or woven wire mesh (cloth) in pattern with 46% to 74% open area. Minimum weight: 1.5 lb. per square foot.
6. Specify heavy duty locks with keyed or special tool operation from the outside, bolts & hinges, single-point emergency release.
7. Security screens and or window guards may be attached to the exterior façade of an existing building if attachment within the existing window opening is not possible.

### **B2070 Exterior Louvers and Vents**

#### **A. General Description/Design Approach**

- 1. Refer to sections above for additional information and requirements
- 2. When necessary, required louvers on the building façade shall be located as inconspicuously as possible on an exterior elevation.
- 3. Where possible, louvers on the building façade may be coordinated and incorporated with the building's window fenestrations.

#### **B. Other Exterior Door, Entrance, and Frame Types**

- 1. Galvanized Steel Louvered Doors: Refer also to Exterior Solid doors above.
  - a. Provide cold rolled galvanized steel louvered doors with fixed blade design.
  - b. Provide mitered and welded corners and Spanner head security fasteners, countersunk to secure louvers.
  - c. Finish: factory-applied baked enamel rust resistant primer finish. Final finish to match the finish of the door the louver is placed in.



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## **Design Requirements**

### **B30: Exterior Horizontal Enclosure**

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## **B30 Exterior Horizontal Enclosures**

### **B3010 Roofing**

#### **A. General Description / Design Approach**

##### **1. General Requirements:**

- a. The selection of a roof system and its component parts; particularly the insulation system, shall meet all the requirements of all current presiding codes including not limited to the New Jersey adopted Energy Subcode. Roof systems shall be designed to resist wind load pressures in accordance with the applicable codes and standards.
- b. Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- c. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- d. ALL MATERIALS AND SYSTEMS INDICATED AS “SUBJECT TO APPROVAL BY THE NJSDA” MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION DOCUMENTS.

##### **2. Emergent, Renovation, Renovation and Addition Projects:**

- a. For complete re-roof projects or projects where a proposed new roof is to be applied to a limited, defined, contained area; whenever possible, follow the recommendations herein for new construction. For projects involving repairs, renovations, and restorations utilize or match the existing system and follow the manufacturers’ recommended practices whenever possible.
- b. Roof system shall not be installed over an existing roof, all existing roof materials must be removed to the deck.
- c. The Design Consultant, roofing contractor and manufacturers’ representative whom will warranty the roof, shall visit the site after roofing is removed to inspect the existing deck, prior to re -roofing. The roof manufacturer shall make appropriate visits so as to certify that roof warranty capability is maintained.
- d. A pre-roofing meeting is required. The meeting shall include NJSDA, the Design Consultant; General Contractor, Roofing Sub-Contractor, roofing manufacturer, and other installers related to the work.
- e. Daily Re-Roof Construction Scope: During the construction period, each section of a re-roofing project shall be completed each day, including all essential components of the selected roofing system to maintain the integrity of the work. At the completion of each day as described above, all exposed edges of the roofing and the building shall be made watertight. Therefore, the contractor shall tear off and remove only that which can be replaced in a day.

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## f. Verification

- 1.) Inspection: Test cuts should be performed only where there is reason to suspect that less than proper installation procedures have been used or materials have been shorted. Otherwise, use 100% non-destructive tests.
- 2.) Site Visit: The Design Consultant shall visit the site to investigate all existing roof and deck conditions.
- 3.) Investigative Methods: The investigation shall consist of acceptable methods, such as: roof cuts or cores, infrared scans, pullout tests for fasteners, etc. The investigation shall be complete and shall form the basis for the comprehensive scope of work. The Design Consultant shall submit to the NJSDA the intended method and roofing consultant prior to commencement of the work.
  - a.) All existing concrete or LWIC roof decks are to be tested for moisture content using the N.R.C.A Deck Dryness Test to ascertain if they are dry enough to allow a hot mopped application of the base layer of insulation. Given the possibility of excessive moisture which would make this application method unfeasible, the designer is to specify alternative means to mechanically fasten the vented base layer of insulation to the roof deck, in consultation with a structural engineer to verify the structural integrity of the deck.
- 4.) All existing roofs to be repaired or replaced must be tested by a certified testing lab to determine if the material contains asbestos or other hazardous materials.
- 5.) Asbestos: If the asbestos content of material to be removed or otherwise disturbed exceeds the permissible amount, the roof must be removed in accordance with applicable codes.
- 6.) Report: The roof inspection report and a scope of work shall be submitted by the Design Consultant. In the event appreciable time (one year or more) has lapsed from the time of the existing investigation or report to the time of the roof installation, a new report must be provided.

## B. Materials

1. Choice of materials must be guided by building construction budget and the following requirements:
  - a. The materials to be used in the design and construction of the school's roof system(s) shall typically be limited to those materials which are specified in the NJSDA's Standards and the parameters established herein.
2. Roof Covering Reflectance Criteria: Select a roof covering membrane which reduces the heat islands to minimize the impact on microclimates, human, and wildlife habitats. Heat Islands are defined as thermal gradient differences between developed and undeveloped areas.
  - a. The roof system selection shall be accomplished by selecting a roof covering membrane which has a solar reflectance index (SRI) equal to or greater than the values

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below for a minimum of 75% of the roof surface. Roofing materials having a lower SRI value than those listed may be used if the weighted rooftop SRI average meets the following criteria:

- 1.) Area Roof Minimum SRI/Total Roof Area X SRI of Installed Roof/Required SRI greater than or equal to 75%.
- 2.) For low sloped roofs of a slope less than or equal to 2:12 select a roof covering membrane with an SRI of 82.
- 3.) For Steep sloped roofs of a slope greater than or equal to 2:12 select a roof covering membrane with an SRI of 39.

### 3. Roof Pitch & Crickets:

- a. The minimum pitch for any roof system is 1/4" per foot.
- b. The minimum pitch for any roof valley, including the leading edge of crickets, parapets, curbing, or other appurtenances, is one half inch per foot (1/2"/1'-0"). Finish slope of cricket shall not be less than one quarter inch per foot (1/4"/ft.).
- c. Construct crickets behind equipment and other roof penetrations using tapered rigid insulation panels covered by the roof covering membrane(s). The crickets shall be specified and detailed at min. one half inch per foot (1/2"/1'-0") finished slope or 2x the finished slope of the field of the roof area, whichever is greatest.

4. Pitch pockets shall be avoided if possible. Pitch pockets may be provided for roof supported structures such as dunnage for equipment, raised maintenance platforms, etc.

5. Roof mounted mechanical equipment shall have walk pads to and around the units. The Design Consultant and their Sub-Consultants shall, whenever possible, locate all roof-top equipment more than twelve (12'-0") feet from the roof edge. Mechanical equipment, fans, and appliances that require service and are located closer than twelve (12'-0") feet from the roof edge and such edge or open side is located more than thirty inches (30") above the floor or roof below provide OSHA/Code compliant safety guard railing system. Where a minimum 3'-6" high parapet is provided, such guards are not required.

6. Source Limitations: Whenever possible, obtain entire roof or soffit and fascia system and all its' component parts through one source from a single manufacturer.

7. Use an installer acceptable to the roof system(s) or soffit and fascia systems' manufacturer for installation of the entire system specified.

8. The entire roof assembly shall comply with all applicable presiding Codes and Regulations.

### C. Quality Assurance

1. Factory Mutual Research & Factory Mutual Global Listing:

- a. All roofing systems or roof system component parts shall comply with Factory Mutual Research (FMR) standards and be rated by Factory Mutual Global (FMG) to meet or



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exceed the factored uplift pressures outlined in FMG Property Loss Prevention Data Sheet 1-28, and complies with FMG Property Loss Prevention Data Sheet 1-29 for enhancements at the perimeter and corners.

b. At all metal and concrete deck substrates provide roofing system and component materials which have been evaluated by Factory Mutual System for fire spread, wind uplift, and hail damage and are listed in "Factory Mutual Approval Guide" for the applicable Class of construction.

c. Provide roof covering materials bearing FM approval marking on all bundles, packages or containers, indicating that material has been subjected to FM's examination and follow-up inspection service.

2.NRCA: All roofing systems and roof system component parts shall comply with National Roofing Contractors Association (NRCA) Roofing (and Waterproofing) Manual Guidelines.

3. UL listing: Provide built-up roofing system and component materials which have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for the applicable Class rating for external fire exposure. Provide roof covering materials bearing Classification Marking (UL) on all bundles, packages or containers indicating that materials have been produced under UL's Classification and follow-up service.

4. Certificates of Compliance: Provide Certificate of Compliance from an independent laboratory indicating that the asphalt fiber glass shingles made in normal production meet or exceed the requirements of the following:

a. ASTM E 108/UL 790 Class A Fire Resistance.

b. ASTM D D7158 or D3161/UL 997 Wind Speed, Resistance Exposure Categories.

c. ASTM D 3462.

d. Submit certification that roofing systems installed in this Project comply with roofing system manufacturer's specifications and installation instructions.

e. Insulation Acceptance Letter: Submit letter from roofing system manufacturer indicating roofing system manufacturer's approval of proposed insulation for use with roofing system.

5. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for roofing system identical to that used for the school facilities project.

6. Pre-Installation Conference: Schedule a Pre-installation conference in a timely manner prior to the scheduled start of roofing system installation. Conduct Pre-Installation Conference; do not begin roofing system installation prior to this conference.

a. Attendance - Include representatives from at least following organizations:

1.) Prime Construction Contractor and Roofing System Installer

2.) Roofing System Manufacturer

3.) Owner

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- 4.) NJSDA Project Representative
- 5.) Design Consultant
- b. Agenda - Include at least following items on conference agenda:
  - 1.) Review of all systems and materials to be used in roofing system installation.
  - 2.) Review and coordination of all substrate preparation and related construction, including installation of curbs or similar items by other contractors.
  - 3.) Review and modification of Roofing System Installer's proposed sequencing of roofing installation.
7. Protection Requirement: Membrane Protection: In addition to other protection requirements, protection against staining, contamination with other materials, and mechanical damages shall be provided for newly applied roofing and adjacent surfaces throughout this project.
  - a. For SBS Modified Bitumen Membrane System do not apply the cap sheet until after all other work on, around, and above the associated roof area(s) is complete. Protect the roof surface prior to and after application of the cap while construction is occurring in the associated area.
  - b. For EPDM single ply membrane protect the entire roof before and after the membrane is adhered. Protect membrane and flashing materials against coming in contact with coal tar pitch, petroleum, grease, oil, solvents or other waste products. After exposure to pitch of other waste products, remove contaminated membrane and flashing material from Site.
8. The Design Consultant shall specify an appropriate system specific water test to be conducted for all low slope and flat roofs.

## **D. Related Standardized Details**

1. Refer to the following details for additional information:
  - a. B2010-11-01 Section: Brick Exterior Cavity Wall w/ CMU Backup
  - b. B2010-11-04 Section @ Parapet: Brick/CMU Cavity Wall
  - c. B2010-11-08 Section @ Roof: Brick/CMU Cavity Wall: Curb: Built up Roof @ Wall
  - d. B2010-11-09 Section: CMU Exterior Cavity Wall w/ CMU Backup
  - e. B2010-11-12 Section @ Parapet: CMU Veneer/CMU Cavity Wall
  - f. B2010-11-16 Section @ Roof: CMU Veneer/CMU Cavity Wall: Curb: Built up Roof @ Wall
  - g. B2010-11-25 Section: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - h. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
  - i. B2010-11-32 Section @ Parapet: Brick/Metal Stud Cavity Wall
  - j. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
  - k. B3010-11-01 Door Saddle: Building to Roof Detail: SBS Multi-Ply Roof
  - l. B3010-11-02 Bulkhead Door Sill Pan Flashing Detail
  - m. B3010-11-03 Edge Metal Detail: SBS Multi-Ply Roof
  - n. B3010-11-04 Roof Edge with Gutter: SBS Multi-Ply Roof
  - o. B3010-11-05 Parapet Flashing Assembly, Typical: SBS Multi-Ply Roof

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- p. B3010-11-06 Base Flashing @ Wall Expansion Joint : SBS Multi-Ply Roof
- q. B3010-11-07 Expansion joint with Metal Cover: SBS Multi-Ply Roof
- r. B3010-11-08 Expansion joint with Neoprene Cover: SBS Multi-Ply Roof
- s. B3010-11-09 Insulated Pipe Penetration: SBS Multi-Ply Roof
- t. B3010-11-10 Eave Wall Closure: SBS Multi-Ply Roof
- u. B3010-11-11 Coping Saddle @ Wall
- v. B3010-11-12 Coping Termination Typical
- w. B3010-11-13 Coping / Counter flashing Termination
- x. B3010-11-14 Coping Corner @ Wall

## **B3010.1 Roofing**

### **A. General Requirements**

1. Minimum roof covering fire classification for low slope roofs to be based upon the type of construction and the presiding codes.
2. All components of the specified roofing system shall be products of the roofing manufacturer or accepted by the roofing manufacturer as compatible.
3. Unless otherwise approved by the Design Consultant and accepted by the membrane manufacturer, all products (including insulation, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the warranty.
4. Asphalt and composition shingles may be used on School Facilities Projects with sloped roofs. Sheet metal standing seam roofing may be used in limited select locations and in limited quantities based upon application and location on the building. The Design Consultant shall justify the use of sloped roof surfaces on new construction and their use shall be approved by the NJSDA during the early Design Phase of the project.
  - a. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Asphalt and composition shingles roofing may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing asphalt and composition shingles roofing building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.
  - b. In rare instances, on a project that is a renovation and or addition to an existing building which contains asphalt and composition shingles roofing and matching a feature is required, asphalt and composition shingles roofing may be used after consultation with and approval of the NJSDA.
  - c. General Sloped Roof Types
    - 1.) Normal sloped shingle roofs are defined as those which are four inches per foot (4" / ft.) or greater in slope.
    - 2.) The use of low sloped shingle roofs, defined as those which have a slope of three to four inches per foot, require the approval of the NJSDA.

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3.) The maximum recommended pitch of any primary roof is 6 in 12, unless greater pitches have been approved by the NJSDA

**B3010.10.2 Sheet Metal Roofing Systems (Under NJSDA Internal Review)**

**B3010.50 Low Slope Roofing**

**B3010.50.1 Styrene-Butadiene-Styrene (SBS) Modified Bitumen Multi-ply Membrane System**

**A. Materials**

1. **SBS Modified Bitumen Multi-ply Membrane System** for roofs in new construction and renovation/addition projects, use a hot asphalt-applied, multiplied prefabricated, fiberglass reinforced, homogeneous, SBS copolymer modified bitumen membrane system secured to a prepared substrate. SBS modified bitumen membrane composition roofing system, complete with flashing system. Hot asphalt-applied SBS modified bitumen roofing systems shall include: (Refer also to other related sections below). When system is installed over non-nailable deck or insulation omit rosin paper, if specified and cement with asphalt.

a. Membrane System: A base-ply, interply(s), and granulated capsheet must be incorporated into the system. All plies to be modified bitumen based sheets with polyester or fiberglass (per ASTM 6162 and ADTM 6162M) mat reinforcement.

b. Provide a SBS Modified bitumen, fiberglass or polyester reinforced, asphalt, base ply and interply (s) per manufacturer's recommendations for the system selected.

c. Provide a cap sheet membrane consisting of a prefabricated reinforced polyester or fiberglass scrim, Styrene-Butadiene-Styrene (SBS) copolymer modified asphalt sheet. The cap sheet shall meet ASTM D6162 and ADTM 6162M and have a ceramic or other manufacturer's granular surface meeting the reflectance criteria in B30 Roofing, B.2 Materials.

d. Separation/Protection Sheet: Reinforced rubberized asphalt, minimum thickness 40 mils.

e. Flashing: Refer to B3010.90.2 Roofing Supplementary Components, Flashing and Trim for additional information.

f. Insulation: Refer to B3010.90.1 Roof Insulation and Fill for additional information.

g. Cover Board – Provide minimum ½" thick fiberglass mat faced (top and bottom), gypsum core cover board. The minimum compressive strength shall be 500 psi.

h. The Design Consultant shall specify all required adhesives, cleaners, sealants, primers, fasteners, membrane terminations, vapor retarder, recovery board, fiberglass coated decking, and accessories etc. to comprise a comprehensive system.

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## **B. Quality Assurance**

### **1. Manufacturers' Warranty**

a. Special Manufacturer's Warranty: Submit roofing system Manufacturer's special warranty, on manufacturers' standard warranty form, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. The guarantee shall be a term type, without deductibles or limitations on coverage amount and shall be issued at no additional cost to Owner. Failure includes roof leaks.

b. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners and fastening systems, insulation, cover boards, sheet metal flashings and trim, copings, roof edge flashings, roof edge drainage systems, counter flashings, and reglets, and roof expansion assemblies specified and all other components of roofing system.

c. The manufacturer, at its expense, shall repair or cause to be repaired, the Roofing System described in this warranty to the extent necessary to return the roofing system to a watertight condition.

d. Guarantee Re-Issuance: In the event repairs are required due to natural disasters, unauthorized alterations, or other causes specifically excluded in guarantee, roofing system manufacturer will re-inspect roof and re-issue guarantee provided that methods and materials used in repair have received manufacturer's prior approval and repairs are accomplished by approved applicator

e. Warranty Period: 20 years from date of Substantial Completion.

### **2. Installers' Warranty**

a. Special Project Warranty: Submit roofing Installer's warranty, on standard warranty form, signed by Installer, covering Work of this Section, including all components of roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period.

b. Warranty Period: Two years from date of Substantial Completion.

## **B3010.50 Low Slope Roofing**

### **B3010.50.2 Single Ply Ethylene Propylene Diene Monomer (EPDM) Membrane System**

#### **A. Materials**

1. Single Ply EPDM Membrane: Ethylene Propylene Diene Monomer (or Terpolymer which consists of three distinct monomers) For roofs in new construction and renovation/addition projects, use a 90 mil, single ply, fully adhered, EPDM roofing system complete with flashing system. A single ply fully adhered EPDM roofing system shall include: (Refer also to other related sections below)

# Model Schools: Materials and Systems Standards

## Design Requirements

## Exterior Horizontal Enclosures – Section B30

- a. Membrane: Non-Reinforced, 90 mil., White, Fire-retardant, EPDM (Ethylene, Propylene, Diene Monomer or Terpolymer) membrane in the largest sheet possible without factory splices for its application to minimize the number of seams.
- b. Application Method: Fully Adhered:
- c. Membrane Sealants: Provide sealants, primers, compatible with the roofing membrane and flashing system and recommended by membrane manufacturer.
- d. Demonstrated resistance to ultraviolet and ozone exposure
- e. Flashing: Refer to B3010.90.2 Roofing Supplementary Components, Flashing and Trim for additional information.
- f. Insulation: Refer to B3010.90.1 Roof Insulation and Fill for additional information.
- g. Seam Tape/Adhesive: Unless otherwise specifically recommended by membrane manufacturer, secure seams between membrane sheets using seam tape recommended by membrane manufacturer. Obtain Design Consultant's review of proposed seam adhesive prior to incorporation into roofing system.
- h. Bonding Adhesive: Where recommended by membrane manufacturer, provide adhesive compatible with membrane and materials to which membrane is to be adhered and recommended by membrane manufacturer.
- i. The Design Consultant shall specify all required adhesives, cleaners, sealants, fasteners, membrane terminations, vapor retarder, cover or recovery board, fiberglass coated decking, and accessories etc. to comprise a comprehensive system.

### B. Quality Assurance

1. The membrane Non-Reinforced, 90 mil., White, Fire-retardant, EPDM (Ethylene, Propylene, Diene Monomer or Terpolymer) membrane shall conform to the minimum physical properties of ASTM D4637/D4637M-15(2021)e1 EPDM Type I, with the following physical characteristics:

- a. Tensile Strength (ASTM D412)
- b. Elongation (ASTM D412)
- c. Accelerated Aging (4 weeks exposure at 240 deg. F; ASTM D412 or ASTM D573):
  - 1.) Aged Tensile Strength
  - 2.) Aged Elongation
- d. Tear Resistance (ASTM D624)
- e. Low Temperature Brittleness Point (ASTM D746): -45 deg. F or lower

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f. Accelerated Weathering (ASTM G23, ASTM G26, or ASTM G53 no loss of tensile strength or breaking strength)

g. Impact Resistance (ASTM D3746, ASTM D4272, CGSB 37-GP-52M or FM 4470) resistant to impact damage

## 2. Manufacturer's Warranty

a. Roofing System Manufacturer's Standard warranty for Labor and Materials. Provide a labor and materials guarantee that roofing system will remain in watertight condition and that roofs' covering will remain intact in its' installed location. Include following conditions in guarantee coverage:

- 1.) Cracking due to membrane expansion or contraction
- 2.) Deterioration due to exposure to weather
- 3.) Decomposition of membrane due to ponding water
- 4.) Separation of factory- and field-fabricated seams and joints
- 5.) Cracking or deterioration of membrane from water vapor trapped under membrane
- 6.) Separation of, or decomposition of, membrane flashing
- 7.) Wind damage sustained up to wind speeds specified in "Wind Uplift" subparagraph of "Performance Requirements" paragraph in "System Description" article above.

b. Remedy: In event roofing system fails to perform, roofing systems manufacturer will, at its own expense, make repairs or modifications to roofing system necessary to reinstate water tightness, re-inspect roof, and re-issue guarantee after re-inspection.

c. Guarantee Re-Issuance: In the event repairs are required due to natural disasters, unauthorized alterations, or other causes specifically excluded in guarantee, roofing system manufacturer will re-inspect roof and re-issue guarantee provided that methods and materials used in repair have received manufacturer's prior approval and repairs are accomplished by approved applicator.

d. Warranty Period: 20 years from date of Substantial Completion.



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## **B3010.90      Roofing Supplementary Components**

### **B3010.90.1      Roof Insulation and Fill**

#### **A.      Materials**

1. Hot asphalt-applied SBS protected membrane modified bitumen roofing systems shall include polyisocyanurate insulation with a minimum R value required to meet the current New Jersey Energy Subcode and other presiding code requirements.

a. Roof Insulation used for all projects shall be UL and FM approved.

b. All panels must possess adequate rigidity to span the flute openings of metal roof decks.

c. Where specified or required, insulation shall be installed as a separation layer over the roof deck, the existing substrate and/or to obtain the desired thermal R-value.

d. A maximum panel size of four feet by four feet shall be maintained where insulation is specified to be installed in hot asphalt. Where insulation is to be installed in two layers, joints in the second layer shall not coincide with joints of the first layer. The courses should be staggered to ensure this.

e. Second Layer: (Typically a universally accepted insulation type) such as a panel composed of a non-structural water resistant core material, integrally bonded with fiberglass mats on both sides. Nominal thickness shall be **1/2"** inches. The gypsum sheathing panels shall be approved by Factory Mutual Research.

2. EPDM Single Ply Membrane systems shall include polyisocyanurate roof insulation: Acceptable to roofing system manufacturer, complying with Factory Mutual requirements for FM Approval for Class 1, for use over the projects roof construction, and capable of bridging metal deck flutes, if applicable, without breaking or cracking.

a. Polyisocyanurate Roof Insulation: Rigid, closed-cell, halo-carbon blown polyisocyanurate insulation board integrally faced on both sides with either bituminous-saturated roofing felt, aluminum foil, or glass fiber mat facer (in accordance with roofing system manufacturer's recommendations).

b. Flat insulation: Flat boards; length and width required for installation specified by thickness required to meet minimum R-value specified.

c. Tapered insulation: Boards tapered at one quarter inch per foot (1/4"-1'-0"); or tapered as required to achieve minimum stated slope (1/4" / 1"0")length and width required for installation specified; minimum 1-1/2-inch thickness, unless otherwise indicated on Drawings or required to meet R-value required to comply with the current New Jersey Energy Subcode. Area-weighted average thickness required to provide minimum R-value of not less than twenty four (24) for roofing assembly.



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## Design Requirements

## Exterior Horizontal Enclosures – Section B30

3. Shingle Roof Systems: The insulation system shall be selected by the Design Consultant based upon the associated roof system assembly and compliance with presiding codes particularly the current New Jersey Energy.

4. The insulation system for a shingle roof shall be separated from the nailable sheathing surface by an air space to allow ventilation and meet code.

### **B. Quality Assurance**

1. All Insulation: Meet or exceed following requirements:

a. Flame spread less than 25 (ASTM E-84)

b. Smoke developed less than 450 (ASTM E-84)

c. Fuel contributed less than 100 (ASTM E-84)

d. Passes tests of FM 4450 and UL 1256 when tested as an assembly.

2. Specify polyisocyanurate insulation meeting ASTM C1289, with at least a minimum R value required to meet the current New Jersey Energy Subcode and other presiding code requirements.

3. Comply with following requirements for both flat and tapered polyisocyanurate types of insulation:

1.) Long Term Thermal Resistance - LTTR (ASTM C1289):

2.) Foam Density: Not less than 1.5 lbs. per cubic foot

3.) Compressive Strength: Nominal 20 psi. For exterior play surfaces: 40 psi or greater based upon applications' loading and presiding codes

4. Roof Insulation used for all projects shall be UL and FM approved.

### **B3010.90.2 Flashings and Trim**

#### **A. General Requirements**

1. Utilize the roofing manufacturers' recommended flashing and trim system(s) for each respective roof system type.

2. The flashing listed below are the recommended flashing for use with the roofing system(s) listed. Other flashing materials may be used such as cold rolled copper, lead coated copper, stainless steel, copper fabric flashing, aluminum, galvanized steel, etc. dependent upon the application. The selection and application of other flashing materials shall not void the manufacturers' roof warranty.

#### **B. Materials**

1. SBS Modified Bitumen Multi-ply Membrane System:

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a. Flashing: Provide two-ply modified bitumen membrane flashing system at all curbs, walls (parapet and rising) consisting of base-ply and granulated cap flashing ply.

b. Flashing Membrane Assembly: The flashing membrane assembly shall consist of a prefabricated, fiberglass scrim-mat reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane. Utilize a granular surfaced flashing sheet to match the cap sheet where applicable.

c. Flashing - Provide reinforced single component liquid flashing system at all pipe, conduit, steel shape, etc. penetrations in lieu of pitch pockets.

d. Trim:

1.) Utilize the manufacturers' standard metal edge, coping systems, and associated fasteners and adhesive if not detailed on the construction drawings and defined by the specifications.

## 2. EPDM Fully Adhered Single-ply Membrane Roof System:

a. Membrane Flashing: EPDM material recommended by membrane manufacturer for flashing applications; thickness as recommended by membrane manufacturer. Conform to profiles indicated at all changes in plane, all roof penetrations, all roof edges, and all roof interruption.

b. Trim:

1.) Utilized the manufacturers' standard metal edge, coping systems, and associated fasteners and adhesive if not detailed on the construction drawings and defined by the specifications

## 3. Shingle Roof System:

a. Trim:

1.) Utilize the manufacturers' standard metal edge, coping systems, and associated fasteners and adhesive if not detailed on the construction drawings and defined by the specifications.

## C. Quality Assurance

1. Except as otherwise shown or specified, comply with applicable recommendations, details, and standards of Copper Development Association (CDA), and Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) "Architectural Sheet Metal Manual".

2. All metal edgings shall be tested and meet ANSI/SPRI ES-1 standards for shop fabricated perimeter edge conditions and comply with presiding codes

3. Shingle Roof System:

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- a. Sheet Flashing: ASTM B 209; 0.025 in (0.63 mm) or 0.032 in (0.8 mm) thick aluminum, mill finish.
- b. Sheet Flashing: ASTM B 370; cold rolled copper; 16 ounces per square foot (0.55 mm); natural finish.

## **B3010.90.3 Roof Eaves and Soffits**

### **A. Materials**

1. The Design Consultant shall select the appropriate eave, soffit, and fascia system including all components to provide a complete, weather resistant water proof assembly. The system selected shall allow for venting from bottom to top of system when applicable and shall require a separate support and attachment system if not provided as an integral part of the manufacturers' eave, soffit, and fascia manufacturers' standard system selected.

2. The eave, soffit, fascia system shall be selected from one of the following system alternatives:

a. A system composed of composite panels made of 0.032" painted aluminum sheet fused to a plywood core and a 0.013" fused aluminum backer sheet attached in a pressure equalized rain screen application. The aluminum faced panels shall be factory fabricated and installed in the field using one of the manufacturers' standard clip and caulk attachment method. Insulation and vapor barrier shall be provided behind the composite panel. The panels shall be supported by a system of light gauge metal framing and a substrate. The soffit system shall include 0.032" aluminum soffit vent panels when applicable.

b. A system composed of composite insulated panels made of 0.032" painted aluminum sheet fused to an expanded polystyrene or polyisocyanurate foam core, an intermediate layer of corrugated polyallomer on both sides of the foam core, and a 0.013" fused aluminum backer sheet attached to a substrate or sub-frame in a pressure equalized rain screen application. The aluminum faced panels shall be factory fabricated and installed in the field using one of the manufacturers' standard attachment methods such as dry seal or route and return. The panels shall be supported by a system of light gauge metal framing and a substrate. This system shall not be used for shingle applications where venting is required.

c. A system composed of prefinished fiber cement solid fascia boards and prefinished, prefabricated ventilated slotted and solid soffit panels. This system shall include insulation to be provided behind the fiber cement board panels. The panels shall be supported by a system of light gauge metal framing.

d. A fascia and soffit system composed of continuous 0.032" aluminum soffit vents and 0.032 thick aluminum fascia panels fused to an insulated core composed of either expanded polystyrene or polyisocyanurate foam core attached to an appropriate substrate material or system utilizing the manufacturers' standard method of attachment.

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## **B. Quality Assurance**

1. All eaves, fascia, soffits, and component parts are to comply with SMACNA "Architectural Sheet Metal Manual" or metal soffit, eave, and fascia panel manufacturer for the respective product or application.
2. Finishes: All finishes are to comply with NAAMM "Metal Finishes Manual for Design of Architectural and Metal Products" for recommendations for applying and designating finishes. Refer to Section B2020.90 Exterior Windows Supplementary Components A.4 Finishes for detail on applicable finishes.

## **B3020 Roof Appurtenances**

### **B3020.10 Roof Accessories**

#### **B3020.10.1 Leaf and Snow Guards**

1. Provide leaf guards and or snow and ice guards compatible with the roofing system, including the drainage system per manufacturer's recommendations.
2. For Aluminum and Steel Standing Seam Metal roofs do not specify plastic or other material glue down snow guards. Provide horizontal metal bar type snow guards that attach to the standing seams or a similar system. Specify snow guards in a color to match the roof finish from the manufacturer's selection of standard colors.

## **B3020.70 Rainwater Management**

### **B3020.70.1 Roof Drains / Gutters and Downspouts**

#### **A. General Requirements**

1. New construction, Flat Roofs:
  - a. For new construction, roofs are typically designed for storm water to dissipate within forty-eight hours of rainfall.
  - b. The roof is to be pitched to drain for positive roof drainage, typically one quarter inch (1/4" per 1'-0") per foot minimum finished slope.
  - c. For a typical square or rectangular roof configuration, positive drainage shall be achieved by sloping the structural steel. For other roof configurations, the desired slope can be achieved by the use of tapered rigid insulation panels where it is not appropriate to provide sloped structural steel.
2. Provide exterior roof drains including but not limited to properly sized aluminum gutters, downspouts, leaders, connector boots, conductor heads, and splash pans on roof surfaces. Scuppers when properly detailed are encouraged when a second means of getting water off a roof is required. Interior drains shall be used when the roof type(s) and configuration dictates their use.
3. All roof drainage systems shall be tied directly to the storm system whenever possible.

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4. When internal roof drains are used, use either a combination roof drain comprised of a manufacturer's standard roof drain and an adjacent overflow drain or a manufacturer's standard roof drain and thru wall scuppers. Plumb all lines in compliance with presiding codes.
5. Internal roof drains that are offset from the lowest roof point due to structure shall be set in a minimum 4 foot square sump to ensure the drain is at the lowest point.
6. Utilizing the roof as a retention basin is not recommended and requires approval of the NJSDA.

## **B3040 Traffic Bearing Horizontal Enclosures**

### **A. Description / Design Approach: Other Roofing Systems and Criteria**

1. No Equipment shall sit directly on roofing system. Provide all equipment and piping a minimum of 12" above the roof system.

### **B. Description / Design Approach Roof Equipment Service Access**

#### **1. General Requirements**

- a. The roof top heating and cooling units' (RTU's) serviceable elements and other rooftop equipment that require maintenance must be accessible for maintenance and service via a stair /bulkhead or other direct means to the major equipment at the projects' highest roof and by ladders or doors to other equipment locations.
- b. Safe access and walking surface to maintain and service RTU's shall be detailed and shown on the construction drawings corresponding roof plans.
- c. Rooftop equipment such as cooling towers if on dunnage may require an OSHA code compliant service platform to gain access to service locations. Equipment on dunnage shall only be provided when necessary to properly support the projects' RTU's.

#### **2. Materials**

- a. Access to panels/doors for equipment on dunnage for service shall be provided via a metal platform constructed of aluminum or galvanized steel. This metal platform shall be minimum twenty four inches (24") wide. Length of the platform shall be sufficient to serve one or multiple access panels.
- b. At locations where access panel/door swings into the platform, the width of the platform shall be such that it is at least twenty inches (20") in width beyond the swing of the panel/door.
- c. Surface of the metal platform shall be non-skid with open grates. Platform shall have an OSHA compliant ladder. Platform shall be located at sill level or such that the relative height between the platform and top of access panel/door is no more than seven feet (7'-0").

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d. All platforms to have a 3'-6" high railing system at all open sides. For platforms greater than four inches (4") above adjacent roof, provide toe board along all open sides i.e. sides that are not against the RTU.

e. Where the top of the unit has items that must be serviced, provide an OSHA compliant ladder to access the top of the unit. The ladder and platform structure if required shall be constructed such that it can be removed to facilitate roofing and flashing during roof replacement or any other related work that requires re-roofing.

f. Roof mounted mechanical equipment shall have walk pads to and around the units. The Design Consultant and their consultants shall, whenever possible, locate all roof-top equipment more than twelve (12') feet from the roof edge. Mechanical equipment, fans, and appliances that require service and are located closer than twelve (12') feet from the roof edge and such edge or open side is located more than thirty inches (30") above the floor or roof below provide OSHA/Code compliant safety guard railing system. Where a minimum 3'-6" high parapet is provided, such guards are not required.

g. Mechanical Equipment:

1.) Mechanical equipment should be designed to be set on a full curb.

2.) Provide additional sloped insulation below framework and between equipment support curbs to remove water from below units. Provide taper strip on all sides of all full-curbed equipment to prevent water standing against flashings.

3.) Rooftop equipment shall be designed to resist wind loads.

## **B3040.50      Wear Surfaces**

### **A.      General Requirements**

1. Walk pads shall be provided on flat roofs at all traffic routes from the points of roof access to all rooftop equipment, fans, and appliances requiring maintenance/service on a routine basis. Walk pads shall be adhered following manufacturers recommendations.

2. Roof-top Play Areas, when provided, shall include both resilient play/sport for fall protection and or hard surfaces over one of the recommended roof systems. The Design Consultant shall also provide presiding code and regulation compliant rooftop enclosures to provide fall protection and contain the sports/play activities where applicable.

### **B.      Materials**

1. All walkway pads and pavers shall meet the reflectance criteria in B3010 Roofing, B.2 Materials. When using resilient play surfaces to provide fall protection and proper flooring for outside activities and sports; the selection of colors may be impacted in order to comply with the reflectance criteria.

2. Walk pads: Hot asphalt-applied SBS modified bitumen roofing systems shall include walk pads composed of an additional layer of cap sheet / walk pad material. The walk treads shall consist of an asphalt impregnated, puncture resistant polyester fabric core,

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coated with a polymer modified bitumen and topped with a ceramic coated granule wearing surface. Sizes as recommended by the manufacturer standard.

3. Walk pads: EPDM single ply membrane systems shall include: Minimum 30-inch x 30-inch walkway pad as recommended by roofing system manufacturer.

## **C. Roof-top Play Area Description / Design Approach**

1. An accessible outdoor, roof-top play area shall be incorporated in the design of the building when necessary due to on-grade site restrictions or scarcity of on-grade open areas for this purpose. An accessible outdoor, roof-top play area is subject to approval by the NJDOE, Office of Facilities and shall comply with all presiding codes and regulations.

2. Refer also to G2060 Site Development Section G2050 Athletic, Recreational, and Playfield Areas (Play Structures) for additional information.

## **D. Materials**

1. Roofing Systems for Roof-top Play Areas: The Design Consultant shall select the appropriate roof system components and their respective order within the roof assembly to be utilized in conjunction with their design for a rooftop play area and the type of walk or play surface(s) to be provided.

2. When precast concrete pavers and resilient play surfaces such as poured in place rubberized asphalt playground surface or prefabricated resilient playground surfacing such as interlocking or other rubber tiles additional substrates and roofing system component parts shall be detailed and specified by the Design Consultant. This may include but not be limited to the following:

a. To provide support and drainage for the use of precast concrete pavers with adjustable and prefabricated manufacturers' standard support pedestals and or pads, the roofing system selected may require the addition of geotextile fabric drainage medium, one or more layers of rigid insulation, filter fabric, etc. above the roofing membrane.

b. To provide support and drainage for the use of a poured resilient rubberized asphalt floor, the roofing system selected may require the addition of geotextile fabric drainage medium, protection boards, additional layers of impact load resistant rigid insulation, filter fabric, and a poured in place floating concrete slab above the roofing membrane.

c. To provide support and drainage for the use of prefabricated resilient tile, the roof system selected may require the addition of, geotextile fabric drainage medium, drainage board, filter fabric, additional layers of impact load resistant rigid insulation, and a setting bed of compacted stone screening such as limestone, above the roofing membrane.

3. The use of other paver or roof surface types other than those listed herein shall be justified by the Design Consultant and their consultants and is subject to approval by the NJSDA.

4. The following general roof systems are to be used for Roof-top Play areas in conjunction with the respective selected wear surfaces:



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a. **SBS Modified Bitumen Protected Membrane System:** As above in B3010.50.1 Styrene-Butadiene-Styrene (SBS) Modified Bitumen Multi-ply Membrane System and the system requirements below. The Design Consultant is to specify all additional required system components or modifications to the components described above and below as required for the specific surface, play/sport function and application, loading requirements, and to comply with all presiding codes and regulations. Including but not limited to the number of plies, location, density, r-factor, and type of insulation, type of flashing sheet and pedestal type, the inclusion of drainage board and geo-textile drainage fabric, a layer of type of stone screening, etc.

b. **Single Ply EPDM Membrane System:** As above in B3010.50.2 Single Ply Ethylene Propylene Diene Monomer (EPDM) Membrane and the system requirements below. The Design Consultant is to specify all additional required system components or modifications to the components described above and below as required for the specific surface, play/sport function, loading requirements, and to comply with all presiding codes and regulations. Including but not limited to the density and type of insulation, type of flashing sheet and pedestal type.

c. Pavers on adjustable pedestals.

1.) Precast Concrete Pavers:

a.) Nominal size: A minimum of two foot by two foot (2'-0" x 2'-0"), 8500 psi min. compressive strength.

b.) Provide integral pedestal type where recommended by membrane manufacturer. Where integral pedestals are not used, provide plastic paver support pedestals and shims, with protection beneath the pedestal as recommended by the membrane manufacturer.

c.) Air space under pavers shall be at least 0.25", and additional space shall be provided if recommended for ventilation by the insulation manufacturer.

d. Pavers applied on top of an Inverted Roof Membrane Assembly (IRMA) or Protected Membrane Roof (PMR) System

1.) Precast Concrete Pavers: As above

2.) The use of other paver or roof surface types other than those listed herein shall be justified by the Design Consultant and their consultants and is subject to approval by the NJSDA.

e. Resilient Play Surfaces

1.) Poured in place resilient playground surface: Refer to Section G2050 Athletic, Recreational, and Playfield Areas (Play Structures) for additional information.



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2.) Prefabricated resilient playground surfacing (interlocking or other tiles): Refer to Section G2050 Athletic, Recreational, and Playfield Areas (Play Structures) for additional information.





# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section C: Interiors**

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# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section C10: Interior Construction**

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## C10 Interior Construction:

### C1010.00 Interior Partitions:

#### A. General Description / Design Approach:

1. The following Typical Interior Partition description and design approach are typically used for all new construction and additions. It is the Design Consultant's (DC) contractual obligation to properly define and document all partition types to meet the requirements for separation, privacy, life safety, and the programmatic requirements in the Educational Specification, as well as specific District needs. All partitions, materials, and assemblies shall meet the approval by the NJ School Development Authority (NJSDA) [www.njsda.gov/](http://www.njsda.gov/), the School District, the NJ Administrative Code (NJAC) 6A:26-6.3 Educational Facilities Planning Standards <http://www.state.nj.us/education/facilities/>, the NJ Uniform Construction Code Title 5:23, the current version of the NJ International Building Code and any other relevant Testing Agency or Authorities.

2. Partitions adjacent to or surrounded by existing construction shall meet the requirements of the NJUCC Subchapter 6 Rehabilitation Sub Code and relevant amendments.

3. The Design Consultant shall follow the guidelines below consisting of General Description/Design Approaches, Design Requirements, Material Recommendations, Recommendations in the Table of Assemblies and Materials (TAM) where the DC may choose between using concrete masonry units (CMU) or gypsum board and nonstructural light gauge framing (GB-NSLGF) partitions. The DC shall determine the most cost effective solution and be prepared to defend their choice. If a variation or conflict should exist with the guidelines or choices, they shall follow the recommended procedures for variance in the Introduction and General Requirements of the Material and System Standards.

4. The TAM that follows in subsection C1010.10.5 is based on sound transmission coefficients (STC) rating values of masonry and gypsum board assemblies specified in the Performance Specifications Section PS1030.00 Project Criteria, or Table PS1030.00-01 Acoustical Performance Criteria. The STC ranges incorporate recommended STC values for school design found in ANSI/ASA S12.60 Part 1-2010 Table 4, located at <http://www.acousticalsociety.org/>. The NJSDA understands that the STC is not the only source of criteria by which an interior partition type may be so designed. It is understood that reverberation and sound absorption or reflection may be adjusted by other means that the material composition of a partition such as hung or wall mounted sound soak or reflective panels or the use of clouds, or carpet, that could further control sound performance in a given space. While STC is used as a general tool for organization, the range of possible acoustical performance required of partition types; the TAM is neither meant to be all inclusive of all room types found adjacent to classrooms. It is the responsibility of the DC to validate the TAM with the presiding ANSI/ASA documentation, building codes, and all other acoustical design criteria in choosing the right materials and design of the partition to meet the required acoustical performance criteria of the space.

#### B. General Requirements:

1. Self-supporting structural 'Fire Walls', 'Shear', 'Bearing' or other interior walls required for structural purposes, though found within the interior envelope of a school, are not considered typical 'Interior Partitions' and are not described in this section. However, they shall meet the

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minimum acoustical and finish criteria as part of the enclosure system of a given space as their adjoining typical nonstructural partition counterparts..

2. Code defined 'Fire Barriers', 'Fire Partitions', 'Shaft Enclosures', 'Smoke Barriers', and 'Smoke Partitions' whose definitions are defined in the presiding Code are classified by hourly performance ratings and are considered typical 'Interior Partitions' . They are included in the text and general requirements descriptions below.

3. Height limitations of self-supporting partitions either of concrete masonry units (CMU), non-structural light gauge framing (NSLGF) are described below, however, the DC must validate thicknesses of partitions and recommended service height limitations with their consulting structural engineers, and that which is set by their respective Trade Councils, such as the National Concrete Masonry Association(NCMA) <http://www.ncma.org> for CMU, or by the Steel Stud Manufacturer's Association (SSMA) [www.ssma.com](http://www.ssma.com), and the presiding NJ codes. Materials and elements that constitute a self- supporting interior partition shall:

a. Maintain continuity and integrity from floor slab to roof/ceiling deck above and its supporting construction

b. Be designed to with stand seismic or other structural forces as required by the presiding Codes.

c. Be protected from fire to prevent failure of continuity and integrity of any portion of its construction whether exposed to fire on one or both sides.

4. The DC is responsible for partition assembly designs to typically provide continuity of construction that extends from floor surface to the roof/floor decking above the floor surface unless it is demonstrated why such an assembly may terminate to some other point below the roof/roof deck.

5. The DC is responsible to determine all Head Wall Details and any other Fire Rated Joint Systems that might either penetrate or terminate a fire rated interior partition.

6. The DC is responsible to coordinate all "fire rated" or non- protected penetration requirements in all interior partition assemblies such as but not limited to:

a. Architectural openings, such as, doors, glass vision panels, borrow or sidelights and their associated hollow metal frames

b. Structural penetrations, such as lateral bracing, co-planar sheer wall bracing, lintels and bond beams over architectural openings, beam or other structural penetrations.

c. Mechanical, electrical, plumbing or fire protection openings or penetrations such as for ducts or piping risers, or any other adjacencies or hanging equipment that affects the partition design.

7. The DC is responsible to coordinate all lateral bracing and structural enhancements adjacent to or in support of the non-structural partitions to include:

a. Diagonal bracing of the partition to roof/ceiling deck such that bracing will not interfere with adjoining MEP equipment, piping or other appurtenances.

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8. Classroom partitions shall be made to allow for flexibility and “Change of Use” wherever possible. It is the NJSDA and School Districts best interest to reduce cost and time of such alterations. See “Change of Use” as defined in the NJ Department of Education definitions section of the N.J.A.C. 6A:26-1.2.
9. Fire rated” specialty glass in partitions such as those used in fire stair enclosures or for atriums shall not be used unless the DC demonstrates the need for such design and shall be reviewed on a case by case basis by the NJSDA and School District.
10. Partitions with borrow or side light glass panels in hollow metal door frames or as stand-alone hollow metal frame elements in partitions shall be limited. The DC shall exercise restraint where quantity and design scope exceeds District preference and NJSDA preference as further described in Section C1030 Interior Doors and C1020 Interior Window.
11. Heavy Duty Service Shops shall typically require CMU partitions and may include, but not be limited to the following types:
  - a. Carpentry, metal, electric, plumbing, HVAC, automotive, welding, and stagecraft.
12. Light Duty Service Non-structural light gauge steel frame (NSLGF) partitions are permitted as an alternative to CMU in the following shops:
  - a. Photography, graphics, mechanical drafting, computer-aided design (CAD), home economics, and cosmetology, some robotics and plastics shops depending on the type of fabrication involved.
13. The Design Consultant shall design partitions typically used for Use Occupancy Separation and shall validate the following requirements against the presiding code:

Commonly Used Occupancy Requirements:

  - a. Educational Uses (Occupancy E Type) require that all new construction be sprinkled, and that no fire resistive ratings of interior partitions are required between “E” Educational and “A” Assembly.
  - b. No fire resistive ratings are require between “E” and “B” use if the business use occupancy does not exceed 10% of the building area.
14. The Design Consultant shall design “Fire Resistive Rated” partitions and identify them in their design documents as “Fire Rated Assemblies” to meet requirements standards set forth in ASTM [www.astm.org](http://www.astm.org) or UL [www.ul.com](http://www.ul.com) tested assemblies: They shall generally fall within the following rating categories, however, the architect shall validate this guidance with the presiding codes.

Commonly Used “Fire Resistive Ratings” for Interior Partitions in new construction:

- a. **Non Rated Fire Resistive Partition Wall Assemblies:** Are typically used for all non-load bearing wall and partition walls that surround all typical interior spaces that are not otherwise described below.
- b. **One-Hour Fire Resistive Rated Partition Wall Assemblies:** Are typically used for the following partitions:
  - 1.) Walls that separate floor penetrations less than 4 stories to adjoining floor areas (however shall not be rated less than the floor assembly penetrated)



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2.) Walls surrounding shafts, some Incidental Accessory Occupancies such as fire pump rooms, furnace or boiler rooms, stand by battery or elevator machine rooms, areas of refuge, stage dressing and related appurtenant spaces, and vertical exit enclosures and their connectivity with a horizontal exit passageway to the point of discharge to a public right of way.

**c. Two-Hour Fire Resistive Rated Partition Wall Assemblies:** Are typically used for the partitions for the following:

- 1.) Walls that separate 4 story floor penetrations or higher to adjoining floor areas, (however shall not be rated less than the floor assembly penetrated)
- 2.) Walls surrounding shafts, elevator machine rooms, vertical exit enclosures and their connectivity with a horizontal exit passageway to a point of discharge to a public right of way
- 3.) Walls separating fire areas of buildings that create a horizontal exit, area of refuge or fire rescue area.

**d. Three and Four Hour Fire Resistive Rated Partition Wall Assemblies:** Are typically not used for partitions in NJ schools. However, if the circumstances require this level of fire resistive rated partition assembly, the Design Consultant shall follow the presiding codes.

15. The Design Consultant is responsible for the choice of building construction classification, and related hourly rating of all partition and shall be aware of the indirect impact of those choices in that may affect potential cost increases to other systems that penetrate the selected partition. Two examples are as follows:

- a. There is potential for additional costs of fire protection of structural steel around shafts and vertical floor/ceiling penetrations above what may be intended or required by the classification of the building to the framing system if the DC doesn't adequately protect or separate the framing from fire exposure from the penetration by the partition assembly.
- b. There is the potential for additional indirect costs to mechanical system that may result from the choice by the DC of a non-rated "smoke partition" or 1hr rated partition surrounding a science lab where though it is sprinkled and may meet code with a non-rated "smoke partition", it may be more cost effective to rate the partition enclosure because it would lower the cost of the mechanical system by allowing through wall dampers in lieu of hard ducted returns from the space to the AHU.

16. Interior finish treatments on all partition types listed in this section shall refer to Section C20 Interior Finishes and shall be subject to recommendations in the Table of Typical Rooms and Finishes and the Paint Schedule at the end of that section.

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## **C1010.10 Interior Fixed Partitions:**

### **C1010.10.1 Concrete Unit Masonry (CMU):**

#### **A. General Description / Design Approach:**

1. Concrete masonry units are the material of choice for partition design throughout all grade levels in K-12 schools for new and existing construction and are generally preferred over other systems because it is durable to high impact loads and abuse, is fire resistant, is acoustically desirable, and reduces long term maintenance and lifecycle costs. However, it is not as flexible as gypsum and steel stud construction is for reconfiguring parts of the building to accommodate a physical change to the facility or for complex integration of technology that may drive the need for flexibility in classroom layout, school configuration, and design. CMU partitions adjacent to or surrounded by existing construction, and CMU in new construction shall meet the characteristics and testing requirements of the presiding Code. In addition; the NCMA, [www.ncma](http://www.ncma) has been used to develop content in this section.
2. CMU's shall typically be ASTM C90-22 (or current version) quality standard with a minimum average net area compressive strength of 1900psi and shall be of a face texture, finish, and pattern, to receive, a painted finish. The weight of the CMU shall typically be in the 105 to 125 pounds per cubic foot density range and shall generally be of nominal 4"-12" thick units with hollow or solid cores.
3. CMU's are the material of choice for use in partition types though not limited to the following:
  - a. As back up for exterior walls (see section B2010 on exterior wall construction).
  - b. For all typical interior partitions within the shell throughout the floor plans of the buildings.
  - c. Partitions for gymnasiums, multipurpose rooms, corridors, toilets, and toilet cores, and egress stair where higher abuse is a concern, particularly for 11 year old youth to 18yr old young adults.
  - d. For fire resistant interior partitions exposed to flame on one side or both sides whether a bearing partition or not.

#### **B. General Requirements:**

1. Structural capacity for a CMU partition shall be self- supporting and shall include in its assembly appropriate vertical and horizontal reinforcement with the minimum net average compressive strength to meet the presiding codes.
2. CMU shall be typically attached to a floor or roof deck with appropriate head joints to allow flexure of the floor or roof deck and to provide the required fire rated fire stopping according to UL and ASTM Testing Standards as required by the presiding codes. See drawing C1010-04.
3. CMU, when it is used and exposed to view, shall have their visible surface filled with block filler and painted either with one or two coats depending on its density. CMU walls shall typically have a minimum nominal thickness of six inches; however four inches may be used for chases or in smaller partition enclosures that do not exceed their structural self- supporting capacity or requirements for fire resistive construction.



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4. When external CMU corners meet end to end with gypsum board clad partition walls, at hollow metal doors and frames, or at locker unit installation, 1" non 'bullnose' 90 degree CMU's should not be installed on exposed edges .
5. 1" outside radius 'bullnose' CMU shall be used on all outside corners exposed to foot traffic and should include but not be limited to the following locations:
  - a. Column covers, piers, fin walls etc.
  - b. Low walls that are adjacent to a ramp or stair shall have 1" radius, 4" thick, 16" nominal length stretcher wall caps or other similar and suitable eased edge masonry cap.
6. Type S pre-mixed mortar in standard colors shall be used for non- structural or structural purposed and shall conform to ASTM C270-24 and shall meet tests evaluation reports in ASTM C780-23 (or current version) for:
  - a. Aggregate ratio
  - b. Water content
  - c. Air content
  - d. Consistency
  - e. Compressive strength
7. Horizontal joint reinforcement shall be hot dipped galvanized steel ladder type.
8. All exposed joints shall be slightly concave and shall be smoothed to a non- abrasive finish with the proper joint tools to prevent graffiti and abuse.
9. CMU steel reinforced and cast in place or precast lintels shall be used over all CMU partition openings and shall typically be of type, size of reinforcing, and scheduled strength indicated in the structural engineer's lintel schedule. Where length exceeds allowable structural loading or fire protection to the reinforcement, the span shall be reduced or shall be protected according to meet the presiding codes.

## **C1010.10.2 Sound Absorbing Concrete Masonry Units (SACMU):**

### **A. General Description / Design Approach:**

1. SACMU's are required typically in a gym, a multipurpose or cafetorium that may be adjacent to rooms requiring a higher STC rating to adjacent quieter classroom, auditorium, or media center spaces. They shall have a double row of cells to accommodate vertical reinforcing separate from the cores used for acoustical absorption or diffusion. Vertical reinforcing rods are not permitted within acoustical cells. SACMU's shall have a minimum thickness of eight inches to accommodate seismic requirements if needed by the presiding code.

### **B. General Requirements:**

1. SACMU's shall typically provide separate cells within the block for vertical seismic bracing and acoustical treatment.
2. SACMU's shall typically be an ASTM C90-24 and ASTM C129-23 and shall be used in a fixed partition where noise control is required. SACMU are typically concrete masonry units with vertical or flared slots or, metal septa, usually introduced between the outside face and inside

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core which may be filled with non- combustible fibrous filler for diffusing sound or may be omitted for absorbing sound. Painting of CMU will affect the acoustical properties and may enhance reflective or lower absorptive properties depending on what is recommended by the DC's acoustical evaluation of the particular needs of a space.

When selecting a SACMU; the STC properties are dependent on the following:

- a. Surface texture
- b. Density of either coarse, medium or fine.
- c. Block weight, either normal or light weight.
- d. Number of paint coats and finish applications.

3. Furthermore when specifying the use SACMU sound absorptive location and quantity within a room is critical. It is recommended that the DC review acoustical requirements with their acoustical engineer to determine location, quantity, block weight, density, insert composition or not, surface configuration, and finishes so that acoustical performance meets the requirements of the space..

## **C1010.10.3 Specialized Interior Finished Masonry Units:**

### **A. General Description/Design Approach:**

1. Specialized Interior finished CMU such as glazed masonry faced CMU or structurally glazed facing tile and cove base, ground faced CMU, or other specialized CMU shall be used only when required to match existing partition construction. The use of such specialized CMU is generally not recommended in new construction, however, should any specialized masonry be introduced into the design, the design consultant must demonstrate to the NJSDA that the use of such material is based on the particular needs of the design and that it can be justified on a comparative basis to life cycle vs. first cost, or other similar criteria.

## **C1010.10.4 Gypsum Wall Board and Non-Structural Light Gauge Steel Framing (GB-NSLGF):**

### **A. General Description/Design Approach:**

1. GB-NSLGF may be used in both new and existing construction where ease and speed of erection, integration of utilities, services and technology, acoustical separation, and flexibility to accommodate future "change of use" are of a primary concern.

2. GB-NSLG are competitive solutions when evaluating first costs particularly in multi-story situations where the weight of masonry may drive up the cost of the steel frame beyond three stories, however, they require more maintenance and up keep than CMU and may negatively impact the long term lifecycle costs of a school facility.

3. The use of GB-NSLGF depends on the level of abuse resistance required of the partition to withstand impact by the student age group occupying the facility and particularly in spaces subject to ball or other high impact loads which may drive up cost beyond its utility where a CMU wall system may be a better choice.

4. Generally, the only spaces and uses permitted by the NJSDA of GB-NSLGF partition assemblies without exceptions across all K- 12 school types are the main administrative offices, guidance and child study team offices, nurse suite, faculty or other similar related spaces. It may

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be considered for use in teacher or staff supervised instructional or core learning spaces on a case by case basis. Otherwise, partitions generally beyond the administrative core shall typically be constructed with CMU.

5. It is the intention of the NJSDA not to discourage the DC from using GB-NSLGF as it may be equally or better suited than CMU in other parts of the building beyond the administrative and staff related spaces, and it is the responsibility of the DC to demonstrate its suitability to the NJSDA, NJDOE, and District by costs benefit analysis or in other means for a more extended use throughout a facility.

## **C 1010.10.5 Interior Partitions Supplemental Components:**

### **A. Non Structural Light Gauge Steel Framing (NSLGF):**

1. NSLGF members shall consist of steel studs and runners meeting standards set in ASTM C645-18 and shall be whatever sizes are specified for the service load requirements by the DC. NSLGF shall generally comply with ASTM C754-20 and ASTM C840-23 that apply to framing installation and shall be provided with protective coating for interior applications based on ASTM A653/A653M-23, G40 (Z120) hot dipped galvanized zinc coating.
2. NSLGF shall typically extend from floor to underside of deck above, however, may stop above a hung ceiling in office and administrative areas or where flexibility may be a concern. In instances where the partitions stop above the ceiling plane the DC shall assure compliance with all related acoustical requirements. Size and spacing of studs may vary as required for height of partition and may depend on other design considerations. NSLGF shall be typically attached below the floor or roof deck with appropriate head joint to allow flexure of the floor or roof deck and to provide the required fire rated fire stopping according to UL and ASTM Testing Standards as required by the presiding codes. See drawing C1010-10.
3. NSLGF gauge, height limitations, and spacing of studs shall meet structural and seismic loads as determined by the Design Consultants structural analysis. Partition deflection shall be limited to L/240 for painted walls and L/360 for walls with ceramic tile wainscot, designed for a minimum lateral load of 5 psf. Horizontal framing for mold & moisture resistant board soffits or for horizontal fire barriers shall be spaced no more than 12" on center.
4. NSLGF components may be used for shaft walls around elevators, mechanical shafts, return air ducts, and stairwells used in conjunction with 1" gypsum board liner panels shall use C-H, E-Studs, struts, J-runners, H studs of one or two pieces, or C-Runner channels in non- load bearing fire rated assemblies. C-H studs and related components shall be used typically for non-structural shaft wall support enclosures where suited to the requirements of the partition type and enclosure details required by the DC and presiding NJIBC.
5. NSLGF Cold formed metal framing accessories such as 'Furring Channels' shall be, 7/8" or larger 'hat' shaped section of 20, ga. made of corrosion resistive steel. 'Resilient Channels', RC-1 shall typically be 1-1/2" wide, 20-25, ga. made of corrosion resistive steel used for acoustical assemblies, and "Z-'Furring Channels', made in various sizes, shall be of 20 gauge corrosive resistive steel.

### **B. Normal Use Gypsum Board (NUGB):**

1. NUGB panels shall meet ASTM C36 for normal use gypsum board (NUGB) and shall be a non-combustible regular gypsum board core panel typically of 5/8" encased in a bonded smooth finish facing paper and a natural finish on the back side. It shall be typically available in tapered or

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non-tapered edge treatment shall be used where normal use without exposure to moisture is anticipated. See table of Typical Room and Finishes Section C20 for gypsum board finish systems.

2. NUGB panels shall be also available in with a specially formulated to resist moisture, water and mold (See W/MRGB below) with treated face and natural faced rear and shall have strengthened formulated core and skins for abuse resistance (See ARGB below).
3. NUGB panels shall be used for partitions surrounding smaller spaces within instructional spaces, such as wardrobes and material supply closets in Pre-K to 5 school types, including special education classrooms as an option to CMU.
4. NUGB panels shall be used within the perimeter walls of an administrative areas of all NJSDA schools regardless of age level served may be constructed of NUGB with the light gauge steel stud partition terminating 6" above the ceiling unless the design of the room within the administrative suite requires a full height partition from the floor to ceiling/roof deck due to smoke, fire rating, or other acoustical properties.

## **C. Fire Resistance Rated Gypsum Board (FRGB):**

1. FRGB panels shall meet ASTM C1396/C1396M-24, C1278/C1278M-24, ASTM D3273-21, and E84-24 for fire resistance and shall meet UL and tests and other nationally recognized testing agencies and presiding codes. It shall have shall have a specially formulated gypsum core containing special additives that enhance the integrity of the core under fire exposure and shall be a Type X or C and be typically 5/8" thick with normal use applied smooth paper front and natural finished paper on the back.
2. FRGB panel cores unto themselves will not support combustion or transmit temperatures in excess of 212F degrees until completely calcinated. Use in fire resistive assemblies shall be consistent with the requirements of assemblies listed in UL, ASTM or other testing agencies and shall meet the presiding codes for the hours required of the overall assembly.
3. FRGB panels shall be also available in with a specially formulated core to resist moisture, water and mold (See W/MRGB below) with treated face and natural faced rear and shall have strengthened formulated core and skins for abuse resistance (See ARGB below).

## **D. Abuse Resistant Gypsum Board (ARGB):**

1. ARGB panels shall offer greater indentation and through wall penetration resistance than GWB and be 5/8" thick, with core type, tapered edges, and minimal physical properties as listed below:
2. ARGB panels shall be manufactured to produce greater resistance to abrasion and indentation ASTM D4977/D4977M-20 and ASTM D5420-21, and tested for penetration due to soft body impact test ASTM E695-22 according to the following criteria:
  - a. ARGB shall meet surface damage and abrasion criteria in (ASTM D4977):30-100cycles .10"-15" inch Indentation
  - b. ARGB shall resist surface penetration according to (ASTM D5420) 5/8" die at 8lb. 9" drop): .15" inch or less.

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- c. ARGB shall meet penetration according to Soft Body (ASTM E695-22) Hard Body (ASTM C1629/C1629M-23) testing according to the following:
    - 1) Soft Body Impact: 90-300 ft-lbs. min. to failure.
    - 2) Hard Body Impact: min. 80-100 ft.lbs. min. to failure .
3. ARGB panels shall be used for partitions in the presence of water or latent moisture shall be enhanced with water and mold resistance and in addition shall be rated for 'fire resistance' where required with a fire-code core.
4. ARGB panels for 'fire resistance' shall meet testing criteria set by the current versions of ASTM C1278/C1278M-24, C1396/C1396M-24 and ASTM D 3273-21, E84-22.
5. ARGB for use in schools shall be further defined by levels of abuse as follows:
  - a. **Light Duty Abuse Resistant Gypsum Board (LARGB)** is an upgrade to GWB with improved resistance to abrasion and indentation due to incidental surface and indentation damage due to soft impact and can be used in higher traffic areas for schools. It shall meet a soft body impact test of 180ft-lbs, and shall be made of a strong face paper and heavy duty backing sheet or a product with an integral fiberglass enhanced mat skin; both types shall be water and mold resistant and available in fire resistant variants.
  - b. **Moderate Duty Abuse Resistant Gypsum Board (MARGB)**  
MARGB shall be resistant to increased level of abrasion and resistance due to denting, breaking, puncturing from pencils or pens, and may be used in higher traffic areas. It shall meet a soft body impact test of 210ft-lbs and be an integral fiber based gypsum cellulose reinforced product, or a product with an integral fiberglass enhanced mat skin; both types shall be water and mold resistant and available in fire resistant variants.
  - c. **Impact Resistant Gypsum Board (IRGB)**  
IRGB shall be resistant to extreme levels of penetration and indentation and damage from hard objects such as thrown balls and shall meet soft body impact test of greater than 300ft-lbs and hard body impact test of 80 or greater and shall be a product with a reinforced integral fiberglass mesh.
- 6 The spacing of studs, use of specialized primer-surfaces, and finish plasters, will affect the total assembly and abuse resistance of ARGB performance. Under supervised public circulation defined in a school as corridors lobbies, vestibules and similar spaces, the partition shall receive double layer wallboard in all partitions with the face layer being of different performance level depending on the performance desired as suggested below.
  - a. For young children to youth; AGWB and may be used in partition construction between classrooms and may use NUGB between classrooms but shall use LGWB on the outer of two layers facing the public circulation spaces. The choice to increase to LAGWB between classrooms shall be determined by a number of considerations determined by the District, SDA, guided by recommendation of the DC.
  - b. For younger teen youth and young adults: LAGWB partition construction shall be used between classrooms but shall use MAGWB on the outer of two layers facing corridors and other traffic or public circulation spaces. The choice to use LAGWB or MAGWB shall be determined by a number of considerations by the District, NJSDA, guided by recommendation of the DC.

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7. Wherever administrative and specialized spaces use a multi layered GWB system, the side facing the corridors or public circulation spaces shall use LAGWB or MAGWB and shall be consistent with the choice and recommendations chosen for classroom wall assemblies.

8. Wherever HAGWB is used such as in a gym or multi-purpose room, the District and the NJSDA shall accept its use only after reviewing its performance, lifecycle cost criteria, and recommendations compared by the DC to those of CMU on a case by case basis.

## **E. Fire Resistive Shaft Wall Gypsum Liner Panels (GLP):**

1. GLP used in shaft wall assemblies shall typically be assemblies of 1hr or 2hr rated enclosures depending on the height of the shaft and construction classification of the building. The DC must validate the shaft wall assembly hourly rating requirement selection with the presiding codes and shall construct the shaft wall assembly of the following suggested materials:

a. GLP shall typically be 1" thick, 2ft. wide, ASTM tested type-X, or C fire resistive core panels incased in a moisture/mold resistant multi layered paper.

b. GLP shall be 8ft. to 14ft. long, with V shaped, T&G, or beveled edges.

c. GLP shall comply with ASTM C1396/C1396M-24, and ASTM E119-24 Standard Test Method for Fire Tests of Building Construction Material.

## **F. Water/Mold Resistant Gypsum Board (MWGB):**

1. WMRGB panels shall be constructed of chemically treated multi layered face and paper back that make the panels water resistant in combination with a core that is constructed with a gypsum composite material core that makes the core both water and mold resistant all the way through. Panel shall typically be:

a. WMGB shall typically be 5/8" regular core or 5/8" thick fire-code core (fire resistive)

b. WMGB shall typically meet testing criteria set forth by ASTM C473-19 and ASTM D3273-21 for water absorption as a percentage of weight and for mold which shall test an 8-10 range for mold resistance.

c. WMGB shall typically be used as a base for finishes listed in Interior Finishes Section C20 such as thin-set tile or sanitary wall panels.

2. In order to ensure satisfactory performance of WMGB panels, quality control of the trades must be met such that they are installed correctly as follows:

a. The DC shall make sure that their specification includes quality control measures that insure all exposed edges are sealed properly, and all tile finishes and sealants are installed correctly.

b. In potentially wet areas the floor track and bottom portion of studs shall receive a protective bituminous coating and all attached gypsum board panels shall be mold and water resistant.

c. The bottom edge of wallboard shall be raised 1/2" above concrete slab in corridors, lobbies, vestibules, and potentially wet areas. Finish bottom edge of wallboard with L-shaped galvanized metal trim. Fill gap with non-shrink material.



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d. WMGB panels that normally are to receive a ceramic tile finish such as at the wet walls of a gang toilet room shall not be installed over a vapor retarder or on a wall acting as a vapor retarder.

3. Where WMGB is not provided with a full tile finish or other similar wall cladding such as above a wainscot; but the space requires a mold and water resistant product; the sheathing shall also meet performance and abuse resistant criteria for the types of students and or adults occupying the spaces such as in gang student toilets, public toilets, or locker rooms above where such finish or cladding ends. However, in spaces occupied by young children or administration and faculty the DC need only provide WMGB to the full height of required wall sheathing including the exposed surface above a wall cladding or wainscot as may be the case.

4. WMGB panels are not intended for wall panel sheathing in areas such as gang showers where a higher degree of constant moisture may be present. In this case, it is suggested to use a 5/8" cementitious fiber mesh reinforces panel backer board.

## **G. Sound Attenuation Blankets (SAB) and Other Acoustical Considerations:**

1. Partitions containing SAB shall be located between all metal stud cavities unless otherwise specified by the Design Consultant in their partition types and generally shall be a 3", 3-1/2", or 5" Type I ASTM C665-23 fiberglass or mineral fiber sound attenuation blanket without facing. Fire resistive rated assemblies shall meet the component requirements of the UL assembly so designated by the DC for the performance and service requirements of the partition.

2. All penetrations in sound rated partitions shall be sealed on their perimeters to meet the STC recommended ratings and attention shall be given to points of 'leakage' between the spaces.

3. Partition walls containing doors between a core learning space and corridors, stairwells, conference, or office space, exclusive of toilets that may have doors that open into the learning space, the STC wall rating is for the wall exclusive of the door.

## **H. Joint Treatment, Finish of Panels, and Accessories:**

1. Joint treatment shall typically consist of gypsum board trim accessories such as but not limited to: metal or metal and paper tape composite corner beads on outside corners, L-C beads at exposed panel edges, and expansion control joints at 30ft on center. Joint treatment material shall be placed according to ASTM C475/C475M(2022) and with manufacturers recommendations using gypsum board compound applied in 5 successive applications consisting of the following:

- a. The prefilling open joints and damaged surfaces with tape setting compound.
- b. The embedding of tape, application of a first coat on joints, and the filling of flanges of trim accessories.
- c. The application of a fill coat to using drying type all- purpose compound.
- d. The application of a finish coat using drying type all- purpose compound.
- e. The application of a final surface finish coat to an ASTM C840 Level 5 finish.

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## **C1010.10.5 Table of Assemblies and Materials (TAM):**

1. The TAM shall be used as guidance for the selection of CMU and NSLGF-GWB interior partitions in the rooms and spaces indicated below.
2. The TAM incorporates and considers the following industry standards, guidelines and recommendations as follows:
  - a. The current version of ANSI/ASA Standard S12.60-2010, “Acoustical Performance Criteria, Design Requirements and Guidelines for Schools.”  
<http://www.acousticalsociety.org/>
  - c. Industry published data for STC assemblies of gypsum board and steel stud assemblies and from TEK notes by the National Concrete Masonry Association.  
[www.ncma.org](http://www.ncma.org)
  - d. Consideration of abuse and durability requirements set by testing standards for abrasion and indentation resistance, and penetration by hard or soft body impact tests described in board tests or other information found at but not limited to [www.USG.org](http://www.USG.org) or at other product websites..
  - c. Consideration of sizes of light gauge steel studs framing capacities that affect the partition thickness ratios, height, and widths prescribed by structural codes or by the DC structural engineer’s recommendations. [www.ssma.com](http://www.ssma.com)
  - d. Consideration of Moisture and Mold growth according to ASTM D3273-21 “Standard Test Method for Resistance to Mold on the surface of Interior Coatings in an Environmental Chamber” [www.astm.org](http://www.astm.org) and information found in but not limited to [www.USG.org](http://www.USG.org) or other product websites.
  - e. Consideration of other acoustical criteria such as prescribed decibel (Db) or minimum Reverberation Time (RT) values that dependent on other room and occupancy acoustical characteristics as listed in the presiding SDA 21<sup>st</sup> Century Design Manual.  
[www.njsda.gov/](http://www.njsda.gov/)
  - f. Consideration of typical programmatic requirements dictated by the DOE Educational Specification or School District Criteria
3. The TAM is organized according to STC for both CMU and GB-NSLGF partition types and provides guidance in the selection of either type of assembly for the space type listed on the far right when adjacent to an instructional classroom. The STC values listed are generally consistent with STC values of tested gypsum board assembly partition types that are commercially available to the DC at the USG or other manufacturer’s websites. CMU STC values are generally consistent with STC values in the TEK 13-1B table 1 STC Ratings for Concrete Masonry Walls.  
[www.ncma.com](http://www.ncma.com)
4. The following Related Standardized Partition Details are included by reference in the TAM and can be found at the end of Section C10 Interior Construction.



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Drawing Numbers at the end of Section C10 are as follows: (Details are for reference only)

1. C1010-01 Interior CMU Partitions
  2. C1010-02 Interior CMU Partitions
  3. C1010-03 Interior CMU Partitions
  4. C1010-04 Interior CMU Partition Firestopping
  5. C1010-05 Interior CMU Control Joints
  6. C1010-06 Interior GB-NSLGF Partitions
  7. C1010-07 Interior GB-NSLGF Partitions
  8. C1010-08 Interior GB-NSLGF Partitions
  9. C1010-09 Interior GB-NSLGF Shaft and Chase Walls
  10. C1010-10 Interior GB-NSLGF Partition Firestopping
5. See Table of Typical Rooms and Finishes that can be found at the end of Section C20 Interior Finishes for additional information regarding surface treatments of partition types.

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Design Requirements

Interior Construction – Section C10

## C1010.10.5. Table of Assemblies and Materials (TAM):

STC Min. Rating or Range (Preferred Rating)	Assembly and Material (CAD Detail Reference)		Suggested Room Types
	Concrete Masonry Units	Gypsum Board	
<b>35-45 Note (a)</b>	6"Hollow units typ. 45-46 with one layer of 5'8" of NUGB, LARGB, or MARGB on 2-1/2" metal studs depending on adjacency 45	6"Hollow units typ. 45-46 with one layer of 5'8" of NUGB, LARGB, or MARGB on 2-1/2" metal studs depending on adjacency 45	Vault, or Records Room, Storage, Emergency Control Center
<b>35-45 Note (a)</b>	6" Hollow units typ., 45-46 8" Hollow units typ., 46-47 (C-1010-03-1) 45-47	3-5/8" min. 22 ga. 16" O.C. Face Layers: 5/8" NUGB ea. side SAB 3" min. (Type C or X 5/8" when req'd.) (C1010-06-1, 1a) 45-49	Main Administrative Offices, Staff Offices, Conference Rooms, Nurse Suite
<b>45-50 (50) Note (a)</b>	6" Hollow units typ., 45-46 6" Solid, grout, sand filled, 48-51 8" Hollow units typ., 46-47 8" Solid, grout, sand filled, 51-55 (C-1010-01-1) 45-55	3-5/8"- 6" min., 20-22 ga., 16" O.C. Face Layers: 5/8" NUGB each side SAB: 3"-5" min (Type C, X 5/8" when req'd.) (C-1010-07-1) 50	Instructional Classrooms, Science Labs, Art Room, Media Center
<b>35-45 Note (a)</b>	12" Hollow units typ., 49-50 8" Hollow units typ., 46-47 (C-1010-01-1) 49-50	8" min., 20 ga., 24" OC or 16" O.C. Face Layer: 5/8" LARGB children to youth, MARGB youth to young adults on corridor traffic side, 5/8" NUGB classroom side, SAB 5" min. (Type C, X 5/8" when req'd.) (1010-03-1) 51	Vertical Egress Stairs, Horizontal Exits
<b>50-65 Note (a)</b>	8"-12" Solid, grout, sand filled 51-63 range 12" Hollow units typ., 49-50 (50 STC if design consultant can demonstrated that machine noise level is lower otherwise use 60 STC) (C-1010-01-2) 50-60	6" min., 20 ga., 16" O.C. Face Layer: 1 Layer of 5/8" LARGB children to youth, MARGB youth to young adults on corridor traffic side, otherwise concealed or face Layer of 5/8" NUGB, Resil Chan. @24" O.C. SAB 5" min. Type C, X when req'd. (C1010-08-3) 59-60	Elevator Machine & Shaft, Mechanical Equipment Rooms, Maintenance Storage, Pump Rooms.
<b>45-60 Note (a)</b>	8"-12" Solid, grout, sand filled 51-63 range 12" Hollow units typ., 49-50 (50 STC if design consultant can demonstrated that machine noise level is lower otherwise use 60 STC) (C-1010-01-2) 50-60	4" C-H studs 22 ga. 24" O.C. Shaft Liners: 1" GBLP Face Layer: 1 Layer of 5/8" LARGB children to youth, MARGB youth to young adults on corridor traffic side, otherwise concealed and face layer of 5/8" NUGB, SAB 3" min. type C, X when req'd. (C1011-09-1) 51	Mechanical Shafts

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Design Requirements

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## C1010.10.5. Table of Assemblies and Materials (TAM) (con't):

STC Min. Rating Range (Preferred Rating)	Assembly and Material (CAD Detail Reference)		Suggested Room Types
	Concrete Masonry Units	Gypsum Board	
<b>35-45 Note (a)</b>	8" Hollow units typ., 46-47 8"-12" Solid, grout, sand filled 51-63 range 12" Hollow units typ., 49-50 (C-1011-01-2) 49-63	8" min., 20 ga., 16" O.C. Face Layers: 5/8" LARGB resist. Gyp.Bd. Vocational Shop side. Concealed Layer and Clsrm. side: 5/8" NUGB Resil Chan. @24" O.C.; SAB 5" min (Type C, X 5/8" when req'd.) (C-1010-07-2) 59-60	Vocational Shops
<b>Note (a)</b>	6" Hollow Units typ., 45-46 8" Hollow units typ., 46-47 (C-1010-01-1) 45-47	6" min., 20 ga., 16" O.C. Face Layer: 5/8" LARGB children to youth, MARGB youth to young adults on corridor traffic side, 5/8" NUGB, SAB 5" min. (Type C, X when req'd.) (C1010-03-1) 51	Corridors, Lobbies, Vestibules
<b>50 Note (a)</b>	8" Solid, sand, grout filled 51-55 range with tile on wet wall Or 8" Hollow unit 46-47 with 4" Hollow unit with tile finish on wet wall min. (See chase wall) (C-1010-03-2,3) 51	3"-5/8 min. 20 ga., 12" O.C. Face Layers: 5/8" WMRGB both sides with 5/8" Cement board & 1/4" ceramic tile over concealed layer @ wet wall Resil. Chan. @24" O.C.SAB 3" min. (Type C, X 5/8 " when req'd.) (C1010-08-1) 53	Gang and Single Stall Toilets, Locker Rooms, Showers
<b>35-45 Note (a)</b>	8" Solid, sand, grout filled 51-55 range with tile on wet wall Or chase wall with 8" Hollow units 46-44 with 4"Hollow unit 44-45 with tile finish on wet wall min. (See chase wall) (C-1010-03-2,3) 51-55	6" min., 20 ga., 16" O.C. Face Layers: 5/8" WMRGB both sides with / 5/8" Cement board & 1/4" ceramic tile over concealed layer @ wet wall or w/sanitary wall panels; 5/8" NUGB on classroom side and for exposed and concealed layer, Resil. Chan. @24" O.C. SAB 5" min. (Type C, X 5/8" when req.'d) (C1011-07-3) 59-60	Kitchen and Servery

# Model Schools: Materials and Systems Standards

Design Requirements

Interior Construction – Section C10

## C1010.10.5. Table of Assemblies and Materials (TAM) (con't):

STC Min. Rating Range (Preferred Rating)	Assembly and Material (CAD Detail Reference)		Suggested Room Types
	Concrete Masonry Units	Gypsum Board	
<b>65</b> <b>Note (a)</b>	8" Solid, sand, grout filled 51-55 range with tile on wet wall 8" Hollow unit 46-47 with 4" Hollow Units 44-45 and on wet walls min. (C-1010-03-2,3) 51-55	3-5/8", 20 ga., 12" O.C.; Horiz. Braces at 24" O.C. vertically Face layers: 5/8" WMRGB both sides with 1/4" ceramic tile over 5/8" cement board on wet walls or 5/8" NUGB clsm. Side (Type C, x5/8" when req'd.) (C1010-09-2) 60	Plumbing Chase Walls
<b>50</b> <b>Note (a)</b>	12" Solid, grout, sand filled 57-63 range 8" Solid, grout, sand filled 51-55 range With 8" SACMU units with 4" Reinf. Cell and 4" CMU backup typ. located 10' above finish floor Acoustical Wall Panels (C-1010-02-2) 55-63	8" min., 20 ga., 16" O.C. Face Layer: 5/8" LARGB Concealed Layer and Clsm. side: 5/8" NUGB each side Resil. Chan. @24" O.C. SAB 5" min; Acoustical Panels, Sanitary Wall Panels for Wainscot in Cafeteria (Type C, X 5/8" when req'd.) (C-1010-07-03) 59-60	Cafeteria
<b>35-45</b> <b>Note (a)</b>	12" hollow units typ., 49-50 8-12" Solid, grout, sand filled 51-63 range 8" SACMU units typically located above wall padding Acoustical Wall Panels, Padding (C-1010-02-2) 49-63	8" min., 20 ga., 16" O.C. Face Layer: 5/8" IRGB Concealed Layer and Clsm. side: 5/8" NUGB Resil. Chan. @24" O.C. SAB 5" min High Density Acoustical Wall Panels, Padding (Type C, X 5/8" when req'd.) (C-1010-07-2) 59-60	Gymnasiums, Multipurpose Rooms
<b>45-50</b> <b>Note (a)</b>	12" Solid, grout, sand filled 57-63 range 8" Solid, grout, sand filled 51-55 range Acoustical Wall Panels (C-1010-02-1) 55-63	8" min., 20 ga., 16" O.C. Face Layer: 5/8" NUGB Concealed Layer and Clsm. side: 5/8" NUGB each side Resil. Chan. @24" O.C. SAB 5" min; Acoustical Wall Panels (Type C, X 5/8 <sup>th</sup> when req'd.) (C-1010-07-03) 59-60	Music, and Vocal Room, Auditorium

Note (a) – STC values listed in the first column indicate values listed in Table PS1030.00-01 of Section Project Criteria in the Performance Specifications. PS 1030.00-01 takes precedence over any contradictions with values listed here.

# Model Schools: Materials and Systems Standards

## **C1010.50 Interior Operable Partitions:**

### **A. General Description/Design Approach:**

1. Provide motorized folding partitions for use in large spaces such as gymnasiums and auditoriums only where acoustical separation is absolutely necessary and as required by the District and is an approved by NJDOE Educational Specification and the NJSDA otherwise a roll down curtain shall be typically specified. Folding partitions must have doors and hardware to accommodate handicapped accessibility, and use as emergency egress where necessary. Otherwise, it is preferred to use a retractable curtain to divide the gymnasium into two half courts.
2. Manually operated folding panel partitions for partitioning large rooms into smaller spaces such as in classrooms, cafeterias and multipurpose spaces may be used for acoustical separation for solving particular complex programmatic needs however such flexibility or modifications shall require District and NJSDA approval and DC will be required to demonstrate the need for the flexibility of the proposed space. Planning for this flexibility must be demonstrated and generally approved at the time of the District, NJSDA, and NJDOE Educational Specification and Programmatic Model Development.

### **B. General Requirements:**

1. A Sound Transmission Coefficient of 46 is minimum requirement for both partition types (motorized and manual). Both types shall have automatic acoustic seals at the top of panels, between panels and between the panels and the floor. STC may be higher depending on the louder of the two adjacent spaces, (see the STC required in the TAM for adjacent room types to a classroom as a guide).
2. Motorized partitions shall provide the following safety features:
  - a. The electrical device controlling the operation of the partition shall be capable of being reversed at any point in the stack travel cycle.
  - b. Leading edge sensor which will stop the partition if it strikes an object in its path is required.
3. Devices are required to be provided for all electrically operated partitions that will stop the forward or backward horizontal motion of the partition such that when an object passes between the leading panels of such partitions at an adjoining wall, the travel will be stopped in either direction.
4. A safety key switch shall be required to operate the motorized partition: Locate one on each side of the partition, one at the stack end and one opposite the stack end of the partition, both in full view of the partition.
5. A constant contact tamper proof button, activated by a key, shall be required to operate each switch. The switches shall be wired in series. Simultaneous operation of both switches shall be required to operate the partition. Warning signs are required to be posted which designate the safe and proper operation and supervision of the electrical device operating the partition. Signs shall be adjacent to each key activated safety switch and securely fastened to the wall 5'-0" above the finished floor.

# Model Schools: Materials and Systems Standards

**C1020 Interior Windows:**

**C1020.20 Interior Fixed Windows:**

(See Section C1030.90.1 for similar components)

**C1020.90 Interior Window Supplementary Components:**

See Section C1030.90.1 for similar components)

**C1020.90.1 Hollow Metal Frames for Windows, Transoms, Borrow lights and Sidelights):**

**A General Description/Design Approach:**

1. All interior doors to instructional spaces equal to or greater than 300 sf. per the NJDOE requirements shall have ¼" safety glazing for teacher and student security, however, are not required to have sidelights, borrow lights or other more extensive use of glass. If a District demonstrates a need to the NJSDA, for added security or requirement for such, sidelights, transom, or borrow lights, for example for sustainable design credit requirements or for added security, such additional glass areas shall be reviewed on a case by case basis by the NJSDA and shall meet the requirements of the prevailing code.

2. Doors that typically do not require a vision panel are suggested in the table below.

• Auditoriums and Coat Check Room	• Teacher/Staff Preparation Rooms/Offices
• Instructional Classrooms under 300 gsf.	• Principal's Office
• Custodial and Security Rooms	• Conference Rooms
• TV/ AV/MDF Studio or Storage	• Refuse and Compactor Rooms
• Stage Dressing Rooms	• Storage Rooms and Closets
• Sound Control Room	• Toilets, Showers and Locker Rooms
• Janitor's Sink Closet	• Utility, Equipment and Service Rooms
• Medical Examination Rooms	• Vault and Records Rooms

3. Typical glass vision panels installed in metal frames shall be of safety glass with acoustical, fire, smoke or other appropriate glazing seals unless otherwise required by the presiding codes.

4. The DC shall keep the types and quantities of hollow metal frame types window associated to HM frame design with or without transom or sidelights standardized and to a minimum number. Door sidelights windows and transom or borrow lights shall be designed to reflect the type of room, natural light needs for the corridor, and reflect the security interests of the School District .

5. The DC shall design hollow metal (HM) frames with as few intermediate vertical and horizontal muntins as possible or be consistent between types and divisions of sidelight or glass into separate panes or panel divisions. A consideration and use of surface applied glass muntins of steel shall be considered where possible to achieve the same effects as true divided HM framing with individual lights if that may be the case.

# Model Schools: Materials and Systems Standards

## **B. Fire Resistive Properties:**

1. Fire-protection of door fire vision panels shall be based on testing and design requirements of the presiding code.
2. Fire resistive rating of interior windows as part of door hollow metal frame assemblies such as in, glass borrow lights, side lights, constituting one or more vision panels shall have assemblies complying with NFPA 80 and shall be labeled by a testing and inspection agency acceptable to the authorities having jurisdiction.
3. Both fire rated vision panels in hollow metal frames and in doors shall be afforded the safety of occupants according to hourly ratings and it is the DC obligation to validate or modify all vision panel opening protection requirements based on the requirements of their design and the presiding codes:
4. Glass sidelight, transom panels, or window panels, made of fire rated glass, or that use as part of a limited area sprinkler systems to wash the glass surface, shall be used in limited circumstances where all other design options have been explored by the DC. Such use of fire rated glass or limited area sprinkler systems shall be permitted only after careful consideration on a case by case basis and approved by the NJSDA.

## **C1020.90.2 Window Treatments:**

(See Section E2010 for location of components)

## **C1030 Interior Doors:**

### **A. General Requirements for Existing Construction: (Including Repairs, Renovations, Alterations, and Reconstructions)**

1. The NJ Rehabilitation Subcode NJUCC 5:23 subchapter-6 generally requires that If doors, frames, hardware, or safety glass are repaired or replaced in existing openings, the repair or replacement of constituent components shall not diminish the existing classification, accessibility, or egress capacity below that which exists at the time based on the requirements of the applicable subcode, or whichever is lower. Replacement of some of the components shall not prevent that the selective part or parts of the assembly shall not be replaced to comply with the current codes as an Alteration, Reconstruction, or Renovation.
2. The Design Consultant shall typically design doors in existing construction according to but limited to the following:
  - a. If doors and frames are replaced to meet new egress or life safety requirements they shall be installed according to unit of egress widths which shall meet capacity calculation methods required by the NJ Rehabilitation Code.
  - b. All entrances shall comply with the requirements of accessibility standards of the state of NJ Subchapter 7 of the NJ Uniform Construction Code and the presiding ICC A117.1 2017. see <http://www.nj.gov/dca/divisions/codes/index.html>



# Model Schools: Materials and Systems Standards

c. Replacement of existing interior doors shall be made accessible wherever feasible, doors, frame, and hardware that are too difficult to change and make accessible by some limitations of the existing conditions, shall not be required to be changed however components such as hardware shall comply with the barrier free accessibility code to the maximum extent feasible.

## **B. General Requirements for Additions and New Construction:**

1. The DC shall typically design door openings and their appurtenant components the following general guidelines and criteria for new construction and new additions:

a. All doors shall be specified as to locations, door width, door leaf/quantity, and shall meet the presiding code requirements for handicapped accessibility, fire, and life safety egress.

b. All doors shall meet the required fire rating for opening protection, exit load capacities, and be located in partitions such that they provide safe egress travel distance to an exit and discharge to a right of way.

c. All doors designed as means of egress shall be designed such that they swing in the required direction of egress to provide safe means of egress without obstruction to stair landing or handicapped refuge, lead directly to an unobstructed right of way, and have a vision panel.

d. All egress doors with a required vision panel shall have the required type of vision glass, size, and location to provide visual and fire safety for the respective age group of occupants of the school. A vision panel for Pre-K is not the same height for adults and accommodation shall meet the required height for both when both are present for both age groups safety and protection.

## **C General Description/Design Approach:**

1. "The DC shall indicate in the door schedule all door and frame types, interior window types, and all glass to be incorporated into all interior partition assemblies. The schedule shall also include but not be limited indicating glass types including tempered, annealed, fire rated, wire, etc., and the associated drawings shall include elevations of all door and frame types, the dimensional sizes and quantities of all glass door vision panels, hollow metal frame thickness and dimensions that include location and size of all glass panels and doors incorporated into door frames as well as any misc. stand-alone interior window frames and their glass panel types and sizes.

2. Specialized Doors, not typically found in a school, such as recessed fire doors, fusible fire shutters, and specialized fire rated glazing, or door openings requiring water curtain, or other fire protective opening elements or devices as well as specialized acoustical door or related devices, are not considered typical interior doors in this section, however, may be used if the DC demonstrates to the NJSDA the need for such specialized opening protection or devices and is at a cost benefit to the design.



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3. All interior doors within the entire school shall typically be solid core 1-3/4" wood doors and shall meet the fire resistance and safety glazing requirements of the presiding codes unless otherwise indicated below.
4. 'Back of house'" doors and in particular doors in abuse areas such as in kitchen or related spaces (e.g. food storage, can wash, Dieticians office, kitchen help locker rooms, etc.) shall be painted 1-3/4 galvanized metal doors.
5. Mechanical room doors and related storage, electrical closets or other non- instructional spaces along principal corridors shall be solid core 1-3/4" wood doors otherwise shall be 1-3/4" painted galvanized metal doors.
6. Single or multiple privacy doors in series shall be omitted in student restrooms entry areas wherever possible and partitions shall be so designed along the entry path to maintain barrier free accessibility as well as visual and acoustical privacy.
7. Dutch doors maybe used for early childhood Pre-K to K toilet rooms in lieu of vision lights for student security and assistants and shall have hinge covers or continuous hinges and shall have hold open devices for upper section.
8. Acoustical consideration shall be given to all doors; however, specific attention shall be given to specialized hardware sets with enhanced door sound seals for instrumental and choral classrooms, as well as for auditorium and other related performance or rehearsal spaces when adjacent to instructional classrooms.
  - a. A core instructional classroom door assembly shall be 40 STC if a vestibule entry composed of two sets of doors with an STC of 30 or greater is within 30 ft. of the space.
  - b. For interior door assemblies with adjacent windows up to 10 sq. ft. that separate core learning spaces from adjacent corridors, stairways, offices, and conference rooms; the STC given to the door shall achieve a rating of 30 when the door is opened. If the door is separating a music room from corridors or stairways, the STC value shall be 40 STC when separating an adjoining corridor and shall achieve also an STC of 30 when separating a stair if they are either within 30 ft. from the door.
9. Doors to and from vestibules to auditorium shall be typically provided in a series however shall have sound and light isolation hardware when not employed in a series.
10. The DC shall coordinate in the door schedule any electrical devices associated to the door hardware such as but not limited to electrical door power assists or strikes for handicapped doors, electrical hold open, closing, or similar devices for fire protection.
11. All interior doors shall be standard size 7' -2" inch high doors in 2" increment widths. The DC may deviate from this requirement if the District and the DC demonstrates a particular need for deviating from such requirements.

## **D. Fire Resistive Properties:**

1. Fire resistive doors shall be as follows:



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- a. Doors shall be classified as a “non-rated” door or a rated “fire door” or “fire shutter”.
  - b. Doors shall be constructed according to requirements of a “fire protected openings” as defined by in presiding codes.
  - c. Shall comply with NFPA 80 “Basic Fire Doors and Fire Windows”
  - d. Shall meet requirements of the approved testing methods and inspection agencies acceptable to the authorities having jurisdiction.
2. Fire doors or shutters in ‘fire protected openings’ shall be labeled to withstand temperatures to afford service and safe passage consistent with hourly ratings listed below and it is the Design Consultant’s obligation to validate or modify all opening protection requirements listed below based on the requirements of their design and the presiding codes:
  - a. **Opening protection of 1-1/2 to 3hrs. are required for the following:**  
Fire walls or Fire barriers having a fire resistance rating of greater than 1hr. located in fire resistive interior partition assemblies of 1-1/2 to 4hr. rating.
  - b. **Opening protection of 3 /4 to 1hr. is required for the following:**  
Fire barriers having a required fire resistance rating of 1hr., such as for shafts, exit enclosures, smoke barriers, exit passageway, as well as for other fire barrier assemblies, located in fire resistive interior partition assemblies of 1 hr. rating.
  - c. **Opening protection of 1/3 to 3 /4 hr. are required for the following:**  
For Fire partitions for either ½ hr. or 1hr for corridor, or other fire partitions area separations walls, including 1hr. smoke barriers located in fire resistive interior partitions of ½ hr. to 1hr. rating.
3. Fire rated doors shall have an approved label permanently fixed to the door or frame that traces the door back to the manufacturer, trademark, or third party inspection agency.
  - a. The door must have an hourly rating tag.
  - b. The frame may be of the same or different certifying agency as the door but must be consistent with the label of the door.
  - c. Hardware and related components may be of different manufacture but shall not diminish the door rating.
4. Smoke and draft control doors shall meet testing and be labeled complying with NFPA 105 or UL 1784.2.
5. Fire door and related fire shutters shall be tested for the passage of flame and smoke consistent with testing requirements of side hinged or pivoted swing doors in accordance with NFPA 252 or UL10C and if the opening protection is a ‘fire shutter’, it shall be in according to NFPA 252 10B.
6. All components of “fire door” assemblies are interdependent on the use of consistent labeling for products for all components such as for hollow metal frame material, vision panels, and hardware. Any component that reduces the rating will subsequently reduce the rating of the overall assembly.

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## **E. Related Standardized Door Types and Details:**

Refer to the following details for additional information:

1. C1030-02 Door Types
2. C1030-04 Hollow Metal Door Details
3. C1030-05 Wood Door Details

## **C1030.20 Interior Entrance Doors:**

(See Section B2050.10 Exterior Entrance Doors for similar components)

## **C1030.20.1 Interior Wood Doors (WD):**

### **A. General Requirements:**

1. Wood doors shall meet WDMA Quality Standard: I.S.I 'Industry Standard for Wood Flush Doors' of the 'Window and Door Manufacturer's Association (WDMA).
2. Interior wood doors shall comply with 'Architectural Woodwork Standard' AWI Quality Standard, including Section AWI 1300 'Architectural Flush Doors' Doors, of the Architectural Woodworking Institutes' AWI and shall be constructed of structural composite lumber core, 1-3/4" thick 5 -ply construction and shall exceed those of WDMA quality standard.
3. All interior wood doors shall be made to the following standards:
  - a. Quality standards of the WDMA I.S.1-A-21.
  - b. Custom Grade with "A" face slip matched plain sliced hardwood face grade veneer,
  - c. 5 ply, stave core, or structural SCL composite lumber with stiles and rails glued to the core.
  - d. Core shall be fire rated where required, horizontal or vertical auxiliary fire latches are not allowed.
  - e. Shall have a factory transparent finish conforming with AWI Finish System TR-4 conversion varnish or TR-6 catalyzed polyurethane
  - f. If the door is required to have a vision window, the frame shall be painted to match the adjoining wood finish.
4. The use of interior wood doors with mineral cores or in any other door types not described above are not permitted.
5. Interior wood door warranty shall be signed by manufacturer, installer, and contractor, for defective material, workmanship, installation, and finishing. Bows or twists shall not be over 1/4" in a 42" x 48" section and core construction shall not show telegraphing of core construction or face veneers exceeding .01 inch in a 3-inch span.

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## **C1030.10.2 Hollow Metal Doors (HM):**

### **A. General Requirements:**

1. Hollow metal doors assemblies shall include all hinged, fixed panel, and frames formed from carbon steel and shall comply with ANSI/SDI A250.8-2023 or current edition.
2. Reinforcing for steel doors shall be as is indicated in the specifications and standard details. Mineral wool shall be used in the core of the doors for sound deadening.
3. All Hollow metal Doors shall be made to the following standards:
  - a. Be heavy duty, 1-3/4" doors, with seamless construction,
    - 1.) Face sheets of cold rolled or hot rolled steel of .042" thickness, level 2
  - b. Be extra heavy duty, 1-3/4" door with seamless construction
    - 1.) Face sheet of cold rolled or hot rolled steel of .053" thickness, level 3
  - c. Shall meet NSI/SDI A250.3-2019 Test Procedure and Acceptance Criteria for Factory applied Finished Painted Steel Surfaces for Steel Doors and Frames
  - d. Where required shall have a vision window with a frame to be with a stile and rail construction painted to match adjoining finish.
  - e. Hollow metal doors shall typically have a closed cell insulated core for acoustical isolation and to minimizes sound travel to corridors from "back of house" spaces.
4. Hollow metal doors and frames shall be made of Metallic Coated Steel Sheet ASTM A653/A653M-23, commercial steel. Type B, with a minimum A40 (ZF180) zinc-iron-alloy (galvannealed or galvalume) coating designation or may be a Electrolytic Zinc-Coated Steel Sheet ASTM A879/A879M, commercial steel Class B coating, mill phosphatized.

## **C1030.40 Interior Coiling Doors and Counter Doors:**

### **A. Description / Design Approach:**

1. Roll down coiling doors, counter doors, and shutters shall be provided with locks and shall not have to move any equipment to reach the unlocking mechanism. The locks shall be on the kitchen side and easily accessible to the NJ Department of Health and any other District designated Kitchen Nutrition or other Agency or related Administrator for periodic inspections.
2. Roll down coiling doors shall be manually operated push up type up to 40 sq. ft, crank type length up to 12 feet. Roll down counter doors or shutters with greater size shall be provided with electrical motors and manual override. If shutter is located in a fire-rated partition, provide fire-rated shutter as required by the prevailing codes.
3. Roll down coiling doors at serving lines are to extend from the ceiling to the tray slide except at the milk dispenser where shutter must extend from ceiling to floor.

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## **C1030.90. Interior Door Supplementary Components:**

### **C1030.90.1 Hollow Metal Frames:**

#### **A. General Description/Design Approach:**

1. The DC shall design HM frames that reflect a modular approach to their design that permits ease of installation within CMU horizontal and vertical modular coursing to minimize field cutting of block.
2. The DC shall use wrap around frames wherever possible except where wall depths preclude their use. The depth and throats of frames shall be consistent with standard ranges of incremental sizes standard to recommended profiles in the (SDI) Steel Door Institute manufacturer's association manufactured standards.
3. If the HM frame package becomes overly complex, the DC must demonstrate to the NJSDA and District why the hollow metal frame types, sizes and quantities described in the drawings are justified. It is the intention to standardize and simplify types and quantities as exemplified in the NJSDA Construction Details Manual wherever possible.

#### **B. General Requirements:**

1. Hollow metal frames assume the rating requirements of fire or smoke door from the door which they are hung and do not require a tag for hourly rating. They shall be fire resistive for flame and sealed for smoke either by fully grouting the assembly when placed against CMU or fully wrapping gypsum board when placed in a NSLGF assembly.
2. Hollow metal frames designed to accept pairs of doors with exit hardware shall have a lockable vertical removable mullion between the doors. Main delivery doors in the loading and 'back of house' shall have no mullion to facilitate moving larger objects and shall have full astragal seals with overlap where necessary.
3. The use of knock-down hollow metal frames are not permitted.
4. Hollow metal frames shall be made to the following standards:
  - a. full size standard profiles with 2" face jamb and head widths (4" may be used at heads), with standard incremental depths to fit CMU and stud sizes.
  - b. Shall have widths that match Door widths standard to the door industry.
  - c. The frames shall be face welded, with all joints smooth ground, and shall be:
    1. .042" thick steel for level 2 type doors,
    2. .053" thick steel for level 3 type doors.
  - d. Shall typically in new construction shall have a minimum of three anchors per side of door in masonry openings'.
  - e. And shall have slip on drywall type anchors for NSLGF openings'.
5. Hollow metal frames shall have a hot dipped factory zinc coating and shall comply with ASTM A924/A924M-22a and ASTM A653/A653M-23 if used in kitchen or other areas where moisture is present.
6. Hollow metal frames shall have removable stops for the ease of broken glass replacement.

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**C. Fire resistive Properties:**

1. Fire resistive hollow metal door framing shall be consistent with the same hourly rating properties of general opening protections as described in the fire resistive properties of Section C1030 Interior Doors section and C1020.90.1 for Hollow Metal Framed Windows above.

**D. Related Standardized Hollow Metal Frame Types and Details:**

1. Refer to the following details for additional information:
  - a. C1030-01 Hollow Metal Frame Elevations
  - b. C1030-03 Hollow Metal Frame Details for CMU Openings
  - c. C1030-04 Hollow Metal Frame Details for GB-NSLGF Openings

**C1030.90.2 Hardware Requirements:**

1. The Design Consultant shall use a Hardware Consultant (HC) to specify and or review all hardware to insure that the quality, type of door hinges, bearing weight, and grades of finishes are consistent with the hardware manufacturers and are compatible with the door manufacturer's specifications so that the intended use of the door and hardware are compatible with each other and that neither warranties are violated.
2. The hardware supplier shall sign and seal all hardware schedules and submissions.
3. The HC shall specify magnetic hold open devices and latching panic hardware for all fire doors in stair towers tied to the building life safety system.
4. The HC shall specify that all egress fire doors shall have panic hardware with positive latching and closing devices for occupancies in excess of 49 occupants and for assembly use.
5. The HC shall specify fluid dampers on hardware devices to absorb shock and noise when serving instructional spaces.
6. The HC shall specify only the highest quality exit devices for safety, and long term cost savings to school maintenance departments.
7. The HC shall specify continuous hinges shall be used for all high volume doors such as for auditorium, gym and cafeteria, or similar multipurpose rooms.
8. The HC shall specify, that only individual keys and grandmaster key operate the principal's office, security office, secured storage records, kitchen, IDF, MDF, or other audio visual record or high security equipment rooms.
9. The HC shall specify smoke or other rated doors in the stage with closers that are consistent with the prevailing ADA accessibility standards.
10. The Design Consultant's hardware specifier shall specify interior door closers where required by code to be a parallel arm type rated for heavy use, supplied by a single manufacturer, and shall be surface mounted with hex nuts mounted to the non-public side of the door. Door hinges shall be fitted with ball bearing type hinges to maintain ease of use by handicapped.

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11. The hardware consultant must be thorough when specifying hardware such as but not limited to: closer travel arm limit stops, coordinators for pairs of doors, wall stops and related bumpers to prevent damage by doors against adjoining surfaces in high traffic locations.

12. The HC shall not specify cross bar arm type panic devices as they will result in pinching of fingers, instead use a touch pad with 'T' design to not extend full width for safety. All panic hardware shall be dead latching types with roller strikes.

## **C1090.90. 3 Window Guards (Interior)**

### **A. Description / Design Approach:**

1. Provide interior wire mesh guards over gymnasium office windows or other windows that must be protected from impact loads. Interior window guards shall be placed within the opening so that there is sufficient clearance to the glass to protect the glass from impact hazard and does not create a hazard by projection of mesh guard on the gym side of the opening.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section C20: Interior Finishes**

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# Model Schools: Materials and Systems Standards

## C20 Interior Finishes

### A. General Description / Design Approach

1. The following interior finish general descriptions, design approach and general requirements described herein are typically required by the NJSDA for new construction and shall meet the requirements of flame spread characteristics and testing requirements of the presiding NJ International Building Code (NJ IBC). New interior finishes adjacent to or surrounded by existing construction shall complement and not necessarily duplicate existing finishes and shall meet the requirements of the NJ Rehabilitation Subcode and relevant amendments.
- 3 There are general requirements that offer guidance to the DC regarding design practice, and specific concerns regarding material choice that effect performance, and where in some cases relate to particular problems in school design that should be avoided.
4. The interior finishes are divided into categories with descriptions and requirements of individual materials and systems for walls, floor and base, and ceilings to be used in NJSDA projects. Where necessary guidance is given in the form of preferences and performance based information to guide the DC on providing a minimum standard with which to generate school specific finish requirement.
5. At the end of section C2090, the DC has been provided with a Table of Typical Rooms and Finishes (TTRF) preceded by a legend of acronyms used to key the various room finishes and materials recommended for rooms found in NJSDA schools. In some cases there are several choices with which may equally share suitability for a finish in a given room however it is the DC's and the Districts choice based on the age of the student using the space, common district practices, cost basis, warranty, NJSDA preference, or any or all of the above that may dictate the level of performance and service requirement, that influences the ultimate selection of the appropriate material finish for a given space.
6. The DC shall choose interior finish systems and materials that are of high quality, are durable in performance for the intended use, and that balance minimum cost with long term life cycle maintenance and up keep. It is the Design Consultant's responsibility to demonstrate to the NJSDA through a Materials Systems Standards variance request process should finish material deviate from the Materials and Systems Standards
6. It is the DC responsibility to coordinate the guidance of this document with the particular needs of their school and that of the District. The TTRF is not intended to be all inclusive and as new materials and systems emerge in the marketplace and become proven in their performance in school design;
7. The DC has also been provided at the end of section C2090 a Schedule of Typical Paint Types and Substrates that may be referenced in the TTRF generically as a painted finish. It is the Design Consultant's responsibility coordinates the paint schedule and the typical room finish schedule to determine the suggested paint type.

### B. General and Specific Requirements

1. Ceramic tile shall typically be thin set in wet floor areas with drains set a ¼" below finish floor with a two feet by two feet sloped concrete drain pan surrounding the drain. At mud set floor areas, floor areas shall pitch to drains to eliminate standing water. For example where both

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conditions may exist in kitchen spaces, wet areas with multiple floor drains shall be mud set while rooms or areas without drains such as dry storage rooms can be thin set.

2. The DC shall limit the use of gypsum board ceilings, soffits, fascias, and similar architectural features in the reflected ceiling designs. Those areas required to be of gypsum board shall be typically painted, and where normal use gypsum board would otherwise be typically used, shall be constructed of mold and moisture resistant gypsum board in moisture prone areas, and be of fiber reinforced abuse resistant gypsum board where subject to impact loads .
3. The DC shall coordinate locations of all wall, floor, and ceiling mounted mechanical, electrical, and plumbing (MEP) and fire protection (FP) devices and shall provide ceiling access to fire stat on kitchen exhaust hood and access panels for filter changes, controls or other above ceiling equipment and devices. Avoid shallow ceilings.
4. The DC shall specify that all wall and floor surfaces be typically be painted and finished or sealed with appropriate primers, paint, and top coating or wear surface finish based on the substrate material and wear characteristics. Block filler shall be used on all concrete block wall surfaces prior to painting.
5. The DC shall specify vinyl composition tile (VCT) products that are thru tile material composition of solid colors and shall be limited to the manufacturer's standard colors and finishes
6. The DC shall avoid complex VCT tile floor pattern design and limit it to no more than what is necessary for way-finding and to help identify constituent parts of the building.
7. The DC shall avoid cutting whole VCT tiles except at the perimeter against walls. There shall be with no custom insets, curves of complexity where non engineered edge to edge cuts may attract dirt and solvents from cleaning and potentially delaminate from the substrate. Any custom work will have to be justified by the DC and District on a case by case basis.
8. The DC shall specify color selections that coordinate with the lighting consultants cavity reflectance values appropriate to the illumination level required in the space and shall be responsible for end result color rendition. Dark or saturated hues shall be avoided and may be used as accents only. Colors shall generally be off white or tints that support the room's natural daylight orientation and compliment artificial light sources be they direct or indirect in their deployment.
9. The DC shall specify ceiling tiles with "hold-down clips" in all non-instructional unsupervised spaces to discourage unwarranted access to concealed space where vandalism criminal use such as in the concealment of weapons, drugs, or stolen property may be of a concern or where an impact load from below maybe an issue such as when balls are tossed in a multipurpose room or where students may jump to hit a ceiling in an under supervised public corridor or locker room.
10. All exposed ceilings open to public view including but not limited to exposed structure, and exposed MEP equipment, shall be painted with a prime and suitable top wear coat and specified accordingly in the Design Consultant's finish schedule and as per NJSDA approval.
11. The DC shall typically limit the use and location of wainscot wall finish materials to what is permitted as an option to typical finishes scheduled in the TTRF. Any specialized use shall require a demonstration to the NJSDA and District where applicable and approved on a cost and performance basis over standard approach to wall finish treatments

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12. The DC shall avoid use of floor cover plates for outlets except where absolutely necessary to avoid traffic or hazards of power cord or other equipment cables. Cover plates for expansion joint shall be reduced in lengths, for plumbing cleanouts shall be located in walls, and for specialized floor access shall have seals that can be subject to punishment of cleaning solvents and other agent.

13. The DC shall avoid saddles or floor transitions at thresholds wherever there is high volume traffic or where carts or heavy equipment passes wherever possible.

14. There shall be no exposed concrete floors in any instructional spaces without being surfaced with a suitable wear floor finish and shall minimally be covered with VCT in the absence of any other specified finish except in in vocational shops.

15. The DC specify an independent testing authority to insure that all interior floor surfaces are cured, are within the range of level tolerances, all other surfaces are free from moisture or mold due to exposure during the construction cycle and the room or space has been conditioned to the proper room temperature to install finish product so to insure the validation and service life and warranty of the applied finish material.

## **C2010 Wall Materials and Finishes**

### **A. General Description Design / Design Approach**

1. The following wall finish materials described below by type shall typically be used throughout NJSDA school facilities. The materials described below use acronyms that are used in a master Table of Typical Rooms and Finishes (TTRF) in Section C2090 at the conclusion of Section C20.

2 Description of wall finishes that follow shall be used in conjunction with section C10 Interior construction, C1010 Interior Fixed Partitions, that include materials and descriptions of the supporting elements and wall construction types used to support the wall finishes described below.

a. ALL MATERIALS AND SYSTEMS INDICATED AS “SUBJECT TO APPROVAL BY THE AUTHORITY” MUST BE APPROVED BY THE AUTHORITY PRIOR TO THE FINAL ACCEPTANCE OF DESIGN DEVELOPMENT DOCUMENTS PHASE.

### **B. Related Standardized CAD Wall Details**

1. Refer to the following details for additional information:

- a. C1010-02,07 Acoustical Panel Detail
- b. C1010-03,08 Glazed Tile Wet Wall Wainscot Detail
- c. C1010-07 Sanitary Wall Panel Detail

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## C2010.10 Tile Wall Finishes

### 1. Ceramic Tile (Glazed) (CTG)

The use of glazed tile shall typically be limited in use for wet wall surfaces behind plumbing fixtures where surface moisture is present such as in showers, and where maintenance, and chemical cleaning products are constant use. It may be designed as a wainscot or more typically in full height applications. Glazed ceramic tile shall be either a porcelain mosaic of 1/4" or glazed tile of nominal 5/16" thickness with a plain face finish. Accent colors or patterns shall include modest horizontal and vertical accents and color groups when specified shall be common across at least three material product suppliers.

#### Notes:

Generally, thin set method of wall tile installation shall be used in new construction. For existing construction a mortar bed and bond coat over a metal lath may be required depending on the subsurface condition and it may vary in thickness from 3/8" to thicker applications as per guideline used from the American Tile Council's current design handbook.

- a. An applied liquid membrane shall be provided for thin set wall tile installations where constant water is in use such as in gang shower areas ANSI A108.13.
- b. For tile grout subject to chemical exposure to cleaners specify epoxy mortar grout ANSI A108.6.
- c. For cementitious tile Grout subject to normal use ANSI A108.10
- d. Tile wall systems shall be installed according to guidelines and standards set by the prevailing current edition of the Tile Council of North America, Inc. Handbook with compliance to and specific concern for proper joint preparations, membrane separations, building expansion joints as well as related sealant joints and preparations required by other trades.

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## C2010.20 Wall Paneling

### 1. Acoustical Wall Panel (AWP)

The use of acoustical wall panels shall be used in rooms where enhanced acoustical performance is desired. Though typically used as individual panels on masonry walls they may on occasion be applied on an entire wall surface when necessary. They are applied at the perimeter of music suites, cafeteria, on walls in auditoriums or multipurpose rooms and gyms to control room acoustics. Location and characteristics of the panels shall be coordinated with the projects acoustician and may be attached by a spline or be back mounted and may vary in their spacing, size, thickness, and density, depending on noise reduction coefficient (NRC) chosen by the acoustician and review by the NJSDA, and School District.

Acoustical wall panels shall be either a Type 1 or a Type 2. The facing materials shall be typically woven or non-woven polyester, or perforated vinyl fabric and shall have a flame spread consistent with the prevailing building codes and applicable testing agency as follows:

Type 1 Shall be a spline mounted edge reinforced abuse resistant panel for resistance to impact loads such as balls being thrown at them with a substrate of perforated water-felted, mineral-fiber board core or cement fiber board of density of not less than 20lbs per cubic foot with a min. NRC of between .60-.70

Type 2 Shall be a back mounted edge reinforced panel mounted to a rigid fiberglass core with edges chemically hardened to prevent warpage or damage of a density of not less than 6-7 lbs per cubic ft with a min. NRC of .80 NRC.

### 2. Wood Paneling and Wood Base Trim (WP),(WB)

Wood veneer paneling and base trim shall be limited to the proscenium and adjoining wall of an auditorium, or multipurpose rooms. It shall typically be a 7 ply glued,  $\frac{3}{4}$ " thick hardwood veneer plywood custom graded paneling, Panels shall be typically specified with a Grade A matching veneer face for transparent finish and a Grade B or better for opaque finish. Base trim shall be min.  $\frac{3}{4}$ " thick 4"-6" of hardwood species. Paneling and base trim shall be fabricated to a custom grade level in accordance with the American Woodworking Institute. Flame spread and wear finishes shall meet the prevailing building codes. Location and use of all of wood paneling and hardwood base trim shall be subject to a design review by the NJSDA and School District.

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## **C2010.20      Wall Paneling (cont'd)**

### **3 Sanitary Wall Panels (SWP)**

Sanitary wall panels are primarily used as an abuse resistant finish over a wall partition subject to moisture, impact load, and abuse. It is often used over light gauge steel stud and gypsum board systems or where ball impact, moisture, and chemical cleaning agents would otherwise damage the substrate. It shall typically be a fiberglass reinforced plastic (FRP) sheet with thickness of .090" and be able to resist impact of 7.0 ft-lbs/in. when tested according to ASTM D256-23e1 test method A. It may also be in the form of a thicker 3/8" prelaminated wall panel with a fiberboard core. They shall have trim, moldings, and anchors consistent with the thickness and type of system and shall meet all fire and flame spread tests of the prevailing construction codes.

## **C2010.70      Wall Painting and Coating**

### **1. Paint (P)**

Painted finishes shall include all interior opaque interior surfaces, including exposed mechanical ductwork or other devices. Paints shall typically be a low (Volatile Organic Compound) VOC paint type and shall comply with the paint manufacturer's recommendations for surface preparation, type of material, and type of wear coat characteristics. Paints shall comply with prevailing codes and regulations and shall be used as per location in the Table of Typical Room Finishes and as per section C2090.10 and as listed in the Schedule of Typical Paint Types and Substrates C2090.20

## **C2010.80      Acoustical Wall Treatment**

### **.1. Sprayed on Acoustical Finish (SAF)**

Sprayed on acoustical wall finish shall be consistent with a similar material application for ceiling finish and shall consist of a sprayed on cellulose acoustical finish over an exposed gypsum wall board or CMU wall at the rear of a stage above the cyclorama, at the rear of the auditorium, or on other vertical surfaces required by the design consultants acoustician to attenuate sound. A typical application consists of a NRC for 1" thickness of .90 NRC on solid backing and .80 NRC on ribbed metal deck. A bond strength greater than 100psf per ASTM E736/736M-19(2023), shall be a fire tested consistent with a Class 1 Class A per ASTM E84-24/UL 723 assembly. The application shall be manufacturer certified as per ISO 9001:2015, and shall be Urea-Formaldehyde free. Colors are generally integral with the product.

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## C2020 Interior Fabrications

### A. Column Covers (Under Development)

## C2030 Flooring

### A. General Description / Design Approach

1. The following floor finish materials described below by type shall typically be used for floor finishes throughout NJSDA school facilities. The materials described below use acronyms that are used in a master Table of Typical Rooms and Finishes (TTRF) in Section C2090 at the conclusion of Section C20.

2 Description of Floor Finishes that follow shall be used in conjunction with Section B1010.20 Floor Deck, Slabs, and Toppings. This section may include materials and descriptions of floor supporting elements and floor construction types used to support the following finishes described below.

a. ALL MATERIALS AND SYSTEMS INDICATED AS “SUBJECT TO APPROVAL BY THE AUTHORITY” **MUST** BE APPROVED BY THE AUTHORITY PRIOR TO THE FINAL ACCEPTANCE OF THE DESIGN DEVELOPMENT DOCUMENTS PHASE.

### B. Related Standardized CAD Floor Details

1. Refer to the following details for additional information:

- a. C2030-01 Resilient/Metal Edge Strip for Resilient Flooring
- b. C2030-02 Anchored Wood Floors
- c. C2030-03 Floating Wood Floors
- d. C2030-04 Floating Wood Floor (Stage/Platform)

#### 1. Ceramic Tile Unglazed (CTU):

The use of unglazed tile shall typically be used for floor and wall bases where surface moisture is present, and where maintenance, and chemical cleaning products are used. Unglazed ceramic tile shall be a porcelain tile of nominal  $\frac{1}{4}$ " thickness with a plain face finish. A slip resistant type shall be used in wet areas or where required for ramps where the wear surface is required to comply with friction coefficients required by the prevailing handicapped codes.

#### **Notes:**

- a. Generally, thin set method of floor tile installation shall be used in new and existing construction. **For wet areas with more than one floor drain provide thickset installation.**



# Model Schools: Materials and Systems Standards

## C2030.20 Ceramic Tile (Unglazed) (cont'd)

### 1. Ceramic Tile Unglazed (CTU) (cont'd)

- b. Thickset method can be specified in existing buildings to match existing or if existing nonstructural fill on top of structural slab can be removed to allow for the mortar bed depth specified. Under no conditions shall the existing structural slab be removed or disturbed
- c. Cold applied liquid waterproof membrane shall be provided for thin set floor tile installations. A sheet waterproof / separator membrane set in thin set shall be used as an alternative solution.
- d. Sheet membrane waterproofing shall be provided in areas that have thick set floor tile.
- e. Tile floor systems shall be installed according to guidelines and standards set by the prevailing current edition of the Tile Council of North America, Inc. Handbook with compliance to and specific concern for proper joint preparations, membrane separations, building expansion joints as well as related sealant joints and cover plates listed in other sections herein.

### 2. Ceramic Tile Unglazed Base (CTUB)

The use of unglazed integral cove base tile shall typically be water tight and impervious to moisture and shall be located surrounding gang showers and behind all wet walls of toilets consistent with the location of plumbing fixtures and where moisture and chemical cleaning products are consistently used. Glazed ceramic tile shall be a porcelain mosaic tile of a minimum of 4" high by a nominal 1/4" thickness with a plain face finish with eased edges to coordinate with inside and outside corners as required to be coordinated with 1" radiused CMU "bullnose" or other partitions that may be unclad with tile but require tile base trim. Radiused horizontal top edges shall be specified where the CTBU is the only vertical application used on the finish surface.

## C2030.25 Quarry Tile

### 3. Quarry Tile (QT)

Quarry tile is one alternative for floor finish in the kitchen, server, pantry and adjoining support rooms of the school as an alternative to Resinous Flooring Type 2. It is a material that is chemical, stain, slip and abuse resistant, long lasting, and has ease of maintenance.



# Model Schools: Materials and Systems Standards

## C2030.25 Quarry Tile (cont'd)

### 3. Quarry Tile (QT)

#### Notes:

- a. Quarry tile in kitchens is to be a mud set application utilizing sheet membrane waterproofing with allowance for proper slope to drains.
- b. Epoxy grout is to be used for quarry tile in kitchens. is non-porous and is resistant to many acids and chemicals found in food products and strong cleaning detergents. It also resists staining and does not promote the growth of bacteria.  
The formulation specified is high temperature resistant and will not soften when exposed to hot liquids or steam.
- c. For other locations, provide thin set application. For areas with drains, provide cold applied liquid waterproof membrane.
- d. See CTU item 2 above for additional notes.

## C2030.30 Specialty Flooring

### 1. Resinous Floor Epoxy (RFE)

A resinous epoxy floor shall typically be a nominal 1/4" thick three part coating system over a concrete floor that consists of a primer/bond coat, a second coat of a two part self-leveling coating with broadcasted quartz chips or sand aggregate and third part wear coat consisting of a clear two part epoxy sealer that creates a standard texture. It is excellent for its durability, is slip resistance, and resistance to stains and chemical cleaners. It shall have a rounded or nubby finish to reduce wear on mops and cleaning instruments.

### 2. Resinous Floor Urethane (RFU)

A resinous urethane floor shall typically be a nominal 1/4" thick two part urethane coating system over a concrete floor consisting of a first part application of a urethane self-leveling urethane formulation with infused broadcasted quartz aggregate and a second part consisting of a finish wear coat of a urethane sealer. It is excellent for durability, is slip resistance, is resistant to grease and moisture, is resistant to chemical cleaners and staining, and has added thermal shock properties for hot fluid spills. Is ideal in food preparation areas. It shall also have a rounded or nubby finish to reduce wear on mops and cleaning instruments.

### 3. Painted Concrete (PC)

Painted concrete is typically used for the concrete floor finish in the seating areas of auditoriums, storage, as well as maintenance rooms. Paints shall be a low VOC water based epoxy system over a latex based compatible primer. (See Schedule of Typical Paint Types and Substrates at the end of section C20.)

# Model Schools: Materials and Systems Standards

## **C2030.50 Resilient Flooring**

## **C2030.51 Vinyl Composition Tile**

### **1. Vinyl Composition Tile (VCT)**

The use of vinyl composition tile is generally classified as a “resilient flooring” and is the most widely used flooring material throughout the school. It shall be typically a 12” x 12” x 1/8” thick “thru chip” tile meeting ASTM F 1066-23 with a slip resistant granulated surface where need for ramps and on other applications as required by the presiding codes.

#### **Notes:**

- a. Floating slab construction with a vinyl floor shall be specified for rooms that are located above occupied instructional spaces such as a library or an auditorium in new buildings or additions. (see section B1010.20 for additional details).
- b. See related specification for quality control standards of concrete slab construction, for leveling tolerances and curing of slab prior to application. (See section B1010.20 for additional details).
- c. Color shall be integral through the entire tile.

### **2. Vinyl Base (VB)**

The use of vinyl base as with vinyl composition tile is generally classified as “resilient flooring” and is the most widely used wall base material throughout the school. It shall be typically 4” or 6” high x 1/8” thick in roll lengths with preformed outside corners as needed and shall meet ASTM F 1861, Type **TV**, Group I or II, as well as all fire tests require by the prevailing codes.

### **3. Rubber Base (RB)**

The use of rubber base is recommended in rooms where higher resistance to abuse and chemical is a concern such as for stair landings, shops, labs, and similar spaces. Rubber may be either a 4” or 6” high with a thickness of 1/8 inch. And shall comply with ASTM F1861-21 (or current), Type TS or TP, Group I or II.

### **4. Vented Rubber Base (VRB)**

The use of vented vinyl rubber shall be typically used in conjunction with a resilient wood floor system and shall be a 4” high x 5/16” thick with a 3” long by 3/8” thick toe. The back surfaces shall be grooved with vertical semi-circular vents to ensure proper air circulation under a typical wood floor. In addition it shall meet performance requirements of ASTM F 1861-21, Type TS, Group I (Solid) and outside corners shall be used where required.

# Model Schools: Materials and Systems Standards

## C2030.52 Sheet Resilient Flooring

### 1. Resilient Sheet Floor (RSF)

Sheet resilient floor often referred to as a sheet seamless vinyl, rubber, urethane, or polyurethane composite floor is ideally used in multipurpose rooms where minimal physical activity may be present as well as in other spaces where a the minimal number of joints is highly desired to resist degradation by maintenance abuse, and to reduce spread of germs and exposure to chemical agents within joints. It shall typically be a single ply fully adhered sheet with a minimum thickness of **0.080"** applied in rolled sections and seamed for a uniform surface over a concrete floor. Quality control of the concrete floor tolerance, moisture content and dryness are a critical part of the warranty and installation of this finish.

## C2030.53 Interlocking Rubber Flooring

### 1. Interlocking Rubber Floor (IRF)

The use of interlocking rubber floor shall be a cushioned removable floor made of an integrally joined tile system. It should be approximately 3/8" thick of recycled rubber, be of a single ply, with a non-laminated construction, and have a slip and stain resistant face. Additionally it should be, durable, non-absorbent, loose laid in a floating system, and be maintenance free, with an anti-microbial treatment to reduce bacterial growth.

## C2030.75 Carpeting

### 1. Carpet (CPT)

The use of carpet in schools shall be used for its durability, acoustical performance and aesthetic qualities. Carpet shall be a static and stain resistant broadloom of a minimum of 22oz., tufted or woven construction **or static and stain resistant carpet tile with a minimum of 16oz, multi-level pattern loop construction.** All carpet to have a color gray scale rating of 4 or better and shall have a backing with a primary and secondary backing **system** impervious to water damage so as to provide a **barrier to liquid.** All carpet products shall be anti-microbial and have a 20yr. warranty.

## C2030.80 Athletic Flooring C2030.81 Wood Athletic Flooring

### 1. Resilient Wood Floor (RWF)

Resilient Wood Flooring shall be either a "fixed or floating" anchored system consisting of a hardwood floor over multi layers substrate system that includes a synthetic cushion for resiliency and anchors when required. A resilient wood floor is typically provided in areas of physical activity that require an ability to absorb shock and impact weight imposed by the user. Activities include but are not limited to basketball, volleyball, calisthenics, and dance.

# Model Schools: Materials and Systems Standards

## C2030.81 Wood Athletic Flooring (Continued)

### 1. Resilient Wood Floor (RWF)

#### Fixed Systems (Anchored, or High Humidity Uncontrolled Environment)

A fixed wood floor system for new construction shall consist of northern maple strip hardwood flooring 2-1/4" wide by 25/32" continuous tongue and groove flooring attached to a 15/32" plywood subfloor a sleeper system with steel anchorage over 7/16" resilient (recycled) padding for cushioning shock when resiliency is required under an athletic or dance surface. It shall be spaced from the perimeter with a cavity for expansion and have a vented rubber base at its perimeter. It shall typically be a DIN certified system of second and better grade wood for high school gyms only, Third, second and better grades of wood may be used under bleachers, A stage may be use third grade or painted plywood and shall be meet the approval of the NJSDA and School District.

#### Floating Systems (Non-Anchored, Low Humidity Controlled Environment)

A floating wood system may be a low profile type for retrofit or higher profile type for new construction and shall consist of northern maple strip hardwood flooring 2-1/4" wide by 25/32" continuous tongue and groove flooring attached to a non-anchored floating double layer 15/32" (actual) plywood subfloor over a 7/16" resilient (recycled) padding for cushioning shock or over blocking at a (stage) when no resiliency but acoustical cushioning is still required. It shall be spaced from the perimeter for expansion and have a vented rubber base at its perimeter and shall typically be of second, third or better grade wood and shall meet the approval by the NJSDA and School District.

#### Notes:

- a. **A Fixed Wood Floor** shall be specified for gymnasiums that are located on grade or on the lowest floor level of the building or above a cafeteria or non-instructional space on any upper floor level when noise transfer is not an issue and where a controlled humidity environment is available.
- b. **A Floating Wood Floor** shall be specified for gymnasiums, stages and dance rooms that are located above any instructional space, libraries, and auditoriums in new or existing construction to reduce transfer to the structure or in conjunction with a double slab where in such circumstance where such vertical adjacencies cannot be avoided.

# Model Schools: Materials and Systems Standards

## **C2030.821 Resilient Flooring**

### **1. Poured Resilient Floor (PRF)**

Poured resilient floor referred to as a seamless poured urethane or polyurethane composite floor over a base mat of recycled rubber with structural and finish self-leveling layers. PRF shall be utilized as a multipurpose surface subject for light weight physical activity and sanitary applications such as for cafeteriums or gym/cafeteriums and other multipurpose rooms where food cleanup is shared with physical activity use. It is ideal for pre-school to youth. It shall be typically of solid color finish with a wear surface of ¼" over a basement shock layer of thickness of 7mm with thicker and thinner applications available depending on the use and activity.

### **2. Poured Resilient Cushioned Floor (PRCF)**

Poured resilient cushioned floor often referred as a seamless poured, urethane, or polyurethane composite floor over a base mat of recycled rubber cushioning layer with a structural and finish self-leveling layers. It is ideal when used as an effective alternative to cushioned wood flooring with low initial cost of ownership and maintenance as well as where multipurpose use such as sports impact loads of youth to young adult and where floor use is shared with a cafeteria use where food distribution/cleanup may be less of a concern than the impact loading of athletic usage. PRCF is used when more emphasis is placed on enhanced cushioning at a lower initial cost of ownership than a cushioned wood floor system. It shall typically be a DIN certified system, of solid color or of printed wood finish, with a wear layer of 2mm and a base mat shock layer of 7mm with thicker/thinner applications available. A PRCF is a viable option to a wood floor and is subject to NJSDA and District review.

## **C2030.85 Entrance Flooring C2030.85 Rubber Mat**

### **1. Rubber Mat (RM)**

A rubber mat shall be generally classified as a loose laid surface applied recycled rubber matt or a surface adhered recycled rubber product bonded to a rubberized substrate for the purposes of reducing the particulate matter from entering the school. The choice is often based on district preference.

## **C2050 Ceiling Finishes**

### **A. General Description / Design Approach**

1. The following ceiling finish materials described below by type shall typically be used for ceiling finishes throughout NJSDA school facilities. The materials described below use acronyms that are used in the Table of Typical Rooms and Finishes (TTRF) in Section C2090 at the conclusion of Section C20.

# Model Schools: Materials and Systems Standards

2. The ceiling heights shall comply with the current version of NJAC Title 6A:26 Educational Facilities Planning Standards and are to be established in conjunction with the Uniform Construction Code of the State of New Jersey Bulletin 00-3. These regulations shall form minimum requirements for the design and construction of NJ Public Schools.
3. Ceiling required fire ratings and separations are to be a UL approved floor/roof assembly consistent with the construction classification of the building and rating requirements for separations. It is the A/E's responsibility to demonstrate that all ceilings and floor finish systems are consistent with those requirements specified by the testing agencies and the applicable sections of the building codes.
4. Description of ceiling finishes that follow shall be used in conjunction with Section B1010.20 Floor Deck, Slabs, and Toppings. This section may include materials and descriptions of ceiling/floor supporting elements for suspended construction used to support the following ceiling finish systems described below.
5. The materials to be used in the design and construction of the school's Interior Ceiling Finishes shall typically be limited to those materials and finishes which are specified in this section of the Authority's Material and System Standards and parameters established herein.
  - a. ALL MATERIALS AND SYSTEMS INDICATED AS "SUBJECT TO APPROVAL BY THE AUTHORITY" **MUST** BE APPROVED BY THE AUTHORITY PRIOR TO THE FINAL ACCEPTANCE OF DESIGN DEVELOPMENT DOCUMENTS PHASE.

## **B. General Requirements of All Ceiling Types**

1. Where the NJDOE facilities efficiency standards requires, that in all new, alterations, reconstructions, and/or change of use of Instructional Space, as defined by the NJDOE facilities efficiency standards, shall meet the maximum noise levels, minimum Reverberation Time (RT), and Sound Transmission Coefficients (STC) requirements as described in ANSI / ASA Standard S12.60-2010 (R2015) (or current version), "Acoustical Performance Criteria, Design Requirements and Guidelines for Schools" as modified by the current version of the 21<sup>st</sup> Century Schools Design Manual: Design chapter and Criteria 1, "Acoustic Comfort".
2. Ceilings types in lobbies and corridors where youth and older students are present in High Schools and Middle Schools shall be abuse resistant mineral fiber composite panels (ACT-2). In Early Childhood and K to 5 schools corridors and lobbies ceilings may be designed as general purpose acoustical ceiling (ACT-1) with a higher durability option value as needed for corridors where youth age children might be present.
3. Gyms or multipurpose rooms that may have typically an exposed structure without a ceiling system shall have painted galvanized acoustical deck to acoustically dampen the space. If a ceiling is provided, such as in Pre-K to youth multipurpose rooms, an acoustical tile ceiling (ACT-2) with a minimum of 4 impact clips, or more per tile, shall be specified or as per the quantity recommended by the ceiling system manufacturer.
4. The DC shall design keep the design of soffits and ceilings of gypsum board construction limited where ever possible. Soffits and ceilings of gypsum board construction shall be used primarily to hide utilities and building system components which would otherwise be exposed to public view and at ceiling height transitions where acoustical tile and grid system might otherwise be unsuitable to resolve geometries.

# Model Schools: Materials and Systems Standards

5. Framing for attachment of the gypsum board shall be on either a light gage framing system, a tee and runner type suspended grid system with accessories, or a “Black Iron” and hat channel suspension system.
6. The use of mold & moisture resistant high impact gypsum board shall typically be used in gang toilets, locker rooms or other spaces where moisture and abuse may be present
7. All systems shall be designed as per service load and code criteria with specific attention given to acceptable loading and seismic restraints as per prevailing codes.
8. If an exposed ceiling is provided, the design consultant shall ensure that duct work, MEP lines and other projecting elements are designed for impact exposure and do not provide areas to trap or damage balls and other equipment (eg. use round metal ducts or inflated fabric ducts). All structure and MEP equipment exposed to public view shall be painted.

## **C. General Requirements for Suspended Ceiling Systems**

1. Typical ceiling shall be 2' x 4' lay-in acoustical tile.
2. School Buildings and additions are to be designed for seismic forces as per NJ presiding codes and as such, suspended ceilings shall meet the manufacturer's certification of compliance for the general design requirements of ASCE 7 Section 13.2.1 and shall be based on analysis, testing, or experience data.
3. Ceilings shall be designed to meet seismic force requirements and design category determined by the project's structural engineers.
4. Sprinkler heads and other penetrations shall have clearances and tolerances around all ceiling penetrations consistent with requirements of seismic zone in the prevailing building code.

## **D. Support of MEP Equipment & Light Fixtures**

1. All mechanical equipment ducts, pipes, etc. regardless of weight, as well as all light fixtures (recessed, surface or pendant) weighing more than 80 lbs:
  - a. Shall be directly supported by the building structure with support hangers of rigidly attached black iron or a light gauge framing ceiling system so designed to support loads independent of the ceiling suspension system (carrying channels or runners).
2. Recessed, surface, or pendant light fixtures weighing less than 80 lbs:
  - a. Shall be either be directly suspended by the building structure with enhanced cables or hangers, or indirectly supported by the structure through rigidly attached light gage framing or rigidly attached black iron ceiling so designed to support loads.
3. In no case shall a fixture may be supported on a ceiling grid of tees, and zee's without meeting criteria of the presiding NJ Building Code.



# Model Schools: Materials and Systems Standards

**E. Anti-Microbial Treatment:**

1. Coating-Based Antimicrobial Treatment:

Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273-21 (or current version).

2. Panel-Based Antimicrobial Treatment:

Provide acoustical panels treated integrally with an antimicrobial treatment in the matrix of the panel formulation that inhibits growth of mold and mildew.

**F. Clearances to MEP and FP Systems and Coordination Access Panels:**

1. Provide adequate clearances to all valves for servicing all above ceiling equipment. Verify accessibility and clearances to all required valves, filters, motors, etc. to allow for all regular maintenance and repair and replacement requirements. Provide properly sized access panels in all areas which do not have suspended acoustical ceiling. Avoid tight equipment clearances or shallow ceiling cavities that are too crammed with systems in ceiling cavities.

**G. Related Standardized CAD Ceiling Details:**

1. Refer to the following details for additional information:

- a. C2050-01 Acoustical Lay-in Tile Suspended Ceiling
- b. C2050-02 Gypsum Board Soffit and Suspended Ceiling
- c. C2050-03 Gypsum Board Pocket and Suspended Ceiling
- d. C2050-04 Gypsum Board Soffit "NO" Suspended Ceiling
- e. C2050-05 Gypsum Board Suspended Ceiling



# Model Schools: Materials and Systems Standards

## 2050.10 Plaster and Gypsum Board Ceiling Finishes

### 1. Gypsum Board (GB)

The DC shall limit the use of gypsum ceiling finishes to interior corridor soffits, rigid ceilings to resist impact loads where a hung ceiling might otherwise not be suitable such as in locker rooms and toilets. Decorative features such as 'Clouds' shall be reviewed on a case by case basis by the NJSDA and District. GB ceilings shall typically be painted and constructed with high impact/mold resistant treated gypsum wall board with a finish based on the schedule of typical paints and substrates at the end of section C2050.90 and as recommended in the TTRF. The cladding of suspended gypsum board may include other custom finishes such as wood or other veneer panels to be subject to reviewed by the NJSDA and District. The GB ceiling may be suspended at option from the floor/roof deck supporting structure with light gauge steel stud assemblies, on a black Iron type, or a grid type runners and tee suspension assembly system. All ceiling types and methods of supports shall be sized to be consistent with the loading and seismic requirements of the prevailing building code.

## 2050.70 Ceiling Painting and Other Coatings

### 1. Galvanized Acoustical Deck (AD)

The DC shall use a galvanized painted acoustical metal deck with air slots and sound absorbing material facing the interior for multipurpose rooms and expansive open ceiling spaces listed in the TTRF and as per the recommendations of the projects acoustician to reduce sound reverberation in the space. This may be used in conjunction with or at option to other acoustical attenuation measures such as acoustical 'clouds' or a partially hung acoustical tile system below a semi exposed ceiling cavity, or when a sprayed acoustical finish in the ceiling cavity may otherwise not be justified. The selection of galvanized acoustical deck shall be primarily based on room type and adjacencies.

### 2.. Exposed Ceiling (Exp.)

Any room listed in the TTRF as 'exposed' may be finished without a hung ceiling and may be exposed to the ceiling cavity above the space which may including but not limited to: ductwork, steel decking and framing of a roof or of a floor deck, plumbing and electrical systems. Any or all elements may be not require a finish other than what is required to meet the protection requirements of the exposed elements by the prevailing codes such as but not limited to intumescent paint or sprayed on fireproofing. However, when exposure is open to view the SDA and District shall decide if a painted finish is desirable such that it hides the exposed systems and that all labels, specialized equipment, acoustical properties, or other characteristics shall be carefully masked prior to painting,

# Model Schools: Materials and Systems Standards

## 1. Acoustical Tile (ACT-1)

### Acoustical Ceiling Tile ACT-1: General Purpose Use

**Size:** 2 x 4 by ¾ inch thick, Square Lay-in

**Material, Texture, Finish:** Wet-Mineral Fiber, Fine Fissured Medium Texture, White Latex.

**Properties:** Humidity Resistant, Anti-sag & Anti-Microbial, Either Durable, or of Higher NRC properties, Low to No VOC.

**Light Reflectance Coefficient:** Not less than 0.85

**Noise Reduction Coefficient:** 0.55-70

**Ceiling Attenuation:** CAC 35-40

## 2. Acoustical Tile (ACT-2)

### Acoustical Ceiling Tile ACT-2: General Impact Resistant

**Size:** 2 x 4 by ¾ inch, Square Lay -in

**Material, Texture, Finish:** Wet Mineral Fiber, Medium Texture, White Latex.

**Properties:** Humidity Resistant, Anti-sag & Anti-Microbial, Impact and Scratch Resistant, Low VOC.

**Light Reflectance Coefficient:** 0.87

**Noise Reduction Coefficient:** 0.50

**Ceiling Attenuation:** CAC 35

## 3. Acoustical Tile (ACT-3):

### Acoustical Ceiling Tile ACT-3: General High Acoustic Value

**Size:** 2 x 4 -1or 1-1/2 inches thick., Square Lay-in Cloud or Soundscape Shapes

**Material, Texture, Finish:** Fiberglass with Acoustically Transparent Membrane, Fine Texture, White

**Properties:** Humidity resistance: Anti-sag-Microbial, Washable, Impact, Scratch & Soil Resistant

**Light Reflectance Coefficient:** 0.90

**Noise reduction Coefficient:** 90.0 to 1.00

**Ceiling Attenuation:** CAC 200-210

# Model Schools: Materials and Systems Standards

## 2050.80 Acoustical Ceiling Treatment

### 4. Acoustical Tile (AcT-4)

#### Acoustical Ceiling Tile ACT- 4: General Wet, Humid and Chemical Use Areas

**Size:** 2 x 4, or 2 x 2 by 5/8, Medium Texture, Square Lay-in,  
**Material, Texture, Finish:** Ceramic/Mineral Fiber Composite,  
Medium Texture, Plastic White Finish  
**Properties:** Humidity resistance: Anti-sag & Anti-Microbial,  
Washable, Scrutable, Soil & Chemical Resistant, No VOC  
**Light Reflectance Coefficient:** 0.84  
**Noise Reduction Coefficient:** NRC 0.55.  
**Ceiling Attenuation:** CAC 38-40

### 5. Acoustical Tile (AcT-5)

#### Acoustical Ceiling Tile ACT- 5: Sanitary and Special Acoustical Use

**Size:** 2 x 4 by 5/8 inch thick, Smooth Textured, Non-  
perforated, Square Lay-in Edge  
**Material, Texture, Finish:** Wet Mineral Fiber, Smooth Soil  
Resistant Polyester Film, White Finish  
**Properties:** Humidity Resistance, Anti-sag & Microbial,  
Washable, Scrutable, Soil Resistant, Low VOC  
**Light Reflectance Coefficient:** Not less than 0.83  
**Noise Reduction Coefficient:** NRC 0.10  
**Ceiling Attenuation:** CAC 40.

## 2050.80 Acoustical Ceiling Coatings

### 1. Acoustical Finish (SAF):

The ceiling finish shall consists of a sprayed on cellulose acoustical finish over an exposed steel deck or structure in a ceiling cavity above the stage and auditorium or on any other horizontal surface where acoustical enhancement is required by the design consultant's acoustician to attenuate sound. A typical application consists of a NRC for 1" thickness of .90 NRC on solid backing and .80 NRC on ribbed metal deck. A bond strength greater than 100psf per ASTM E736/E736M-19(2023) (or current version), shall be a fire tested consistent with a Class 1 Class A per ASTM E84-24/UL 723 assembly. The application shall be manufacturer certified as per ISO 9001:2015, and shall be Urea-Formaldehyde free. Colors are generally integral with the product.

# Model Schools: Materials and Systems Standards

## C2090 Interior Finish Schedule

### C2090.10 Table of Typical Rooms and Finishes (TTRF):

1. The following Legends identify typical materials and finish acronyms used in the preceding sections of C20 that are used to throughout the TTRF as follows:

Legend of Floor and Base Materials and Finishes		
<b>CPT</b> Carpet	<b>PRCF</b> Poured Resilient Cushioned Floor	<b>RWF</b> Resilient Wood Floor
<b>CTU</b> Ceramic Tile Unglazed	<b>QT</b> Quarry Tile	<b>SC</b> Sealed Concrete
<b>CTBU</b> Ceramic Tile Base Unglazed	<b>RFE</b> Resinous Floor Epoxy	<b>RSF</b> Resilient Sheet Floor
<b>IRF</b> Interlocking Rubber Flooring	<b>RFU</b> Resinous Floor Urethane	<b>VCT</b> Vinyl Composition Tile
<b>PC</b> Painted Concrete	<b>RM</b> Rubber Mat	<b>VB</b> Vinyl Base
<b>PRF</b> Poured Resilient Floor	<b>RB</b> Rubber Base	<b>VRB</b> Vented Rubber Base

Legend of Wall Finishes		
<b>AWP</b> Acoustical Wall Panel	<b>SAF</b> Sprayed on Acoustical Finish	<b>WP/WB</b> Wood Panel and Base Trim
<b>CTG</b> Ceramic Tile Glazed	<b>SWP</b> Sanitary Wall Panels	
<b>P</b> Paint	<b>EP</b> Epoxy Painted	

Legend of Ceiling Materials and Finishes	
<b>ACT -1</b>	Acoustical Tile General Purpose Use
<b>ACT- 2</b>	Acoustical Tile General Impact Resistant
<b>ACT- 3</b>	Acoustical Tile General High Acoustic Value
<b>ACT- 4</b>	Acoustical Tile General Wet, Humid
<b>ACT- 5</b>	Acoustical Tile Sanitary-Special Purpose Acoustical ( Project Acoustician to validate/specify use)
<b>GB</b>	Gypsum Board, Moisture Resistant
<b>SAF</b>	Sprayed on Acoustical Finish (Project Acoustician to validate/specify use)
<b>AD</b>	Acoustical Deck (Project Acoustician to validate/specify use )
<b>EXP</b>	Exposed to Structure and MEP Systems Above

# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Instructional Classrooms						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
General Classrooms Preschool to Early Childhood	VCT	VB	P	---	ACT-1	Includes coat storage areas
Self Contained Bathroom Preschool to Early Childhood	CTU/RFE	CTU/RFE	CTG/P	___+/-4'-6"	ACT-4	CTG on wet wall only
Classroom Storage Room	VCT	VB	P	---	EXP	
General Classrooms Early Childhood High School (Including Self Contained Spec. Ed. Classrooms)	VCT	VB	P	---	ACT-1	
Specialized Rooms						
Cafeteria	VCT	RB	P/AWP	---	ACT-1,3 or & SAF	See Room Ed Spec for use of either ACT-1 or 3 SAF, or AWP
Auditorium	PC/CPT	RB/WB	P/AWP SAF/WP	Wainscot height varies due to slope	ACT-3,5 or SAF & AD	See Room Ed. Specs. for SAF or AWP, WP, Carpet in isles surrounding seating, otherwise painted concrete,
Platform Stages Preschool to High School	VCT/CPT	RB	---	---	EXP/ SAF	See Room Ed. Specs. For specific finishes
General Purpose Stages Elementary School thru High School	RWF	RB	P/ SAF	---	EXP/ SAF	See Room Ed. Specs. for SAF use
Multi-Purpose Room Preschool to Middle School (Mixed functions such as Cafetorium, Gymnasium, Café-Gymnasium (see Ed. Specs.))	VCT/PRF/SRF	RB	P/SWP AWP	+/-4'-6"	ACT- 2,3,5 SAF or AD, EXP	See Room Ed. Specs. For PRF, or SRF AWP or SWP Padding at ends only
Gymnasium Preschool to Elementary School	PRF	RB	P/AWP	Padding	ACT-2 or AD, EXP	See Room Ed. For AWP Specs. Padding at ends only
Gymnasium Middle School to High School (With Multiple Teaching Stations)	RWF/PRCF	VRB	P/AWP	Padding	ACT-2 or AD, EXP	See Room Ed. Specs. For RWF or PRCF

# Model Schools: Materials and Systems Standards

Design Requirements

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Specialized Rooms						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Auxiliary Gymnasium	PRF/PRCF	RB	P/AWP	Padding	ACT-2 or AD,EXP	See Room Ed. Spec.
Wrestling Room	PRF	RB	P	Padding	ACT-2 or AD,EXP	See Room Ed. Spec.
Weight and Fitness Room	IRF	IRB	P	---	ACT-4	
Media Center	CPT	VB	P	---	ACT-1 or, ACT-3	ACT-1 of Higher Acoustic Value
Computer Room	VCT	VB	P	---	ACT-1	
Large Group Instruction	VCT	VB	P	---	ACT-1	
Science Labs or Science Demonstration Labs	VCT/RFU	VB	P/EP	---	ACT-1	See Room Ed. Spec.
Visual Arts Classroom	SRF/SC	VB	P	---	ACT-1or EXP	See Ed Spec., Kiln areas may have SC
Photography Lab	RFE	VB	P	---	ACT-4	
Instrumental Music	CPT/VCT	VB	P/AWP	---	ACT-3 w / ACT-5	See Room Ed. Spec. Acoustical reflectance tiles
Choral Music	CPT	VB	P/AWP	---	ACT-3 w / ACT-5	See Ed. Spec. Acoustical reflectance tiles
Vocal/Instrumental Storage	CPT	VB	P	---	ACT-1	
Music Ensemble Room	CPT	VB	P/AWP	---	ACT-3 w / ACT-5	See Room Ed. Spec. Acoustical reflectance tiles
Music Practice Room	See note	See note	See note	See note	See note	Modular Practice Rooms with integral finishes
Drama Classroom	VCT	VB	P	---	ACT-3	

# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Administrative Staff and Common Support Areas						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Dance Classroom	RWF	RB	P/AWP	---	ACT-3	
Vocational Lab 6-12 (Home Econ, Electronics)	VCT	RB	P/EP	---	ACT-1	
Vocational Shop (Auto Metals, Wood, Materials)	SC	RB	P/EP	---	EXP	
Instructional Greenhouse	QT/SC	QT/SC	P/EP	---	EXP	
TV Recording Studio, Green Room	CPT	VB	P	---	ACT-3	
Resource, SGI, OTPT, Special Ed., Basic Skills Classrooms	VCT	VB	P	---	ACT-1	
ISS Classroom (In School Supervision)	VCT	VB	P	---	ACT-1	
Career Center, Youth Based Services	VCT	VB	P	---	ACT-1	
Student Store, Ticket Office 9-12	VCT	VB	P	---	ACT-1	
Student Offices, Activities Rooms 6-12	VCT	VB	P	---	ACT-1	
Common Circulation Areas						
School Corridors , Main Public Lobby Areas	VCT	VB	P/EP	+/-4'-6"	ACT-1	Act-1 Ceiling of Higher Durability Value,
Vestibules	RM	RB	P/EP	+/-4'-6"	ACT-1	Act-1 Ceiling of Higher Durability Value,
Special Purpose Stairs, Treads and Risers	See note	See note	See note	See note	See note	Design finishes to be reviewed by SDA
Egress Stairs Landings, Treads and Risers	P	RB	P/EP	+/-4'-6"	EXP	EP for CMU,



# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Administrative Staff and Common Support Areas						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Reception/ Main Waiting Area, Open Office	CPT/VCT	VB	P	---	ACT-1	See Room Ed. Specs.
Principal's, VP Offices	CPT	VB	P	---	ACT-1	
Admin. Secretary, Attendance Offices	CPT	VB	P	---	ACT-1	
Main Conference Room	CPT	VB	P	---	ACT-1	
Teachers Work Room/ Mail Boxes	VCT	VB	P	---	ACT-1	
Teachers Storage Rms.	VCT	VB	P	---	ACT-1	
Teachers/Admin. Toilets	CTU/RFE	CTU/RFE	CTG/EP	+/-4'-6"	ACT-4	See room Ed. Specs CTG on wet wall only
Attendance Office	CPT	VB	P	---	ACT-1	.
Child Study/Guidance Reception Area	CPT	VB	P	---	ACT-1	.
Child Study/ Guidance Staff Offices	CPT	VB	P	---	ACT-1	
Faculty Conference Rooms	CPT	VB	P	---	ACT-1	
Faculty Offices	VCT	VB	P	---	ACT-1	
Faculty Work Room	VCT	VB	P	---	ACT-1	
Faculty Dining Room	VCT	VB	EP/P	---	ACT-1	See room Ed. Specs.
Student Based Youth Services (SBYS) Reception/Offices	VCT	VB	P	---	ACT-1	
Student Assist. Counselor's Office (SAC)	VCT	VB	P	---	ACT-1	
Parent Resource and Community Room	VCT	VB	P	---	ACT-1	Higher Acoustical Value

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# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Administrative Staff and Common Support Areas						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Parent Liaison Office	VCT	VB	P	---	ACT-1	
Parent Toilet	CTU/RFE	CTU/RFE	CTG/EP	+/-4'-6"	ACT-4	CTG on wet wall only
Nurse's Suite (Including Exam, Dispensary, and Cot Areas)	SRF	VB	EP	---	ACT-1	
Nurse's Toilet	CTU/RFE	CTU/RFE	CTG/EP	+/-4'-6"	ACT-4	See Ed. Specs. CTG on wet wall only
Nurse's Storage	VCT	VB	P	---	ACT-1	
Librarian's Office	CPT/VCT	VB	P	---	ACT-1	
Librarian's Workroom	VCT	VB	P	---	ACT-1	
Technology Coordinator Office	VCT	VB	P	---	ACT-1	
Main Data Frame (MDF) Room	VCT	RB	P	---	EXP	
Gym Office	VCT	VB	P	---	ACT-1	
Gym Office Toilets	CTU/RFE	CTU/RFE	CTG/P	+/-4'-6"	ACT-4	CTG on wet wall only
Gymnasium, Equipment/Uniform Storage	PC	RB	P	---	EXP	
Locker Rms., and Visiting Team Rms. 6-12	CT/RFE	RB/RFE	P	---	ACT-4	
Gymnasium Training/ Physical Therapy Room	SRF/RFE	RB/RFE	P	---	ACT-4	
Stage Dressing Room 6-12	VCT	RB	P	---	ACT-1	
Stage Storage Prop Room	SC	RB	P	---	EXP/SAF	
Stage Projection Room	VCT	RB	P	---	ACT-3	

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# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Administrative Staff and Common Support Areas						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Kitchen, Prep. Areas	QT/RFU	QT/RFU	P/EP	+/-4'-6"	ACT-5	
Kitchen Offices	QT/RFU	QT/RFU	P	---	ACT-5	
Kitchen Storage	QT/RFU	QT/RFU	P/EP	---	EXP	
Maintenance Office	VCT	RB	P	---	ACT-1	
Maintenance Lockers/Lunch Room	VCT	RB	EP	+/-4'-6"	ACT-1	
Storage Rooms	SC	RB	P	---	EXP	
Maintenance Repair Shop Area	SC	RB	EP	---	EXP	
Mechanical Equipment Rooms	SC	RB	EP	---	EXP	
Electrical/Data Closets	VCT	RB	EP	---	EXP	
Male/Female Student Toilets Male/Female Public Toilet Rooms	CTU/RFE	CTU/RF E	EP/CTG	---	ACT-4	CTG on wet wall only
M/F Individual Faculty/ Staff Toilets	CTU/RFE	CTU/RF E	EP/CTG	+/-4'-6"	ACT-4	CTG on wet wall only
Unisex Handicapped Toilets	CTU/RFE	CTU/RF E	EP/CTG	+/-4'-6"	ACT-4	CTG on wet wall only
Custodial Closets	RFU	RB	EP	+/-4'-6"	EXP	
Drinking Fountain Wall or Alcove	VCT	P/CTU	EP/CTG	+/-4'-6"	ACT-1,2	CTG on wet wall only
Security Office, Alcove Area	VCT	VB	P	---	ACT-1	

# Model Schools: Materials and Systems Standards

## C2090.20 Paint Schedule of Typical Paint Types and Substrates:

### A. Schedule:

The following Paint Schedule identifies typical paints used in the interior of NJSDA School Facilities and are categorized by substrate material and type of exposure. It is intended for general use as a performance specification to further clarify and offer guidance to the design consultant as to what type of paint system may be required in a given application when referenced by **(P)** in the TTRF above. For exterior painted finishes or special exterior coatings see Section B20.

- 1) Concrete Surfaces (Semi-Gloss): (Latex)
  1. Primer: Latex Wall Primer, 1.0 – 1.2 mils DFT/coat
  2. Finish Coats: Latex Semi-Gloss Enamel (34-45 units at 60°F.), 2.0-2.4 mils DFT/coat
  3. Surfaces: Concrete walls and concrete locker bases.
- 2) Concrete Surfaces (Gloss): (Water Based Epoxy System)
  1. Primer: Latex Wall primer, 1.0-1.2 mils DFT/coat
  2. Finish Coats: Water Based Catalyzed Epoxy (Gloss) (55-75 units at 60°F.), 2.5-3.0 mils DFT/coat
  3. Surfaces: Floors, stairs, striping on floors
- 3) Concrete Masonry Surfaces (Semi-Gloss): (Water Based Epoxy System)
  1. Primer: Pigmented High Solids/High Build Epoxy Polyamide Filler/Sealer, 30mils DFT/coat
  2. Finish Coats: High Solids, Epoxy Polyamine Coating, Gloss (75-95 units at 60°F.), 4.0-8.0 mils DFT/coat
  3. Surfaces: New masonry walls, graphics (not for use in high humidity areas).
- 4) Concrete Masonry Surfaces (Gloss): (Water Based Epoxy System – High Humidity)
  1. Primer: Pigmented High Solids/High Build Epoxy Polyamide Filler/Sealer, 30mils DFT/coat
  2. Finish Coats: High Solids, Epoxy Polyamine Coating, Gloss (75-95 units at 60°F.), 4.0-8.0 mils DFT/coat
  3. Surfaces: Showers and high humidity areas.
- 5) Metal – Ferrous (Semi-Gloss): (Alkyd Enamel System, Maximum VOC content 450 grams/liter)
  1. Primer: Modified Alkyd Resin Primer, 3 mils DFT/coat
  2. Finish Coats: Alkyd Enamel, Semi-Gloss (40-50 units at 60°F.) 3.0 mils DFT/coat
  3. Surfaces: Hollow metal doors, frames, door mullions, railings, ferrous metal surfaces
- 6) Metal – Ferrous (Gloss): (Acrylic-Latex System)
  1. Primer: 100% Acrylic, Waterborne, Gloss (60-80 units at 60°F)
  2. Finish Coats: 100% Acrylic, Waterborne, Gloss (60-80 units at 60°F.), 3.0 mils DFT/coat
  3. Surfaces: Hollow metal doors, frames, door mullions, railings ferrous metal surfaces
- 7) Metal - Galvanized (Semi-Gloss): (Acrylic Latex System)
  1. Finish Coats: 100% Acrylic, Waterborne, Semi-Gloss (30-40 units at 60°F.), 3.0 mils DFT/coat
  2. Surfaces: Hollow metal doors, frames, door mullions, railings ferrous metal surfaces

# Model Schools: Materials and Systems Standards

- 8) Metal – Galvanized (Gloss) Acrylic Latex System
  1. Finish Coats: 100% Acrylic, Waterborne, Gloss (60-80 units at 60°F.), 3.0 mils DFT/coat
  2. Surfaces: Hollow metal doors, frames, door mullions, railings ferrous metal surfaces
- 9) Wood – Painted (Gloss): (Acrylic Latex System)
  1. Primer: Pigmented Interior Modified Alkyd Primer, 2 mils DFT/coat
  2. Finish Coats: Vinyl Acrylic Gloss Enamel (65-75 units @ 60°F.), 2 mils DFT/coat
  3. Surfaces: Wood trim, etc.
- 10) Wood – Painted (Semi-Gloss): (Acrylic Latex System)
  1. Primer: Pigmented Interior Modified Alkyd Primer, 2 mils DFT/coat
  2. Finish Coats: Modified Acrylic Semi-Gloss Enamel (65-75 units at 60°F.), 2.0 mils DFT/coat
  3. Surfaces: Wood trim, etc.
- 11) Gypsum Board (Egg Shell): (Modified Alkyd System – Low V.O.C)
  1. Primer: Vinyl Acrylic Latex, 1.1 mils DFT/coat
  2. Finish Coats: Modified Alkyd Egg Shell (20-30 units at 60°F.), 2.5-2.8 mils DFT/coat
  3. Surfaces: Gypsum board surfaces, subject to moderate abuse
- 12) Gypsum Board –Painted (Semi-Gloss): Acrylic
  1. Primer: Pigmented Interior Modified Alkyd Primer, 2 mils DFT/coat
  2. Finish Coats: Modified Acrylic Semi-Gloss Enamel (65-75 units at 60°F.), 2.0 mils DFT/coat
  3. Surfaces: Gypsum walls, ceiling, bulkheads, graphics
- 13) Plaster Surfaces (Egg Shell): (Acrylic Latex System)
  1. Primer: Interior Modified Alkyd Primer, 2 mils DFT/coat
  2. Finish Coats: Vinyl Acrylic Egg Shell Enamel (10-20 units at 60°F.), 1.5 mils DFT/coat
  3. Surfaces: Plaster ceilings, bulkheads
- 14) Exposed Structure – Ferrous (Flat) (Waterborne)
  1. Primer:
  2. Finish Coats: Acrylic Waterborne (white) flat (0-10 units at 60°F.), 1 mil DFT/coat
  3. Surfaces: Exposed metal decking, trusses, structural steel, metal joists
- 15) Exposed Structure – Galvanized (Flat) (Waterborne)
  1. Finish Coats: Acrylic Waterborne (white) flat (0-10 units at 60°F.), 1 mil DFT/coat
  2. Surfaces: Exposed metal decking, trusses, structural steel.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section D: Services**

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# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section D20: Plumbing**

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# Model Schools: Materials and Systems Standards

## **D20 Plumbing**

### **D2010 Plumbing Distribution**

#### **D2010.10 Piping (General)**

##### **A. Description**

1. Provide code compliant piping distribution systems necessary for building occupancy and use. Extent of plumbing piping work to be indicated on Drawings and by the requirements of this Section including but is not limited to the following:

- a. Materials - Piping
- b. Materials - Fittings
- c. Materials - Pipe Nipples
- d. Materials - Unions
- e. Materials Dielectric Fittings/Unions
- f. Materials – Gaskets
- g. Materials - Cleanouts and Cleaning Screw Plugs
- h. Materials - Sleeves for Pipes
- i. Materials - Traps
- j. Materials - Escutcheon Plates
- k. Drain Bibs
- l. Hose Bibs

##### **B. Codes and Standards**

1. Comply with applicable portions of the National Standard Plumbing Code, International Building Code, International Fuel Gas Code, International Mechanical Code and all other Federal, State, County, Municipal, Local Codes and ordinances having jurisdiction over this project. "The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards (<http://www.nj.gov/dca/divisions/codes/index.html>).

2. Standards listed below are referenced in this section.

- a. American Society for Testing and Materials (ASTM).
- b. American Standards Association (ASA).
- c. American National Standards Institute (ANSI).
- d. United States of America Standards Institute (USASI).
- e. Cast Iron Soil Pipe Institute (CISPI).



# Model Schools: Materials and Systems Standards

f. National Sanitation Foundation (NSF)

## **C. Delivery, Storage and Handling**

1. Pipe materials to be properly protected, and undamaged.
2. All piping to be shipped to job site with suitable caps, sheet metal covers or plugs. Pipe caps shall not be removed until just before installation
3. All pipe and fittings to be examined before installing.

## **D2010.11 Products (General)**

### **A. Materials - Piping**

1. Piping specifications shall conform and convey the following as they apply to each plumbing system's Application Section:

#### **a. Hub and Spigot Cast-iron Pipe:**

1.) Evenly coated, cylindrical, smooth, and free from all defects, of uniform thickness and shall be of the grade known in commerce as "service weight". Each length of pipe and each fitting shall be plainly marked with the Manufacturer's initials or registered trademark and with the letters "SW" to indicate "Service weight". The marking may be cast, stenciled, or otherwise applied on the pipe so as to be clear and legible at the time of installation. The marking shall be cast on fittings and shall be located away from the spigot end so as not to interfere with proper joining upon installation. Cast iron soil pipe and fittings shall comply with American Society for Testing and Materials (ASTM) A74, latest applicable edition.

2.) Each length of pipe and each fitting shall be plainly marked with the manufacturer's initials or registered trademark. The marking may be cast, stenciled, or otherwise applied on the pipe so as to be clear and legible at the time of installation.

#### **b. Steel Pipe:**

- 1.) Black steel pipe and galvanized steel pipe shall be Grade A, seamless, electric resistance welded pipe, or type F furnace butt-welded, and shall be made in accordance with the current Edition of the ASTM A53 Specification. Pipe shall be free from scale, and rust, injurious sand marks, blisters, scale, pits, laminations, imperfect welds, or other defects that might affect its strength, appearance or ability to resist corrosion. The maker's name shall be rolled or stamped in the metal at intervals of each length of pipe 2" and larger, and stamped on a metal tag secured to each bundle of pipe 1-1/2" and smaller.

2.) Unless otherwise specified or indicated on Drawings, black steel pipe shall be standard weight and galvanized steel pipe shall be Schedule 40 galv. pipe.

#### **c. Brass Pipe:**

# Model Schools: Materials and Systems Standards

1.) Seamless drawn red-brass pipe made in accordance with the current edition of ASTM B43, Specification made of an alloy containing not less than eighty five (85%) copper and not more than 0.05% lead, semi-annealed, regular weight. Pipe to be threaded on both ends with National Pipe Thread NPT, (Taper Pipe Threads) conforming to ANSI/ASME B1.20.1. The maker's name shall be stamped at intervals on each length of pipe and the pipe shall be color-coded White in accordance with The Copper and Brass Research Association standards.

d. Copper Tubing Type "K":

1.) Tubing shall be hard drawn seamless tubing manufactured in 20 foot lengths, in accordance with the Copper Development Association and ASTM B88, for below ground use only. Each tube shall be identified by means of color bars, green, running full length of each tube.

e. Copper Tubing Type "L":

1.) Tubing shall be hard drawn seamless tubing manufactured in 20 foot lengths, in accordance with the Copper Development Association and ASTM B88, for above ground use only. Each tube shall be identified by means of color bars, blue, running full length of each tube.

f. Ductile Iron Pipe:

1.) Ductile iron pipe shall have an outer coating of coal tar and shall comply with the requirements of the latest Standard Specifications of ANSI A21.51. Types of pipe shall be as follows:

- a) Push-on Joint Pipe: Pipe shall be for: use on yard drainage when indicated and shall be thickness class 51 for all sizes; use on House Sewers and shall be thickness class 56 for all sizes; use for water service piping, class 52 for three (3) & four (4) inch diameter pipe and class 56 for pipe size greater than four (4) inch. Pipe shall be Bell Joint with EPDM gaskets.
- b) Mechanical Joint Pipe: Pipe shall be used for underground drainage when indicated, with EPDM gaskets, joint retainer glands, steel nuts and bolts.

2.) Ductile iron pipe shall also comply with the following requirements:

- a.). Marking: the weight and class and other designated markings required by ANSI specifications shall be stenciled at the foundry on all ductile iron pipe, fittings and special markings shall be painted conspicuously in white on the outside of each pipe length, fitting and special casting after the shop coat has hardened.
- b.) Cement Lining: Pipe shall be cement lined, except when used in association with sewer piping, in accordance with ANSI, Standard A21.24, with thickness of lining to be 1/8" minimum. A plus tolerance of 1/8" shall be permitted on all sizes of pipe.

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g. PVC Pipe:

- 1.) Standard weight (SCH 40) PVC pipe, CPVC shall comply with ASTM D-1784, D-1785 and HDPE shall comply with AWWA C906, ASTM F2164, F2620.

h. Diesel Fuel Pipe:

- 1.) All above ground pipe, inside the oil storage tank and emergency generator rooms unless otherwise specified, shall be standard, full weight, Schedule 40, black steel pipe, ASTM SA53, Grade B seamless. All other piping to and from boiler room and emergency generator room shall be double wall. Carrier (inner) pipe shall be Schedule 40 ASTM A-53B and the containment pipe jacket shall be 10 gage carbon steel ASTM A139. All double wall piping shall slope back and drain to the generator room floor sump.
- 2.) Each length of pipe shall be stamped with the trademark of its manufacturer.
- 3.) The pipe to be installed shall be free of flaws, blisters, cracks and all other imperfections or defects which would impair its quality.
- 4.) All pipes shall be tested by the manufacturer under standard test pressure.
- 5.) All pipe threads shall be NPT standard, accurately and cleanly cut and perfect in every respect.
- 6.) Nipples shall be of the same material and weight as the pipes installed. The use of running nipples will not be permitted.
- 7.) Pipe sleeves shall be of standards weight, galvanized steel pipe and shall be provided as required.
- 8.) All fittings and connection shall be screw type except where indicated on the Contract Drawings, or specified herein.
- 9.) All fittings, unless otherwise specified, shall be galvanized malleable iron, Class 150 with a working pressure of 300 psi, at 150 degrees F.
- 10.) Unions shall have bronze seats and shall be furnished and installed adjacent to, and on the downstream side of each threaded end valve and as directed by the Engineer.
- 10.) Flanged connections may be used where indicated on the Contract drawings and where necessary with the approval of the Engineer.
- 11.) Street side fuel oil supply connector: Storage tank fill lines shall terminate in a Spill Container, including a composite top seal; tight fill adapter and locking fill cap. To prevent damage from frost heave, normal settling, or roadway traffic, the spill compartment shall have a flexible bellows protected by a ribbed gravel shroud. The noncorrosive resin spill compartment shall be readily removable to allow soil testing directly through the spill container without breaking the concrete. The drain valve shall close with tank pressure to help prevent leakage during tank testing or filling.

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## **B. Materials - Fittings**

1. Fittings shall conform to the following;

a. Cast-iron Hub and Spigot Piping:

1.) Fitting shall be service weight pattern, evenly coated, manufactured in accordance with the current ASTM Standard Specifications A74 and shall correspond with the pipe in all particulars.

2.) Material used for Hub and Spigot caulked joints shall be molten lead and packed oakum.

3.) Push-on joint with neoprene gasket.

b. Where screwed pipe is used for storm water or sanitary drainage purposes, fittings and couplings shall be galvanized cast-iron, recessed and threaded drainage fittings conforming to ASTM Specification A 126, Class B, with smooth interior waterway and with threads tapped so as to give a uniform grade to branches of not less than 1/4" to the foot and keep the vertical lines plumb. Fittings for screwed vent piping shall be galvanized cast iron recessed and threaded drainage fittings.

c. Fittings for brass water supply piping shall be cast bronze threaded fittings, Class 125 working steam pressure, conforming to ANSI B16.15. They shall be made of cast bronze containing not less than eighty-five percent (85%) copper and five percent (5%) each of lead, tin and zinc. All connecting threads of pipes and fittings shall be NPT conforming to the requirements of ANSI B2.1. Exposed fittings for fixture connections shall be rough, plain, polished or chromium plated as specified.

d. Fittings for Type "K" copper tubing shall be cast bronze solder joint fittings suitable for soft-soldering and shall be in accordance with ANSI Std. B16.18-1973. Fittings for type copper tubing shall be wrought copper solder joint fittings suitable for soft-soldering and shall be in accordance with ANSI B16.22-latest adopted version Type "L" fittings shall have a minimum working water pressure of 150 PSI Solder shall be lead-free solder as per ASTM B-32.

e. Grooved Joints-Copper Piping: Rolled grooves, EPDM center legged gaskets, Ductile Iron housing, wrought copper or cast bronze fittings, rated for 300 psi working pressure. System shall be designed for rigid installation. Brazed flanges must be used at equipment connections, and for maintenance removal sections. Submit certified brazing procedures and brazers.

f. Fittings, joints and accessories for ductile iron pipe shall comply with the requirements of the latest Standard Specifications of ANSI A21.10 and ANSI A21.11. Types of fittings shall be as follows:

1.) Fittings for mechanical joint pipe shall be mechanically restrained type.

2.) Fittings for push-on joint pipe.

g. Fittings for polypropylene plastic pipe shall be flame retardant schedule 40 polypropylene fittings. Materials shall be in accordance with ASTM D2146 and shall be fire retardant in accordance to ASTM test D635. Fittings shall be legibly marked with molded on letters showing manufacturer's trademark, pipe size of each socket,

# Model Schools: Materials and Systems Standards

manufacturer's part number, N.S.F. - CW National Standards Institute listed for chemical waste, and symbol PPFR (polypropylene flame retardant) indicating the material.

**C. Materials - Pipe Nipples**

1. All pipe nipples shall be of the same materials as the connecting piping.
2. The use of close nipples is prohibited.

**D. Materials – Unions**

1. Unions 2" and smaller shall be threaded. Unions 2-1/2" and larger shall be flanged
2. Threaded unions on copper or brass pipe shall be brass, ground joint suitable for 300pounds W.S.P.
3. Threaded unions on steel pipe, unless otherwise specified, shall be of malleable iron with bronze ground seats suitable for 300 pounds W.S.P.
4. Flanged unions shall be cast iron for steel pipe, and brass for copper or brass pipe, gasket type suitable for 150 pounds W.S.P.
5. Flanged unions shall be provided with the necessary steel bolts, nuts and gaskets.
6. All unions used on galvanized piping shall be galvanized.
7. All unions used on chromium plated piping shall be chromium plated.

**E. Materials – Dielectric Fittings/Unions**

1. Unions shall be rated at 250 psi at 180 or 280 F respectively per application and shall meet the requirements of ANSI B16.39. Pipe threads shall be in accordance with ANSI B2.1 and solder ends shall be suitable for brazing. Submit certified brazing procedures and brazers.
2. Flange fittings shall have a minimum rating of 175 psi and shall conform to ANSI B16.24 (Bronze), B16.42 (Iron).

**F. Materials – Gaskets**

1. Gaskets for cold and hot water services shall be full- face gaskets. The retaining gasket shall be made of 1175 fabric inserted rubber sheeting and shall be pre-cut at the factory for standard 125 pound cast iron flanges and fittings and for 150 pound raised face steel flanges and fittings.

**G. Materials - Cleanouts and Cleaning Screw Plugs**

1. Cleanouts shall conform to the features of the cleanouts contained in the schedule below. The manufacturer's numbers are for the purpose of type only. The contractor shall submit manufacturer's product technical data for each type required before installation for approval.

a. Gasket seal plugs will not be accepted in place of taper thread plugs.

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- b. Cleanout plugs shall be bronze and countersunk type with taper screw threads.
- c. Cleanouts within membrane waterproof floors and roof slab shall be furnished with an integrally cast flashing flange with flashing clamp. Cleanouts in unfinished areas shall have cast iron tops and covers; in finished areas shall have nickel bronze tops and covers.
- d. Cleanouts within cast iron pipe, galvanized steel or PVC piping located in exposed horizontal runs shall be made accessible.
- e. Cleanouts and Cleaning Screw Plugs for Acid Drainage Piping:
  - 1.) Floor cleanouts shall be flush with floor and of silicon iron material. All other cleanouts shall be of the same materials and by the same manufacturer as the piping to which they are connected.
- f. Wall access covers shall have vandal proof screws.

## **H. Materials - Sleeves for Pipes**

- 1. Sleeves and materials for sealing sleeves for gas piping through exterior walls, floor slabs, and slabs on grade shall be as specified and approved by the Gas Utility Company.
- 2. Sheet metal sleeves shall be 20 gauge Minimum.
- 3. Pipe sleeves shall be service weight cast iron pipe or schedule 40 galvanized steel pipes or larger weight as applicable.
- 4. Fire stop penetration materials for sealing sleeves shall be listed by Underwriters Laboratories.
- 5. Material for sealing spaces between pipe and sleeve through foundation walls below grade shall be Link-Seal Type "C" or approved equal, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve. Links shall be loosely assembled with bolts to form a continuous rubber bolt around the pipe with a pressure plate under each bolt head and nut. Link-Seal pressure plates shall be Type "C" (insulating type) to provide for electrical insulation and cathodic protection.
- 6. Materials for sealing space between each pipe and sleeve through non-fire rated exterior walls above grade shall be Non-shrinking cement.
- 7. Waterproof sleeves shall be similar to Link-Seal type wall sleeve or approved equal.

## **I. Materials - Traps:**

- 1. Brass traps shall be heavy pattern cast brass conforming to the National Standard Plumbing Code and in accordance with the current ASTM standard specifications. All cast brass visible traps shall be chrome plated.
- 2. Cast-iron and silicon iron traps shall be extra heavy pattern, manufactured in accordance with the current ASTM Standard Specifications.

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3. Traps associated with drains placed in slab on grade shall be deep seal type with floor cleanout with adjustable housing ferrule and cover. Provide with trap primer connection for unoccupied areas.

**J. Materials - Escutcheon Plates**

1. Galvanized cast-iron with set screw.
2. Galvanized cast iron escutcheons with set screw shall be chrome plated for use in finished rooms or spaces.
3. Chrome plated cast brass with brass set screws

**K. Materials - Drain Bibs**

1. Drain Bibs shall be 1/2" heavy brass compression faucets with plain end and recessed lockable wall box.
2. Drain Bibs in the supply connections under the lavatories and wash sinks shall have lock shields and loose keys. Exposed drain bibs and lock shields shall be chrome plated.

**L. Materials - Hose bibs**

1. Hose bibs shall be 3/4" brass with integral vacuum breakers and dual check valve, nickel plated finish, vandal resistant cap, and recessed lockable wall box.

**D2010.12 Installation**

**A. Piping**

1. The run and arrangements of all pipes shall be approximately shown on drawings or specified and as directed during installation, and shall be as straight and direct as possible, forming right angles or parallel lines with building walls and other pipes, and neatly spaced. No piping shall be installed where the headroom will be interfered with unless the conditions are such that it is unavoidable and permission is obtained from the NJSDA. Offsets will be permitted where walls reduce in thickness or beams interfere with direct runs; offsets shall be made at an angle of 45° to the vertical; in no case shall the space between the pipes, partitions, walls, etc., exceed 5". All exposed risers shall be erected plumb, standing free, close to and parallel with walls and other pipes and be uniformly spaced. All horizontal runs of piping hung from structural floor, slab or floor beams shall be erected as closely as possible to bottom of floor slabs, ceilings, or I-beams as the case may be. In no case shall the headroom, beneath the pipe, be less than (7'-0") where the pipe is installed more than (1'-0") from wall, partition, etc., except where piping is required to be installed in Boiler Room and Mechanical spaces above floor. Horizontal piping shall be so graded as to drain to the low points and water lines to drain bibs. All piping installed in floor shall be painted with a heavy coat of asphaltum. All piping shall be installed with ample space for pipe covering. All exposed plumbing piping in the Kitchen Areas shall be chrome plated brass pipe except for gas line. Provide threaded fittings. Chrome (silver) paints will not be accepted.

2. Roughing construction, underground or concealed in the floor or wall, shall be properly installed, tested and inspected before any of the roughing is covered up. Should any work be covered up before being inspected and tested, it shall be uncovered and recovered at the expense of the installer. Plugged fittings shall be installed when called for. Reducer fittings shall



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be used in making reductions in sizes of pipes; bushings will not be allowed. Suitable air chambers or Water Hammers Arresters shall be provided as called for in other sections.

3. All lines of piping and branches for fixtures passing through or in connection with waterproofing shall be brought to the proper locations and levels so that fixtures and piping may be installed without disturbing the waterproofing.

4. For work in existing buildings the following additional requirements shall be adhered to:

a. Piping shall run as straight as possible with the fewest number of changes in direction. Provide variations from the layout as shown on the Drawings as existing conditions may require, as approved by the Design Consultant and the NJSDA at no extra cost to the NJSDA. Provide piping without sharp bends, quick changes of sections, pockets or bushings.

b. Specify that the Contractor shall field verify the exact locations of any existing piping systems to remain and coordinate the new piping system layouts as required, at no additional cost to the NJSDA.

c. Design Consultant shall consider the location of all existing infrastructure including equipment, ductwork, piping, electric conduits, structure, etc., in the design of new system layouts. Relocation and rerouting of existing systems to accommodate new shall be noted on design documents.

d. Wherever existing branch piping interferes with installation of new branch piping, the existing branch piping shall be removed and re-routed to accommodate the new work. The rerouted work shall be of all new materials.

e. Specify that all new extensions and relocations of existing piping systems in occupied areas shall be concealed in existing or new walls, floors, ceilings, pipe chases or as otherwise specified.

f. Specify that abandoned piping shall be removed and capped at main. No dead end legs are permitted to remain.

g. Specify that all existing or new hot and cold water branches from mains and risers shall contain isolation valves.

## **B. Piping Joints**

### **1. Cast Iron Bell and Spigot Type-**

a. Joints in cast-iron bell and spigot piping shall be caulked joints made with packed oakum and molten lead, 12 ounces of which must be used for each inch in diameter of the pipes at each joint and must be poured in at one time. The lead to be used for this purpose shall be soft "Pig" or "Bar." After cooling and shrinking, the lead shall be thoroughly caulked and the joints made impermeable to gases and liquids, and also be capable of withstanding the tests applied. The face of the lead joints shall finish flush With the, face of the hub and be left without putty, paints or cement. Whenever joints are made on the floor or surface they shall be re-caulked after being placed in position.



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b. Push-on joint in cast-iron bell and spigot shall be of a molded gasket made of neoprene. As the spigot barrel is forced into the gasket, the gasket is compressed and completely seals the joint both in displacement and compression.

2. The joints of steel and brass piping shall be screwed joints of full length and threads shall be NPT conforming to the requirements of ANSI B 2.1. All pipes shall be screwed close up to their shoulders. The use of lamp wick is prohibited in threaded joints. All burrs shall be removed. Pipe joint cement or Teflon tape shall be used only on male threads.

3. Joints in type "L" copper tubing and type "K" copper tubing shall be soft-soldered joint. All surplus flux shall be wiped off immediately after completion of the soldering. Contractor to use pre-formed Tee fittings. The maximum diameter of branches shall be 2, 1/8". Joint shall be brazed. Submit certified brazing procedures and brazers.

4. Joints between galvanized steel and cast iron pipes shall be caulked joints as specified for cast iron piping.

5. Joints for ductile iron mechanical joint pipe shall be made by using ductile iron mechanical joint retainer glands, tee head nuts and bolts for tightening.

6. Joints for PVC and cast iron hub and spigot pipes shall be by caulking with lead and oakum or by use of compression gasket.

7. Unions shall be used to connect equipment (pumps, circulators, tanks, meters, etc.) to water lines. The union shall be installed as close to the equipment as practical. Where valves are adjacent to equipment, union shall be on downstream side of valves.

8. Dielectric fittings and unions shall be installed where ferrous piping joins copper tubing or brass piping.

## **C. Cleanouts and Cleaning Screw Plugs**

1. Specify and or include cleanouts in the following locations: on all traps (except traps integral with floor drains), at the end of and at all points in change of direction of all drain pipes and branch drains, at all offsets, at the ends of all branch soil and waste pipes, and located in runs not more than fifty (50'-0") feet on center, and at all points to make accessible all parts of the drainage system.

2. For underground lines the cleanouts for drains, traps, or branches shall extend up to grade and finish flush with finished level surface or made accessible with brick pits with cast iron frame and covers.

3. Cleanouts in connection with vertical cast iron pipe above the cellar, except the traps and fittings on horizontal branches, shall have tapped tee fittings; same size as pipe, closed with bronze screw plugs. All other cleanouts in connection with cast iron pipes, traps and fittings shall have heavy full size cast iron ferrules, same size as pipes or fitting, caulked into hub and closed with bronze screw plug.

4. All cleanouts in connection with galvanized steel pipe, traps and fittings shall consist of drainage fittings closed with bronze screw plugs of heavy pattern. All cleanouts for silicon iron pipe shall be silicon iron, with silicon iron bolted covers, except cleanouts flush with floor.

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5. Plugs used for cleanouts shall be same size as the fittings up to and including 4 inches. Sizes above 4" shall be reduced to allow for 4" cleanouts. For house traps 8" and larger plugs allowing for 6" cleanouts shall be used.

6. Cleanouts occurring in membrane waterproof floors shall be provided with a flashing clamp device secured with brass bolts. Cleanouts in unfinished areas shall have brass or bronze tops and cover. Cleanouts in finished areas shall have polished nickel bronze tops and cover. Provide cleanouts with spanner type vandal proof screws.

7. Indicate cleanouts at the base of all soil, waste and storm water leaders, and at all changes in direction on horizontal piping.

8. Specify or otherwise indicate a complete list of the locations of access doors and frames for cleanouts located in or behind walls.

6. Cleanouts on 3" and larger pipes shall be installed so as to allow clearance of at least 18". Cleanouts on pipes less than 3" shall be installed so as to allow at least 12" of clearance.

## **D. Sleeves for Pipes**

1. General: All plumbing pipes passing through floors, roofs, walls, partitions, furring, beams, trenches, and wherever else indicated on drawings shall be shown with sleeves installed. Core drilled holes shall be provided with sleeves. Where plumbing pipes pass through potentially wet floors that do not have membrane waterproofing such as toilet rooms, cafeteria kitchens, serving areas, dish washing room, janitor's sink closet, mechanical equipment rooms, pipe chases and areas that are provided with fire protection sprinkler systems, design to show sleeves of galvanized steel pipe with welded clips or equivalent at bottom ends for securing sleeves to form work and shall project one inch above finished floors, and shall be caulked watertight.

2. Sleeves for gas service piping through exterior walls below grade and floor slabs on earth shall be installed and sealed in accordance with the latest regulations of the Administrative Code of New Jersey. Sleeves for gas piping and gas vents through exterior walls shall be installed and sealed in accordance with the requirements of the serving utility. The space between each pipe and its sleeve through floor slabs on earth and exterior walls above grade for all other piping shall be sealed tightly with picked oakum and molten lead. The lead caulking shall finish flush with the face of the sleeve. The space between each pipe and its sleeve through exterior walls below grade for all other piping shall be sealed tightly with link seals.

3. For interior walls and floors and for pipes through roof, specify that the space between each installed pipe and its sleeve shall be sealed with a three hour rated fire stop penetration material. Fire stop materials shall be installed in accordance with the instructions of the manufacturer.

### **4. Sheet Metal Sleeves.**

a. Sleeves for pipes passing through floors, partitions, hung or furred ceilings, shall be installed with 1/2" maximum clearance all around pipes. Each sleeve for a pipe passing through an interior floor slab shall be fitted with a 1" flange, or equivalent, at the bottom end for the purpose of securing it to the form work or sheet metal deck. The sleeve shall finish flush with the top of the finished floor. Sleeves for pipes passing through partitions, hung or furred ceilings shall be of one piece construction and shall finish flush with the finished surface.

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b. Sleeves installed for pipes passing through vent ducts shall be securely fastened, soldered and made airtight.

5. Pipe Sleeve:

a. Specify that the contractor is to install pipe sleeves for all pipes passing through roofs, concrete beams, and brick walls, foundation walls and floor slabs on grade, etc. Sleeves shall be installed with 1/2" maximum clearance all around pipe and shall finish flush with the surfaces penetrated. Pipe sleeves for pipes through roof shall be made of service weight cast iron only.

6. Sleeves through foundation walls below grade shall be provided under General Construction Work.

**E. Traps**

1. Install traps full size of the piping to be shown on drawings. All traps shall have bottom cleanout or floor cleanout.

**F. Escutcheon Plates**

1. Chrome plated solid cast iron one-piece escutcheon plates with set screw on exposed pipes passing through walls, partitions, floors and ceilings, in finished rooms and spaces.

2. Galvanized solid cast iron one-piece escutcheon plates with set screw on concealed pipes passing through walls, partitions, floors and on exposed piping in unfinished rooms and spaces.

3. Chromium plated cast brass one-piece escutcheon plates with brass set screw on waste and water supply piping at all plumbing fixtures including lavatories, drinking fountains, cabinet sinks, wash sinks, etc.

4. Plates shall fit snugly around the pipes and shall be fastened in place before pipes are insulated or concealed. .

5. Split type escutcheon plates are not acceptable.

**G. Drain Bibs**

1. Specify Drain bibs shall be provided in the following locations:

a. At the base of all water risers.

b. At low points of water lines.

c. Where supply piping to fixture is concealed or only Barrier Free Lavatory or Barrier Free Wash Center is installed, the drain bib shall be wall mounted 18" above the finished floor adjacent to the fixture in each room having a floor drain.

d. Provide at all other points as indicated on Drawings.

**H. Hose bibs**

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1. Provide insulated freezeless wall hydrants with lockable recessed wall box located a maximum of 100 feet apart on each building façade and roof. Provide hose bibs on the exterior of the building for all required maintenance functions, watering of landscaping, and as specified in the DOE approved Educational Specifications.

## **D2010.40 Domestic Water Piping**

### **A. General**

1. Description
  - a. Design with components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
    - i. Domestic Water Service Piping: 160 psig.
    - ii. Domestic Water Distribution Piping: 125 psig.
2. Quality Assurance
  - a. All piping materials shall bear label, stamp, or other markings of specified testing agency.
  - b. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
  - c. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9."
3. Provide complete domestic cold and hot water, gas, sanitary and vent, and storm piping riser diagrams clearly showing all system components and pipe sizes, including domestic water heaters, system pumps, plumbing fixtures and equipment. Assure riser diagrams indicate water temperatures per National Standard Plumbing Code Section 10.15.2 and Temperature Control Section 10.15.6 and flow capacities (gpm, cfh).
4. Comply with NSF 61, NSF 61 Annex G and ANSI 372, "Drinking Water System Components-Health Effects" for potable domestic water piping and components.

### **B. Products**

### **C. Piping**

1. Ductile Iron Piping
  - a. Mechanical-Joint, Ductile-Iron Pipe: AWWA C 151, with mechanical-joint, bell- and plain spigot end, unless grooved or flanged ends are indicated.
    - 1.) Mechanical-Joint, Ductile-Iron Fittings: AWWA C 110, ductile- or gray-iron, standard pattern; or AWWA C 153, ductile-iron, compact pattern.

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- 2.) Glands, Gaskets, and Bolts: A WW A C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- 3.) Ductile-Iron Piping, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.
- 4.) Ductile-Iron-Piping, Keyed Couplings: A WW A C606 for ductile- iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- 5.) Push-on-Joint, Ductile-Iron Pipe: AWWA C 151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.1.) Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray- iron, standard pattern; or AWWA C153, ductile-iron, compact pattern.

a. Gaskets: AWWA C111, rubber.

- 6.) Ductile-Iron, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.
- 7.) Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- 8.) Ductile-Iron, Flexible Expansion Joints: Compound, ductile-iron fitting with Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
- 9.) Ductile-Iron, Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
- 10.) Ductile-Iron, Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.

## 2. Copper Tubing

a. Soft Copper Tube: ASTM B 88, Types K , water tube, annealed temper.

- 1) Copper Pressure Fittings: ASME B 16.18, cast-copper-alloy or ASME B 16.22. wrought copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
- 2) Bronze Flanges: ASME B 16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- 3) Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

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b. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

- 1) Copper Pressure Fittings: ASME B 16.18, cast-copper-alloy or ASME B 16.22, wrought copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
- 2) Bronze Flanges: ASME B 16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- 3) Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- 4) Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
- 5) Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

## D. Valves

1. Specify all valve types. Construction drawings shall indicate all valve types to be used. Where specific valve types are not indicated, the following requirements apply:

- a. Shutoff Duty: Use bronze ball valves for piping NPS 32 and smaller. Use cast-iron globe or gate valves with flanged ends for piping NPS 4 and larger.
- b. Throttling Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron globe valves with flanged ends for piping NPS 2-112 and larger.
- c. Hot-Water-Piping, Balancing Duty: Memory stop balancing valves.
- d. Drain Duty: Hose-end drain valves.

## E. Piping Applications

1. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
2. Flanges may be used on aboveground piping, unless otherwise indicated.
3. Grooved joints may be used on aboveground grooved-end piping.
4. Fitting Option: Brazed joints above ground copper tubing.
5. Above ground Domestic Water Piping: Use the following piping materials for each size range:
  - a. NPS 2" and Larger: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.
  - b. Type L (blue color bar) copper tubing with wrought copper solder joint fittings suitable for soft soldering; Brass, seamless drawn pipe, regular weight with cast bronze fitting;

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- Groove copper pipe and grooved fittings for 2" and above. Provide copper tubing for short branch connection to plumbing fixtures.
  - c. Exposed Piping Serving Laboratory, and Food Service Equipment, Except Piping Installed within Cabinets, and not Exposed to View: Polished, chrome plated brass pipe with cast brass fittings, and threaded joints.
  - d. NPS 1 ½" and Smaller: Soft copper tube. Type K; copper pressure fittings; and soldered joints.
6. Domestic Incoming Water Service – Underground
- a. 2-1/2" and Less: Type K soft annealed copper tube with cast bronze solder joint fittings; Brass, seamless drawn pipe with threaded fittings.
  - b. 3" and Up: Ductile iron (Class 52 for 3" & 4" and Class 56 for 6" & up) and fittings with mechanical or push-on joints.

## F. Piping Installation

1. Extend domestic water service piping to exterior water distribution piping in sizes and locations to be indicated on drawings.
2. Design underground ductile-iron piping according to AWWA C600, and AWWA M41, and NFPA 24. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall, or floor. Install thrust-block supports at vertical and horizontal offsets.
3. Design underground copper tubing according to Copper Development Association's (CDA) "Copper Tube Handbook."
4. Design cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to "Sleeves for Pipes" section for additional information.
5. Design above ground domestic water piping level, plumb without pitch.
6. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
7. Specify that the following steps are completed before operation:
  - a. Close drain valves and hydrants.
  - b. Open shutoff valves to fully open position.
  - c. Open throttling valves to proper setting.
  - d. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
  - e. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - f. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.



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g. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

h. Check plumbing specialties and verify proper settings, adjustments, and operation.

i. Energize pumps and verify rotation and proper operation.

## **G. Joint Construction**

1. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

2. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3. Mechanically Formed Outlets: Not acceptable. Provide pre-formed elbows and tee fittings.

## **H. Roughing-In For Water Meters**

1. Rough-in domestic water piping for water meter installation and install water meters according to utility company's requirements. Water meters will be furnished by Utility.

2. Obtain approval of Utility company for supply usage.

## **I. Valve Installation**

1. Provide sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball valves for piping NPS 2 and smaller. Use globe or gate valves for piping NPS 2-1/2 and larger.

2. Provide shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use globe or gate valves for piping NPS 2-1/2 inches and larger.

3. Provide drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

4. Provide hose-end drain valves at low points in water mains, risers, and branches.

5. Provide stop-and-waste drain valves where indicated.

6. Provide calibrated balancing valves in each hot-water circulation return branch, end of run, and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

## **J. Hanger and Support Installation**

a. Indicate code compliant hangers and supports of all piping, fittings, and specialties.

## **K. Connections**

a. Design piping adjacent to equipment and machines to allow service and maintenance.



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- b. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- c. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:
  - 1.) Water Heaters: Cold water supply and hot water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2.) Plumbing Fixtures: Cold and hot water supply piping in sizes indicated, but not smaller than required by plumbing code. Provide copper tubing for short branch connection to plumbing fixtures.
  - 3.) Equipment: Cold and hot water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

## **L. Field Quality Control**

1. Do not enclose, cover, or operate piping systems until they are inspected and approved by authorities having jurisdiction.
2. During installation, it is required that the installer notify Authorities Having Jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of Authorities Having Jurisdiction and engineer.
  - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - b. Final Inspection: Arrange for final inspection by Authorities Having Jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - c. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
  - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

## **M. Testing Domestic Water**

1. It is required to test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Specify that the contractor is required to cap and subject piping to static water pressure of 150% of operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow standing for four hours minimum or required by code if more stringent. Leaks and loss in test pressure constitute defects that must be repaired.

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4. Specify that the contractor is required to repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

5. Specify that the contractor is required to prepare reports for tests and required corrective action.

## **N. Adjusting**

1. Include balancing valves in hot-water-circulation return piping to provide adequate flow.

2. Include balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.

3. Adjust calibrated balancing valves to flows indicated.

## **D2010.50 Cold Water Supply**

### **A. General**

#### **1. Description**

- a. Extent of cold water supply Work is to be indicated on the Drawings and by the requirements of this Section.
- b. Provide independent domestic water service installed in adherence to all Applicable Codes and Standards. Domestic water service shall serve all project potable water and service needs. Fire water service shall be separate from domestic water service.

### **B. Codes and Standards**

1. Comply with applicable portions of the National Standard Plumbing Code, International Building Code, Mechanical Code and all other Federal, State, County, Municipal, Local Codes and ordinances having jurisdiction over this project. "The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards  
<http://www.nj.gov/dca/divisions/codes/index.html>.

2. Standards listed below are referenced in this section.

- a. American Society for Testing and Materials (ASTM).
- b. American Standards Association (ASA).
- c. American National Standards Institute (ANSI).
- d. United States of America Standards Institute (USASI).
- e. Cast Iron Soil Pipe Institute (CISPI).
- f. The Building Subcode of New Jersey.

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g. International Building Code (current version)

## C. Products

### 1. Materials

a. The following piping shall be as specified in Section D2010.11 Products (General) Materials – Piping, and shall also comply with the following:

1.) Ductile iron mechanical joint pipe shall be used on water service piping. Pipe shall be Class 52 for 3" and 4" pipe sizes and Class 56 for pipe sizes 6" and larger.

2.) Type "L" Copper Tubing (Hard Drawn) shall be for use on water distribution piping, excluding short branch supplies to fixtures, above ground.

3.) Copper Tubing Type "K" shall be hard drawn for use on water distribution piping below ground only.

### 2. Water Hammer Arresters (Shock Absorbers)

a. Engineered water hammer arresters shall consist of a stainless steel housing, welded metal or elastomer bellows, pneumatic displacement cushion, hydraulic displacement fluid, and threaded plug. Shock Absorbers shall be sized and installed in accordance with Plumbing and Drainage Institute Standard PD1-WH201 and ASSE Standard 1010.

### 3. Water Meters

#### a. City Water Supply

1.) Compound type water meter supplied by the Water Company and shall comply with all applicable requirements of AWWA Standard C702, latest revision. Meter must be equipped with an approved encoder register.

2.) Meter shall have strainer.

### 4. Pressure Gages

a. Specify and indicate pressure gauges with 4-1/2" diameter dials, 0-100 psi dial range phosphor bronze bourdon tube and black enamel cast aluminum, safety case. Pressure gauges shall have an accuracy of 1/2 of 1% of the scale range.

b. Require all gauges be equipped with pigtail siphons and shutoff cocks.

c. Require siphons and cocks to be of same manufacture as gauges.

d. No permanent gauge shall be used while the installer is making hydrostatic tests on any portion of the piping systems.

### 5. Pressure Reducing Valves

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a. Provide flanged pressure reducing valve (screwed ends 2-1/2" and smaller) with equalizing pipe. Pressure reducing valves shall be all bronze up to 2" and shall be iron body over 2". Valves shall be of the size and type suitable for the service and flow conditions.

## 6. Water Gages.

a. Provide water gages threaded for 1/2" connections, with four guards, 5/8" diameter glass, with finished brass.

## 7. Vacuum Breakers and Backflow Prevention

a. Atmospheric Vacuum Breakers to have:

1.) Poppets shall be molded plastic (polypropylene) or unicellular hi-car rubber.

2) Vacuum Breaker shall be rated to 150 psi working pressure and shall withstand water temperature to 212° F. The uni-cellular hi-car rubber is recommended in 1/2" and 3/4" for low flow applications. The vacuum breaker cannot be subjected to more than 12 hours of constant pressure.

b. Require Pressure Vacuum Breaker Assemblies shall consist of an approved check valve, vacuum relief, inlet and discharge shutoff and field testing cocks. All nipples and other fittings shall be red brass. Vacuum breakers shall be rated to 150 psi working pressure and shall withstand water temperatures to 170° F. The vacuum relief valve must be of brass construction with a spring loaded diaphragm member to assure positive opening of air inlet when back siphonage occurs. In sizes above 2", two check valves are required.

c. The Double Check Valve Detector Assembly, 2-1/2" and above, shall consist of two brass internally spring loaded check valves, two brass gate valves and field testing cocks. Double Check Valve Assembly shall be rated to 150 psi working pressure and shall withstand water temperatures to 170° F.

d. The Double Check Valve Assembly, 2" and below, shall be indicated on drawing. The assembly shall consist of two positive seating check modules with captured springs and rubber seat discs. The check module seats and seat discs shall be replaceable. Service of all internal components shall be through a Single access cover secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves; four top mounted, resilient seated test cocks. The assembly shall meet the requirements of ASSE Std. 1015 and AWWA Std. C510.

e. Reduced Pressure Backflow Preventer to consist of two separately spring loaded "Y" type check valves, a differential pressure relief valve, two shut-off valves, and test cocks for field testing.

1) Backflow Preventer to be tested and certified under A.S.S.E. No.1013, AWWA and USC manual. It shall be rated to 150 psi (minimum) working pressure and 110°F water temperature.

## D. Execution

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## 1. Cold Water Service Piping

- a. All operative permanent water service mains provided shall be metered. Temporary service mains shall be metered as required by the Water Company.
- b. If a combination of domestic water service and fire protection water service are required by the Utility Company, install meters of the size and type, sized appropriately for each service and to meet all project and code requirements. Fire water service assembly to include code compliant detector check valve / dual back flow preventer.
- c. Install meter on a concrete pier, pad or other code compliant manner above the floor.
- d. Each incoming service shall be extended inside of the building and shall be fitted with O.S. & Y. valve, check valve, backflow preventer device, strainer, plugged fittings, meter, pressure gages, appurtenances, etc., and shall comply with all Code requirements, and local Authority Having Jurisdiction.

## 2. Signs for Fire Services

- a. Provide signage indicating the location of the fire water service control valve on a deck plate or of another acceptable type.
- b. Provide signage for the main sprinkler control valve per code and local Authority Having Jurisdiction.

## 3. Cold Water Distribution Piping

- a. The cold water distribution mains are to be suspended from the overhead structural floor slab or steel beam and shall be of the sizes and arrangements as detailed on the Drawings. Each system main branch shall be installed with an isolation valve for system segregation during times of maintenance and repair.
- b. Provide gate valve, union and 1/2" drain bib for each main branch serving a riser. Branches connected to risers shall be connected in such a manner that the riser is free to expand upward for its entire length.
  - 1.) Install water hammer arresters on all mains, risers and branches to plumbing fixtures utilizing flush valves / flushometers..

## 4. Vacuum Breakers and Backflow Prevention

- a. Vacuum breakers are to be provided at points where air or gases may develop on the interior of water distribution systems through piping or hose connections.
- b. Potable water supply backflow preventers are to be provided in accordance with Code and filtration to remove pollutants.
- c. Atmospheric Vacuum Breakers may be used as protection against cross connections where the vacuum breaker is not subjected to back pressures due to pumps or gravity and must be installed on the discharge side of the shutoff. They must be installed a minimum of 6" above the highest overflow level. Install with the air inlet in a level position.

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- d. The Pressure Vacuum Breaker may be installed where it would be subject to continuous pressure but must be installed 12" above the highest outlet it is protecting. It should be located where it would be accessible for periodic testing.
- e. Where a Double Check Valve Assembly is required it must be installed in a horizontal position and must be accessible for periodic testing.
- f. Provide Reduced Pressure Backflow Preventers with:
  - 1.) Adequate clearance for testing and maintenance.
  - 2.) Proper drainage provisions.
  - 3.) Protect from freezing.
  - 4.) Adequate support.

## 5. Disinfection

- a. Installer shall be responsible for bacteriological examination, testing, and reporting of the disinfection of the potable water system.

### D2010.50.1 Hot Water Supply

#### A. General

##### 1. Description

- a. Hot water system shall be a circulating system.
- b. Show extent of hot water supply Work on the Drawings and by the requirements of this Section.

#### B. Products

##### 1. Materials

- a. The following piping shall be as specified in Section D2010.11 Products (General) Materials – Piping, and shall also comply with the following:
  - 1.) Type "L" Copper Tubing (Hard Drawn) shall be for use on water distribution piping above ground, excluding short branch supplies to fixtures.
  - 2.) Type "K" Copper Tubing (Hard drawn) shall be for use on water distribution piping underground.

##### 2. Water Hammer Arresters

- a. Water hammer arresters shall be as specified in Section D2010.50 Cold Water Supply.

##### 3. Three-Way Regulating Valves

- a. Three-Way regulating valves shall be installed as noted.
- b. The size of hot and cold inlets and tempered water outlet shall be as indicated on the Drawings.

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## 4. Balancing Valves

a. Specify that the contractor is to provide calibrated balancing valves. Valves to be of bronze construction with glass and carbon filled TFE seat rings and have differential pressure read-out ports across valve seat area. Read out ports to be filled with internal EPT insert and check valve. Valves bodies to have 1/4" NPT tapped drain/purge port. Valves to have memory stop feature and calibrated name plate to assure specific valve setting. Valve to be leak-tight at full rated working pressure.

## 5. Thermometers

a. Specify that the contractor is to provide thermometers in proper locations as indicated to record temperatures of the following:

- 1.) Building hot water circulating line
- 2.) Tempered water, temperature downstream of 3-way mixing valve.
- 3.) Hot water storage tank temperature.

b. Thermometers shall be gas actuated dial thermometers having a bulb 6" long with a brass separable socket, 1" NPT filled with a conducting medium. The dial shall be white enameled black figured, approximately 4" in diameter, and graduated 30 to 240° F. The case shall be cast aluminum, with polished chrome ring.

## 6. Vacuum Breakers

a. Refer to Section D2010.50 Cold Water Supply. Vacuum breakers shall be suitable for use on 212° F hot water.

## C. Execution

### 1. Hot Water Piping

a. Connect to the hot water heater and extend, suspended from the cellar or basement ceiling, brass pipe or type "L" copper tubing hot water mains of the sizes indicated on the Drawings and extend from same the required number of branches and risers to

supply all fixtures apparatus, etc. All mains, risers and branches to fixtures shall have water hammer arresters indicated on the Drawings.

b. Indicate gate valves, unions and 1/2" drain bibs on all branches from mains to risers.

c. Branches connected to the hot water and circulation risers shall be connected to the risers in such manners that the risers supported at their base are free to expand upward for their entire length.

d. From a point on the ceiling below the branch to the highest fixture on each riser, extend circulating pipes to the return main, which shall be extended and connected to the piping at water heater to be indicated on the Drawings. At the base of the hot and

circulation pipes and before they connect to return main, indicate gate valves, unions and 1/2" drain bibs.

e. Indicate check valves and balancing valves at the base of circulating line. Adjust balancing valves and regulate same so that a good circulation of hot water is obtained.

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Hot water system shall provide adequate hot water at the designated temperature to all plumbing fixtures that require hot water. Hot water system to be balanced at maximum velocity between 4 and 5 ft.

## 2. Three-Way Regulating Valves

a. Specify that the contractor is to provide regulating valve connected to the hot water header at top of the heater and to the cold water header with separate branches of pipe and fittings. install brass and/or bronze "Y" type strainers on the hot and cold water inlet piping to regulator. The hot and cold water branches shall each be shown with gate and check valves, drain faucets and unions.

b. Three-way valve shall be set to deliver water at a temperature of 105° F, unless otherwise noted.

c. Indicate O.S. & Y valves by-pass between hot water header and tempered water header.

## 3. Thermometers

a. Location of thermometers shall be as indicated on the Drawings.

## 4. Vacuum Breakers

a. Indicate vacuum breakers on the Drawings and as required by the National Standard Plumbing Code, International Building Code, Mechanical Code and all other Federal, State, County, Municipal, Local Codes and ordinances having jurisdiction over this project. "The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards (<http://www.nj.gov/dca/divisions/codes/index.html>).

## 5. Balancing Valve

a. Balancing valve shall be indicated on the Drawings.

### D2010.60 Plumbing Fixtures

#### A. Description

1. **Project** Specifications and Drawings to include all required plumbing fixtures and trim work.

#### B. Indexing Faucet Handles

1. Specify that all faucet handles to be indexed to indicate type of water it will supply. Cold water faucet shall be indexed by a "C", "COLD", or be color coded blue. Hot water faucet shall be indexed by an "H", "HOT", or be color coded red. Tempered water shall be indexed by a "T" or be color coded white.

#### C. Fixture Mounting Height Schedule

1. Unless otherwise required, plumbing fixtures shall be mounted in accordance with all applicable codes and shall comply with American Disabilities Act.



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## **D2010.61 Products**

### **A. Fixture supports**

#### **1. Water closets**

- a. Require water closet chair carrier to have two separate base supports secured to an adjustable face plate.

## **D2020.10 Sanitary Sewerage Equipment**

1. See section D2020.90 Sanitary Drainage Supplementary Components and G30 Site Utilities for additional information.

## **D2020.30 Sanitary Sewerage Piping (General)**

### **A. Related Documents**

1. Drawings and general provisions of the Contract, including General and Supplementary conditions apply to this Section.

### **B. Performance Requirements**

1. Design components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - a. Soil, Waste, and Vent Piping: 10-foot head of water.

### **C. Quality Assurance**

1. Require piping materials to bear label, stamp, or other markings of specified testing agency.

## **D2020.40 Sanitary Sewerage Piping (Products)**

### **A. Products**

#### **1. Materials**

- b. The following piping shall be as specified in Section D2010.11 Products (General) Materials – Piping, and shall also comply with the following for applications of pipe, tube, fitting, and joining materials.

##### **1) Cast Iron Soil Piping**

- a) Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.

- i. Gaskets: ASTM C 564, rubber.

- b) Hub less Pipe and Fittings: ASTM A 888 or CISPI 301

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- i. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
- ii. Compact, Stainless-Steel Couplings: CISPI310 with ASTM A 167, Type 301, or ASTM A 666, Type 301, stainless-steel corrugated shield; stainless-steel bands; and sleeve.
- iii. NPS 1 ½" to NPS 4: 2-1/8-inch- wide shield with 2 bands.
- iv. NPS 5 and NPS 6: 3-inch- wide shield with 4 bands.

## 2) Steel Piping

- a) Black steel pipe and galvanized steel pipe shall be Grade A, seamless, electric resistance welded pipe, or type F furnace butt-welded, and shall be made in accordance with the current Edition of the ASTM A53 Specification. Pipe shall be free from scale, and rust, injurious sand marks, blisters, scale pits, laminations, imperfect welds, or other defects that might affect its strength, appearance or ability to resist corrosion. The maker's name shall be rolled or stamped in the metal at intervals of each length of pipe 2" and larger, and stamped on a metal tag secured to each bundle of pipe 1-1/2" and smaller.
- b) Unless otherwise specified or indicated on Drawings, black steel pipe shall be standard weight and galvanized steel pipe shall be Schedule 40 galvanized pipe.

## 3) Ductile Iron Piping

- a) Require ductile iron pipe shall have an outer coating of coal tar and shall comply with the requirements of the latest Standard Specifications of ANSI A21.51. Types of pipe shall be as follows:
  - i. Push-on Joint Pipe: Pipe shall be for: use on yard drainage when indicated and shall be thickness class 51 for all sizes; use on House Sewers and shall be thickness class 56 for all sizes; use for water service piping, class 52 for three (3) & four (4) inch diameter pipe and class 56 for pipe size greater than four (4) inch. Pipe shall be Bell and Spigot Type Joint.
- b) Ductile iron pipe shall also comply with the following requirements:
  - i. Marking: the weight and class and other designated markings required by ANSI specifications shall be stenciled at the foundry on all ductile iron pipe, fittings and special markings shall be painted conspicuously in white on the outside of each pipe length, fitting and special casting after the shop coat has hardened.
  - ii. Cement Lining: Pipe shall be cement lined, except when used in association with sewer piping, in accordance with ANSI, Standard A21.24, with thickness of lining to be 1/8"

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minimum. A plus tolerance of 1/8" shall be permitted on all sizes of pipe.

## 4) Copper Tubing

- a) Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- b) Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper solder-joint fittings.

## B. Piping Applications - Sanitary

1. Transition and special fittings with pressure ratings at least equal to piping pressure ratings.
2. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
3. Provide hard piped vent system, vent piping shall be routed to discharge to exterior atmosphere. Air Admittance Valves to relieve system pressure not acceptable. Submit venting for freestanding plumbing fixtures to the Authority for review and approval.
4. Above ground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:
  - a. NPS 1-1/4 and NPS 1½": Copper DWV tube, copper drainage fittings, and soldered joints.
  - b. NPS 2 and larger: Hub less, cast-iron soil piping and one of the following:
    - 1.) Couplings: Compact, stainless steel.
5. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:
  - a. NPS 2 and larger: Service class, cast-iron soil piping; gaskets; and gasket joints.
6. Above ground Sanitary-Sewage Force Mains: Use the following piping materials for each size range:
  - a. NPS 2 to NPS 4: Steel pipe; steel-piping, grooved-end fittings; steel-piping, keyed couplings; and grooved joints.
7. Underground Sanitary Sewage Force Mains: Use the following piping materials for each size range:
  - a. NPS 2 to NPS 4: Use mechanical- or push-on-joint, ductile-iron pipe and fitting.

## C. Piping Installation

1. Provide cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
  - a. Provide cleanout fitting with closure plug inside the building in sanitary force main piping.

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b. Provide cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Section D2010.11 for basic mechanical materials and methods" for sleeves and mechanical sleeve seals.

c. For changes in direction of soil and waste drainage and vent piping use appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long turn; double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

d. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

e. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1.) Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.

2.) Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.

3.) Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

4.) Do not enclose, cover, or put piping into operation until it is inspected, tested and approved by governing authorities.

## **D. Joint Construction**

1. Refer to D2010.11 Products (General) Materials Sections for basic piping joint construction.

## **E. Hanger and Support Installation**

1. Refer to D2010.11 Products (General) Materials Sections for pipe hanger and support devices, which shall also comply with the following:

a. Vertical Piping: MSS Type 8 or Type 42 clamps.

b. Individual, Straight, and Horizontal Piping Runs, according to the following:

1.) 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

2.) Longer than 100 Feet: MSS Type 43, adjustable roller hangers.

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- 3.) Longer than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.
- 4.) Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls, support pipe rolls on trapeze.
- 5.) Base of Vertical Piping: MSS Type 52, spring hangers.
- 6.) Support vertical piping and tubing at base and at each floor.
- 7.) Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- 8.) Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

## **F. Connections**

1. Drawings to indicate general arrangement of piping, fittings, and specialties.
2. Indicate soil and waste piping to exterior sanitary sewerage piping. Use transition fittings as necessary.
3. Indicate drainage and vent piping to the following:
  - a. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - b. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction. Vent to exterior.
  - c. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - d. Equipment: Connect drainage piping as indicated. Provide union for each connection, and shut off valve if indicated. Use flanges instead of unions for connections NPS 2½" and larger.

## **G. Field Quality Control**

1. During installation, provide notification of Authorities Having Jurisdiction at least 24 hours before inspection must be made. Tests specified below to be performed in presence of Authorities Having Jurisdiction.
  - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - b. Required Inspections: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
2. Re-inspection: If Authorities Having Jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
3. Reports: Provide inspection reports signed by Authorities Having Jurisdiction.

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4. Testing of sanitary drainage and vent piping to be performed according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

a. Contractor is to test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

b. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

c. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

d. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent stack openings for roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1". Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

e. The contractor is to repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

f. The contractor is to prepare reports for tests and required corrective action.

g. The contractor is to test the force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

h. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

i. Cap and pressurize piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four (4) hours. Leaks and loss in test pressure constitute defects that must be repaired.

j. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

## H. Cleaning

1. Provide cleaning of the interior of piping. Remove dirt and debris as work progresses.
2. Provide protection of the drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

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3. Provide the placing of plugs in ends of uncompleted piping at end of day and when work stops.

## D2020.90 Sanitary Drainage Supplementary Components

### A. Pumping Apparatus and Tanks

#### 1. Description

- a. The contractor is to provide pump and controls for floor drain sewage ejector and storm water submersible sump pumps and controls indicated on the Drawings and as required herein.

### B. Products

#### 1. Motors

- a. The casing for pumps shall be of close-grained cast iron for bronze fitted pumps or bronze on all bronze pumps. The waterways must have large cross-section areas with smooth turns so that the water will pass through at a low velocity without shock.
- b. Suitable openings shall be provided for the suction gauge, discharge gauge, air vent and cock. Openings shall be tapped and plugged.
- c. The shaft shall be of the best grade of 18-8 stainless steel and of ample size to transmit safely the maximum amount of power required. Shaft shall be provided with ample keyway and key to accurately hold the impeller in place. The impeller shall be secured to the shaft using a nut and locking washer. The impeller shall be hydraulically balanced for all pressures and shall be of bronze, hand finished on the inside, machine turned and polished on the outside, dynamically balanced at all speeds, and with liberal keyway to fasten to shaft. Coupling shall be flanged and of the flexible type with pin and rubber bushing construction. That portion of the shaft passing through the pump casing and stuffing boxes shall be encased in a bronze sleeve, securely fastened to the shaft.
- d. Provide stainless steel name-plate showing the serial number, discharge GPM and Head of each pump shall be attached to the respective pump. The necessary wiring and controlling devices will be furnished and installed complete under the Electrical Division, unless otherwise specified.
- e. Require test curves of the pumps to be installed shall be provided for all pumps.

### C. Submersible Sewage Ejector

1. Locate submersible sewage ejector in sump pit as indicated on drawings. Pump shall have engineered thermoplastics non-clog impeller, 18-8 stainless steel shaft, factory bronze sleeve, hermetically sealed capacitor start with built-in overload protection and Class "B" insulation. The control panels shall be in a NEMA 4 enclosure.
2. Design for each sump an angle iron frame and a split steel checkered plate non-skid sump pit cover. The cover shall have all required openings for pump and piping including power



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cable and mounting hardware. The General Construction Subcontractor will install the angle frame and cover when sump pit is poured. The detail of sump pit is to be shown on Design Drawing.

3. The contractor is to provide Factory finishing as follows:
  - a. Cover and angle frame for sump pit shall be given one coat of iron primer paint.
  - b. Underside of sump pit cover shall be given one finish coat of black asphalt paint over the iron primer paint.
  - c. Pumps and motors shall be given one coat of iron primer paint and one finish coat of water resistant metallic enamel paint.
  - d. Submit shop drawings of the pumps, pump motors, angle frame and cover for approval before installing pumps.

## D2030 Building Support Plumbing Systems

### D2030.10 Stormwater Drainage Equipment

1. Refer to Section D2020.90 Sanitary Drainage Supplementary Components and G30 Site Utilities for additional information.

#### A. Storm Water, Submersible Sump Pump

1. Locate a submersible sump pump in a sump pit as indicated on the drawings. Pump shall have engineered thermoplastic impeller, 18-8 stainless, steel shaft, factory sealed grease lubricated ball type shaft, factory sealed grease lubricated ball type bearings, mechanical seal and a perforated bronze or steel strainer. Pump motor shall be, hermetically sealed capacitor start with built-in overload protection and Class "B" insulation. Pump Model No. and horsepower to be indicated on the Drawings. Control shall consist of a wide angled float switch that is mounted on the pump, furnished with 10 feet of power cord and a "piggy back" combination, grounded plug and receptacle.
2. Each sump pump shall have an angle iron frame and a split steel checkered plate non-skid sump pit cover shall be provided. The cover shall have all required openings for pump and piping including power cable and mounting hardware.
3. Factory Finishing to be required as follows:
  - a. Cover and angle frame for sump pit shall be given one coat of iron primer paint.
  - b. Underside of sump pit cover shall be given one finish coat of black asphaltum paint over the iron primer paint.
  - c. Pumps and motors shall be given one coat of iron primer paint and one finish coat of water resistant metallic enamel paint.
  - d. Submit shop drawings of the pumps, pump motors, angle frame and cover for approval before installing pumps.

#### B. Installation



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1. Pumps

- a. All pumping apparatus as shown on the Drawings to be installed in accordance with Manufacturer's specifications.

**C. Demonstration**

- 1. A Factory Trained Representative shall be on the job site for start-up and for instructing. The Custodian (or building manager) and staff in the operation and maintenance of each system installation shall provide a minimum of two visits.

## **D2030.20 Stormwater Drainage Piping**

**A. General**

- 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 2. This Section includes storm-drainage piping inside the building and to locations indicated.
- 3. Refer to Civil Site Sections G30 and project specifications for exterior piping.

**B. Performance Requirements**

- 1. Design components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - a. Storm Drainage Piping: 10-foot head of water.
  - b. Storm drainage forced main piping: 100 psig.

**C. Quality Assurance**

- 1. Piping materials shall bear label, stamp, or other markings of specified testing agency.

**D. Products**

1. **Piping Materials**

- a. Refer to D2010.11 Products (General) Materials Sections for pipe, tube, fitting, and joining materials to make installation watertight and installation for sleeves and mechanical sleeve seals.
- b. Require permanent modular wall penetration system at each service pipe penetration through foundation wall. Seal penetrations and make installation watertight. Refer to Materials – 'Sleeves for Pipes' section for wall penetration systems additional information.
- c. Require cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook, "Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

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- d. Storm piping shall use appropriate branches, bends, and long-sweep bends for changes in direction. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- e. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- f. Storm drainage piping to have the following minimum slopes, unless otherwise indicated:
  - 1) Building Storm Drain: 2 percent downward in direction of flow for piping NPS 4 and larger.
  - 2) Sleeves are not required for cast-iron soil piping passing vertically through concrete slabs-on-grade if slab is without waterproof membrane.
  - 3) Do not enclose, cover, or put piping into operation until it is inspected and approved by Authorities Having Jurisdiction.

## E. Piping Applications (Storm)

- 1. Above ground storm drainage piping within building – Use the following piping materials for each size range:
  - a. NPS2 to NPS8:
    - 1) Service Class, cast iron soil pipe and fittings, gaskets and gasket joints.
    - 2) Hubless, cast iron soil piping and fittings, hubless pipe couplings; rubber gasket joints, sleeve with integral center pipe stop, and stainless steel bands.
    - 3) Ductile iron pipe, push-on joints, EPDM gaskets.
- 2. Underslab storm drainage piping within building – Use the following piping materials for each size range:
  - a. NPS2 and larger:
    - 1) Hubless, cast iron soil piping and fittings, heavy-duty hubless pipe couplings; rubber gasket, sleeve with integral center pipe stop, stainless steel bands.
    - 2) Ductile iron pipe, mechanical joints, EPDM gaskets, joint retainer glands, steel nuts and bolts.

## F. Joint Construction

- 1. Refer to Section D2010.11 Products Materials Sections for basic piping joint construction which shall also comply with the following:
  - a. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

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- b. Hub less Joints: Make with rubber gasket and sleeve or clamp.

## **G. Hanger and Support Installation**

1. For pipe hanger and support devices install the following:
  - a. Vertical Piping: MSS Type 8 or Type 42 clamps.

## **H. Cleaning**

1. Provide the cleaning of the interior of piping. Remove dirt and debris as work progresses.
2. Provide protection of the drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- 3 Provide the placing of plugs in ends of uncompleted piping at end of day and when work stops.

## **D2030.90 Bldg. Support Plumbing System Supplementary Components**

### **D2060 Process Support Building Systems**

#### **D2060.30 Gas Systems**

##### **A. General**

###### **1. Description**

- a. Show the extent of gas piping system work on the Drawings and by the requirements of this Section.

###### **2. Quality Assurance**

- a. Comply with rules and regulations of the Local Utility Company, National Standard Plumbing Code, International Building Code, International Mechanical Code and all other Federal, State, County, Municipal, Local Codes and ordinances having jurisdiction over this project. "The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards (<http://www.nj.gov/dca/divisions/codes/index.html>).

- b. When welding is to be performed as part of the work covered in this specification, require the Contractor, before assigning any welder for this work, shall provide NJSDA with the names of welders to be employed for this work. Welders installing gas piping at any pressure shall be qualified for all pipe sizes, wall thicknesses, and all positions in accordance with the latest editions of either API 1104 or ASME Section IX Boiler and Pressure Vessel Code and be prequalified on an annual basis. The qualification testing shall be performed by an approved agency and the inspector, that verifies the welder's qualifications, shall have a minimum radiography qualification of Level II in accordance with the American Society of Non Destructive Testing Recommended Practice Document No. SNT-TC-IA, Supplement A. Copies of the certified welder qualification

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reports shall be maintained by the responsible welding contractor and shall be submitted to NJSDA.

c. All welding of gas piping shall be in full compliance with the latest editions of API 1104 and ASME Section IX Boiler and Pressure Vessel Code. Whenever welding operations are performed, the services of a full time certified inspector or certified technician shall be retained by NJSDA D.B. to ensure said compliance. Certified inspectors and certified technicians shall be qualified to perform visual inspections and shall have a minimum radiography qualification of Level II in accordance with the American Society of Non-Destructive Testing Recommended Practice Document No. SNT-TC-IA, Supplement A. The certified inspector or certified technician shall also be responsible for sign off upon completion of the work.

d. Upon completion of Gas Pressure Booster System installation and start-up, the booster manufacturer shall furnish a written certification to the NJSDA and the utility company that the Gas Booster System operates in accordance with the design standards.

e. Comply with NFPA 211: Standards for Chimney, Fireplace, Vents and Solid Fuel Burning Appliance.

## **B. Products**

### **1. Materials**

a. Gas piping shall be standard weight (Schedule 40) black steel pipe. Gas control, vent and relief piping shall also be standard weight, schedule 40 black steel pipe. Steel pipe shall be seamless or welded made in accordance with the current adopted edition of the ASTM A53 Specification.

b. In no case shall any gas pipe be less than 3/4". The sizes of pipe indicate nominal pipe size.

c. Provide Gas distribution piping systems operating at 1/2 PSIG or less shall be in accordance with ANSI Z223.1 -1974 (NFPA-54) and National Fuel and Gas Code.

d. Materials used in gas service and meter piping systems shall be in accordance with the requirements as specified by the Gas Utility Company providing the services.

e. Piping Joints for Gas Distribution Piping:

1.) Piping at 1/2 psig (14" WC.) and less:

2.) 4" and Smaller: Threaded Connections

3.) Over 4": Welded

### **2. Fittings**

a. Fittings for screwed gas piping shall be 150 lbs. black malleable iron fittings, conforming to ASTM specifications A-197, latest edition.

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- b. Compression type fittings and steel welding fittings shall be as specified and approved by the Gas Utility Company.
- c. Steel butt welding fittings shall conform to ANSI B16.9 requirements.
- d. Fitting for control, vent and relief piping shall be 300 lb. black malleable iron screwed fittings conforming to ASTM Specification A-197, latest edition.

### 3. Flanges

- a. Design all flanges to be steel and compatible in type and pressure ratings with mating flange and shall comply with ANSI B16.5.
- b. Flanges shall be welding neck or threaded end. Slips on flanges are not permitted.

### 4. Gaskets

- a. Gaskets to be compatible with the gas service on which they are used, without change to their chemical or physical properties.
- b. Gasket specified to be compressed asbestos free.
- c. Gaskets specified of metal or metal-jackets, aluminum O-rings and spiral wound metal gaskets, or other materials only if approved by the Utility Company.
- d. Specify full face gaskets to be used with all bronze and cast iron flanges.

### 5. Thread sealant

- a. Thread sealant to be used on natural gas piping. Thread sealant shall be a non- toxic, soft setting, slow drying sealant made from inert fillers. The joint compound shall not contain any Teflon. Teflon tapes shall not be used in natural gas lines.

### 6. Gas Safety Shut Off Valves

- a. Gas safety shut-off valves to be FM & UL listed, electric motor operated, normally closed, manual reset type. Valves shall be rising stem design with a straight through flow path with metal-to-metal seat and disc arrangement. The valve seat shall be stainless steel and the disc ductile iron. Valves to be provided with a NEMA 4 enclosure modified for Class 1, Division II hazardous locations, be provided with an electrical terminal block and shall operate on 120 Volt, A.C., 60 Cycles, single phase. Valves shall meet ANSI Class VI leakage standard and shall be provided with a visual indicator to note the position of the valve whether "OPEN" or "SHUT".
- b. Gas safety shut-off valves 2" and smaller shall be threaded, 2 1/2" and larger shall be flanged. Flanged valves shall be provided with companion flange set by valve manufacturer.

### 7. Gas Safety Shut Off Valves: Operating Sign

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- a. Provide a sign made of two colors laminated engravers stock phenolic, 1/16" minimum thickness, machine engraved to expose inner core color (white). Signs to be minimum 2" x 3", provided with uniform margins and character size minimum 1/2" high.
- b. Sign to read: "GAS SHUT OFF", per the International Fuel Gas Code 409.6.

**1) "IMPORTANT" GAS SAFETY SHUT-OFF VALVES LOCATED IN THE NEAR-GAS-METER PIPING MUST BE MANUALLY RESET UPON ACTION OF THE GAS LEAK DETECTION SYSTEM OR LOSS OF NORMAL ELECTRICAL POWER**

**8. Gas Lubricated Plug Valves**

- a. Lubricated plug valves for use on gas service and gas meter piping shall be as approved by the Gas Company.
- b. Lubricated plug valves for use on gas distribution piping; mains, branches and base of risers shall be cast iron body, rated for 200 pounds cold working pressure and shall be wrench operated, except valves 10" and larger which shall be worm gear operated.
- c. Lubricated plug valves 2" and smaller shall be short pattern threaded; 2-1/2" and larger shall be regular pattern flanged.

**9. Gas Cocks**

- a. Gas cocks shall be specified for use only as manual gas shut-off valves at each piece of gas burning equipment; shall be of the plug type, bronze construction with check, nut and washer bottom and tee handle.
- b. Gas cocks shall only be used on piping 1" and smaller.

**10. Solenoid Valve**

- a. Provide solenoid valve designed for use in each gas supply line serving kitchen area, mechanical rooms and instructional spaces to be explosion proof, water tight, 120V, 60 cycle, and 1-phase. Locate on floor level served.

**11. Gas Meter Room Sign**

- a. Provide a sign made of two colors laminated engravers stock phenolic, 1/16" minimum thickness, machine engraved to expose inner core color (white). Sign to be provided with uniform margins and character size 2" high.

- b. Sign to read:

**GAS METER ROOM. NO STORAGE PERMITTED**

**12. Natural Gas Booster**

- a. Gas appliances to be specified to use existing gas supply from Utility's bushing hub.

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## 13. Gas Pressure Regulator

- a. A gas pressure regulator shall be installed before the inlet of each gas fired piece of equipment.

## C. Execution

### 1. General

- a. Make the necessary arrangements with the Utility Company to bring natural gas service to connection points shown on the design drawings, or as required by the Utility Company. Design the necessary pipe, fittings, valves, service, cocks, governors, etc., to extend service to the Project's natural gas distribution system.

- b. Exact locations of gas service at property line shall be secured from the Utility Company by the Architect/Engineer.

- c. As part of the gas service and meter piping certain equipment, such as meters, regulators, security valves, plug valves, relief valves and compression coupling will be furnished by the Utility Company, however, the Architect/Engineer shall specify any additional equipment and materials not furnished by the Utility Company, to make this service complete.

- d. Gas service line to pitch toward the building and be provided with drip leg and plugged outlet, or drip pot, as required by the Utility.

### 2. Installation

- a. Gas service and gas distribution piping, quantity of appliances, shall be indicated on Drawings and installed in accordance with the rules and regulations of the Gas Utility Company.

- b. Provide inspection adjustment and commissioning of all gas appliances.

- c. Require notification of NJSDA when all is ready for the Gas Company to extend their service pipe to the street line; and again after tests, when all is in readiness for the installation of the meter. The meter shall then be connected with the service pipes, and with the several lines of distributing pipes. The setting, piping and connecting up of the meters shall be done in accordance with the rules of the Gas Company.

- d. Joint compound (pipe dope) used with screwed fitting shall be applied sparingly and only to the male threads of pipe joints. Such compounds shall be resistant to the chemical reaction of gases and shall not contain any Teflon. The burrs made in cutting the pipe shall be removed. Plugged tees in place of elbows shall be used wherever directed. Where pipes of different sizes come together reducing fittings shall be used; no bushing will be permitted.

- e. Piping installed below grade shall be connected by welding by approved certified welders.

- f. Service piping below grade shall be mill wrapped in accordance with the Gas Company regulations.

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- g. Backfill operations shall be started only after welding inspection, coating inspection and testing have been completed as per regulations of the Gas Utility Company.
- h. Inter-connections between piping at different pressure levels are not permitted.
- i. Provide gas lubricated plug valves and show on drawings or otherwise required for control of gas in the distribution piping; mains, branches and at the base of each riser. Install sleeves in floors for risers to pass through. An accessible manual gas cock or lubricated plug valve of the same size as the pipe shall be installed at each piece of gas burning equipment, to allow for isolation of the equipment and where indicated on Drawings. All valves and cocks for gas throughout the building shall be tagged with numbered metal tags. Install drip, consisting of nipple and cap, at the base of all risers and changes in elevation.
- j. Gas valves shall not be located within drop ceiling and inaccessible ceiling areas. Wall enclosures, pipe spaces or other recess in which gas valves are installed must be vented to the exterior.
- k. Final connections to all gas fired equipment and boiler gas trains shall be made by a licensed Plumbing Contractor.

### 3. Gas Piping Venting

- a. Gas service piping and gas meter piping shall have vent and relief piping designed and sized in full accordance with the requirements of the Gas Utility Company.
- b. Gas train venting (Boilers and Water Heater):
  - 1.) Gas vents from boilers shall not be combined with the water heater gas vents or other boilers.
  - 2.) All normally open vent valves must be designed to be piped separately and directly to the outside.
  - 3.) Design vent piping from pilot system (firm gas) and main burner system (interruptible gas) to be piped separately.
  - 4.) Gas vents from gas pressure regulator and high and low gas pressure switches can be manifolded.
  - 5.) Design gas vents with a Utility Company approved weatherproof vent cap.
  - 6.) Vents shall terminate in accordance with all codes.
  - 7.) Vents outlets shall not be located under a window overhang projection.
  - 8.) The size of the vent lines shall be shown on the drawings.



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## **4. Gas Safety Shut Off Valves**

- a. Gas safety shut-off valves shall be designed downstream of its meter and before any branch take-offs.
- b. Gas safety shut-off valves shall be hard wired to the gas leak detection system and shall function to shut off gas supply upon:
  - 1.) Notify the gas leak detection system of alarm condition
  - 2.) Loss of electrical power (fail closed).
  - 3.) Valves must be designed to be manually reset upon correction of the alarm condition or restoration of electrical power.

## **5. Gas Safety Shutoff Valves; Operating Sign**

- a. Install one sign for each boiler burner or chiller unit control panels.
- b. Require a sign to boiler burner/chiller unit control panel door using adhesive specifically designed for the purpose or mount sign on wall or other conspicuous location adjacent to the boiler burner control panel. Do not penetrate any door with fasteners.

## **6. Gas Meter Room, Incoming Gas Service Room, Boiler Mechanical Room Ventilation**

- a. Gas meter room shall be ventilated by one of the following methods and indicated on the drawings:
  - 1) A louvered opening to the outside air in the exterior wall with a minimum free area of not less than 30 square inches.
  - 2) Gas Leak Detection Systems' exhaust fan and louver.

## **7. Painting**

- a. Require all exposed gas pipe to receive one (1) coat of Rust Inhibitive primer paint and one; (1) finished coat of safety yellow.
- b. Mill-wrapped piping shall not be painted.
- c. Piping at different pressure levels in the same space shall be color coded and labeled.

## **8. Labeling**

- a. Gas piping operating at different pressures shall have labeling markers indicate operating pressure within that piping.
- b. All valves shall be tagged to indicate the operating pressure level within the distribution piping.

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**9. Gas Meter Room Sign**

a. Gas meter room sign shall be permanently and conspicuously posted on the exterior of the gas meter room door.

**10. Demonstration**

a. The services of a factory trained representative shall be available on the job site for start-up and for instructing NJSDA and School Custodian, and School Facility Director in the operation and maintenance of the gas safety shut-off valve.

b. The trainer shall videotape training of NJSDA and School Custodian.

**D2060.50 Processed Water Systems**

**A. General**

**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.

**2. Summary**

a. This Section includes design requirements water-treatment systems for the following:

1.) Hot water piping (closed-loop system).

2.) Dry cooler glycol-water piping (closed-loop system).

**3. Chemical Feed System Description**

a. Closed-Loop System: One bypass feeder on each system with isolating and drain valves downstream from circulating pumps

b. Introduce chemical treatment through bypass feeder when required or indicated by test.

**4. Performance Requirements**

a. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

b. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

c. Closed System: Maintain system essentially free of scale, corrosion, and fouling to sustain the following water characteristics as required / recommended by the Water Treatment Sub-Contractor (WTC) or company.

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## **B. Equipment**

### **1. Bypass Feeders**

a. Cast iron or steel, for introducing chemicals into system; with funnel shutoff valve on top, air-release valve on top, drain valve on bottom, and recirculating shutoff valves on sides.

### **2. Chemical Solution Tanks**

a. Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with graduated markings with molded fiberglass cover with recess for mounting pump, agitator, and liquid-level switch.

### **3. Packaged Conductivity Controller:**

a. Solid-state circuitry, linear dial adjustment, built-in calibration switch, on-off switch and light, control-function light, output to control circuit, and recorder.

### **4. Chemical Tubing**

a. Schedule 40, PVC with solvent-cement joints; or polypropylene tubing with heat fusion.

### **5. Plastic Ball Valves**

a. Rigid PVC or CPVC body, integral union ends, and polytetrafluoroethylene seats and seals

### **6. Plastic-Body Strainer**

a. Rigid PVC or CPVC with cleanable stainless steel strainer element.

## **C. Chemical Treatment Test Equipment**

1. Test Kit: Manufacturer recommended equipment and chemicals, in a pH, carrying case, for testing total dissolved solids, dissolved oxygen, bio count, chloride, and total alkalinity and for calcium hardness field tests.

2. Corrosion Test Coupon Assembly: Constructed of corrosion material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly.

## **D. Field Quality Control**

1. Require a factory-authorized service representative to perform startup service.

2. Require an inspection field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

3. Require an inspection of all piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.

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4. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

## **E. Adjusting**

1. Require the sampling water at one-week intervals after boiler startup for a period of five weeks, and certified test report for each required water performance characteristic. Comply with ASTM D 3370 and the following standards:

a. Silica: ASTM D 859.

b. Acidity and Alkalinity: ASTM D 1067.

c. Iron: ASTM D 1068.

d. Water Hardness: ASTM D 1126.

2. Occupancy Adjustments: Within 12 months of Substantial Completion, require that two separate water analyses to prove that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Perform analyses at least 60 days apart. Submit written reports of water analysis.

## **F. Demonstration**

1. Require a factory-authorized service representative to train Owner's adjust maintenance personnel to operate, and maintain HVAC water-treatment systems and equipment.



# Materials and Systems Standards Manual

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## Design Requirements

### D50: Electrical

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# Model Schools: Materials and Systems Standards

## D50 Electrical

### D5010.10 Packaged Generator Assemblies

#### A. Emergency Generator Codes-Qualifications

1. An emergency generator, rated for stand-by operation, shall be provided in schools as per NJSDA Bulletin #27 and #27A, dated 1/9/2003 and 8/26/2003 respectively.
2. Emergency generators shall meet the latest code requirements of UL, NFPA 70 (National Electrical Code), 101 and 110 respectively.
3. Authorized or franchised distributor shall have a minimum of Ten years documented experience with service facilities within 100 miles of project.

#### B. Criteria

1. Emergency generators 200KW or less shall be air-cooled or water cooled, utilizing natural gas from the local utility serving as the primary fuel source. A dual fuel emergency generator with an onsite secondary fuel source is not required if a letter from the Gas Utility Company, on their letterhead, stating that the gas service they are providing to the building is continuous and not dependent upon the local power grid. This letter must be submitted to and accepted by the DCA. A dual fuel generator and an alternate fuel connection with the supply line below grade shall be provided only if a letter from the Utility is not provided. If natural gas is not available, alternative fuel sources shall be considered on a case-by-case basis.
2. Emergency generators shall be supplied with load banks for generator testing.
3. Generator loads shall be divided into two (2) classifications, each of which shall be connected to the emergency generator distribution system via its own dedicated automatic transfer switch (ATS) as follows:
  - a. Emergency Life Safety Systems
  - b. Emergency Power Systems (non-life safety loads).

**Note: The fire or sprinkler pump controller shall have its own integral dedicated and listed ATS.**

4. The following systems shall be connected to the Emergency Life Safety Systems ATS:

Fire/Smoke Detection and Alarm Systems including all related control panels

- a. Main and Remote Emergency Control Centers
- b. Auditorium Stage Emergency Control Panel
- c. Emergency lighting in corridors, exit and emergency egress lighting, security night lighting, stairs and places of assembly.

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- d. Code-required exterior lighting fixtures at exit discharge doors.
  - e. Lighting, Power and Air Conditioning for Emergency Control Room and Backup Control Room.
  - f. Lighting for Main Office, Nurse's Office, Custodian Office, Security Desk, and Electrical Rooms.
  - g. Power to operate one elevator: minimum.
  - h. Elevator cab lighting
  - i. Elevator pit lighting and sump pump.
  - j. Air conditioning or ventilation systems serving elevator machine and information technology rooms
  - k. Smoke Control Systems (including smoke control systems required for atriums, elevator hoist way ventilation, and stair pressurization systems).
5. The following shall be connected to the Non-Life Safety ATS:
- a. Public Address System
  - b. Telephone System
  - c. Building Automation System
  - d. Intrusion Alarm System
  - e. Telecommunication Main Distribution and Intermediate Distribution Frame (MDF and IDF) Rooms; lighting, power and air conditioning systems.
  - f. Video Surveillance System
  - g. Gas Leak Detection and Alarm System
  - h. Central Station Reporting System
6. Generator Rooms/Utility Areas
- a. The preferred location of the emergency generator is outdoors on the roof or alternately on grade within close proximity to the Electrical Service Room in a sound attenuated weatherproof enclosure with a critical silencer muffler for maximum sound attenuation and engine exhaust noise.
  - b. Such rooms or areas shall be physically isolated from the main entrance and parking, and concealed from public view, all sides shall be enclosed with walls and have the capability of being locked and alarmed.

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c. Utility service transformer shall be concealed from public view, all sides shall be enclosed with walls and have the capability of being locked and alarmed.

d. Utility service entrance equipment mounted on the exterior of the building shall be enclosed with walls or fences with lockable doors or gates.

## **D5010.70 Transfer Switches**

### **A. Codes and Qualifications**

1. Transfer switches shall conform to the latest edition of NEMA ICS 10, Industrial Control and Systems, AC Transfer Switch Equipment, and NEC (NFPA 70). Inspect and test in accordance with NETA Standards.

2. Manufacture Qualification: Company specializing in manufacturing transfer switches with a minimum of ten years documented experience, with service facilities within 100 miles of project.

3. Supplier Qualification: Authorized distributor of specified manufacturer with minimum five years documented experience.

### **B. Criteria**

1. Transfer switches shall be automatic type with time delayed to provide optimum minimum sizing of the generator containing the following features.

2. The transfer switch shall be electrically operated, mechanically held double-throw type with single solenoid operator and mechanical/electrical interlocks.

3. The transfer switch shall contain a control panel with adjustable timing delay functions for normal, emergency and engine shutdown, including an In-Phase monitor.

4. The transfer switch shall be able to withstand a three-phase RMS fault for three cycles without the use of series current limiting fuses.

5. Transfer switches utilizing molded case circuit breakers or contactors shall be rated for continuous duty and repetitive switching.

6. Nameplates: Engraved lamicoid type screwed or riveted to transfer switch.

7. Environmental Conditions: Temperature 120 degrees F at an altitude of 3,300 feet.



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## **D5020 Electrical Service and Distribution**

### **D5020.10 Electrical Service**

#### **A. Electric Service Description/Design Approach**

1. At the Schematic Design or Preliminary Design Phase, the design engineer shall submit a service request/load letter to the utility company. This request shall inquire about the available service voltage, utility short circuit current and impedance, charges and any other requirements. The request shall also indicate the desired voltage and point of entry, as well as a site plan with all available geotechnical, architectural and structural information.
2. The design engineer must perform an economic analysis to justify the service voltage and / or the need for step-down transformers design.
3. If transformers are used the electrical engineer must coordinate with the HVAC discipline for the ventilation.
4. The main service switch shall be a bolted pressure switch type.

### **D5020.30 Power Distribution**

#### **A. Switchboards Codes**

1. Switchboards shall comply with the latest editions of NEC (NFPA 70) and UL 891 and shall be fabricated and installed to withstand the effects of earthquake motions determined according to SEI/SCE 7 requirements. Receive, handle and store switchboards according to NEMA PB 2.

#### **B. Criteria**

1. Busses and Connections: All buses (phase, neutral, ground and connections) shall be hard-drawn copper of 98 percent conductivity tinplated of uniform ampacity for entire length of switchboards main and distribution sections. Future extensions from both ends shall be provided. Neutral buses shall be minimum, 100 percent of the ampacity of phase buses. Bolted bus connections to be front accessible for maintenance.
2. Short-circuit Rating: Switchboards, circuit breakers, switches and fuses shall be rated to withstand and interrupt the full value of the available short circuit current. Series connected rating are not acceptable.
3. Submit Short Circuit, Coordination, and Arc Flash Study of entire distribution system in accordance with NFPA 70E, prior to equipment fabrication.
4. Overcurrent Protective Services: Switchboards shall contain Solid state-molded case circuit breakers in compliance with UL 489, and contain adjustable electronic RMS sensing for adjustable timing and current settings for circuit breakers 250 A and larger. Interrupting capacity to meet available fault currents. All other circuit breakers shall be Thermal-Magnetic type.

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5. Future Provisions: Equipment spaces for future devices with bussing and bus connections, insulated, and braced for short circuit currents. Components to have continuous current rating.
6. Transient Voltage Surge Suppressor (TVSS): The TVSS shall not be an integral component of the switchboard. Provide the TVSS in accordance with the latest edition of UL 1449, standard for safety and UL 1283, Electromagnetic Interference Filters. TVSS to have a life expectancy of at least 5000 transients without failure or degradation in accordance with ANSI/IEEE C62.41 Category C3 transients. TVSS to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage. A transient event surge counter shall be located on the front cover of the switchboard. The counter shall be equipped with a manual reset and battery to retain memory upon loss of AC power.
7. Nameplates and Labels: Nameplates shall be screwed or riveted to equipment. Glue will not be an accepted alternate method. Label each switchboard compartment, disconnect, overcurrent protective device, meter and control device mounted in compartment doors.
8. Bases: Switchboards shall be installed on concrete base, 4-inch nominal thickness.
9. Filler plates: unused spaces of panel mounted sections shall be provided with filler plates.
10. Environmental conditions: install switchboards in enclosed weather tight spaces after wet and dry work above switchboards is complete and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
11. Equipment operating conditions: Rate equipment for continuous operation under an ambient temperature not exceeding 104 degrees F at an altitude not exceeding 6600 feet.
12. Protection: Apply temporary heat to maintain temperature according to manufacturer's written instructions until switchboard is ready to be energized and placed into service.
13. Infrared Scanning: After substantial completion but not more than sixty days after final acceptance perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner. Perform an additional follow-up infrared scan of each switchboard (11) months after date of substantial completion. Include a certified report describing scanning results.

# Model Schools: Materials and Systems Standards

## **D5020.30 Power distribution**

### **D5020.30.20 Panelboards**

#### **A. Panelboards Codes and Certifications**

1. Panel boards shall comply with the latest editions of NEC (NFPA 70), NEMA PB 1. Panel boards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 requirements. Fabricate and test according to IEEE 344 to withstand seismic forces. Install Panelboards and accessories according to NEMA PB 1.1.

2. Submit certification that panelboards, overcurrent protective devices accessories and components will withstand seismic forces. Indicate whether withstand certification is based on actual test of assembled components or on calculations.

#### **B. Criteria**

1. Busses: All busses (phase, neutral, ground) shall be hard-drawn copper of 98 percent conductivity. Neutral busses where indicated shall be minimum, 200 percent of the ampacity of phase busses and UL listed as suitable for nonlinear loads.

2. Short-circuit current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Series connected ratings are not acceptable.

3. Branch overcurrent protective devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units. Mounting brackets, bus connections, filler plates and necessary appurtenances required for future installation of devices.

4. Overcurrent Protective Services: Panel boards shall contain thermal-magnetic molded case circuit breakers and comply with UL 489. Thermal - magnetic circuit breakers to contain adjustable magnetic trip settings 250 A and larger, with interrupting capacity to meet available fault currents.

5. Doors: Concealed hinges secured with flush latch and tumbler lock; keyed alike. Distribution panels to be door-in-door construction.

6. Nameplates: Nameplates shall be screwed or riveted to equipment.

7. Filler plates: unused spaces of panel mounted sections shall be provided with filler plates.

8. Directory Card: inside panelboard door mounted in metal frame with transparent protective cover.

9. Environmental conditions: install panelboards in enclosed watertight spaces after wet and dry work above panelboards is complete and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

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## Design Requirements

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10. Equipment operating conditions: Rate equipment for continuous operation under an ambient temperature not exceeding 23 degrees F to 104 degrees F at an altitude not exceeding 6600 feet.
11. Equipment mounting: install floor mounted panelboards on concrete bases, 4-inch nominal thickness.
12. Acceptance Testing: Perform acceptance tests in accordance to NETA. Test insulation resistance for each panelboard bus, component, connecting supply, feeder and control circuit. Test continuity of each circuit. Certify compliance with test parameters.
13. Infrared Scanning: After substantial completion but not more than sixty days after Final Acceptance perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner. Perform an additional follow-up infrared scan of each panelboard (11) months after date of substantial completion. Include a certified report describing scanning results and include notation of deficiencies, remedial action taken and observations after remedial action.
14. Load Balancing: After Substantial Completion but not more than 60 day after final acceptance measure load balancing and make circuit changes as necessary. Differenced exceeding 20 percent between phase loads is not acceptable. Rebalance and recheck as necessary to meet the minim requirement
15. Protection: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

### D5020.30.30 Transformers

#### A. Transformers Codes and Qualifications

1. Transformers shall comply with the latest edition of NEMA ST 20, NETA STD ATS, NFPA 70, UL 1561 and NEMA ST – TP2.2. Manufacture Qualification: Company specializing in manufacturing transformers with a minimum of ten years documented experience.

#### B. Criteria

1. All transformers shall be air-cooled two-winding dry type with copper windings
2. Insulation system shall be UL Class 220 degree C with an average temperature rise of 115 degree C in a maximum ambient temperature of 40 degree C. and a hot spot temperature of 30 degrees C.

### D5020.70 Facility Grounding

#### A. Codes

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1. A grounding and bonding system for underground utilities, steel building structure grounding electrode system, ground well test stations, equipment, raceways and piping, shall be provided in accordance with the latest edition of UL 467, and NEC (NFPA 70).

## **B. Criteria**

1. All wiring shall be copper with cast bronze cable splicers and clamps. Use exothermic – welded connections for outdoor locations.
2. Measured ground stance values:
  - a. Building Structure Grounding Electrode System, Pad-Mounted Equipment: 5 ohms
  - b. Power and Lighting Equipment with capacity 500kVA and less: 10 ohms
  - c. Power and Lighting Equipment with capacity more than 1000kVA: 3 ohms
3. Testing and inspections: After installing grounding system but before permanent electrical circuits have been energized test for compliance with above criteria. Make tests at ground rods before any conductors are connected. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means for reducing natural ground resistance. Perform all tests by fall-of – potential method according to IEEE 81.

## **D5030 General Purpose Electrical Power**

### **D5030.10 Branch Wiring System**

#### **A. Conduits and Codes**

1. Conduits shall comply with the latest editions of ANSI C80.1, ANCI C80.3, NECA 1, NECA 101, NEMA TC 2, NEMA TC 3, and NFPA 70. Products to be listed and classified by underwriters Laboratories, Inc. as suitable for purpose specified and shown on construction documents.

#### **B. Criteria**

1. Protection: Conduits to be protected from corrosion and entrance of debris by storing above grade and providing appropriate covering. Protect PVC conduit from sunlight.
2. Interior Installation: All conduits located concealed in ceiling and walls or run exposed shall be installed in electrical metallic tubing for branch circuit wiring. Rigid Steel Conduit shall be used where conduit is encased in the buildings poured concrete construction or exposed to weather or wet and damp locations. Minimum Size: ¾ inch.
3. PVC Conduit: Heavy wall non-metallic conduit shall be used for all conduits buried in ground or in concrete ductbank.

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4. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type up to 1-1/4 inch EMT, and set screw type; 1-1/2 inch and larger EMT. Cast compression fittings are not acceptable.

## **C. Wire Codes and Qualifications**

1. Wire to conform to latest addition of NFPA 70

2. Manufacturer qualifications: Manufacture Qualification: Company specializing in manufacturing wire with a minimum of ten years documented experience.

3. Supplier Qualification: Authorized distributor of specified manufacturer with minimum five years documented experience.

## **D. Criteria**

1. Concealed Dry Interior Locations: Install building wire in raceway or use metal clad cable. Use of metal clad cable is limited to 30 amps, single-phase circuits, as permitted by NFPA 70.

2. Exposed Dry Interior: use building wire in raceway.

3. Above accessible ceilings and in drywall: use building wire in raceway or metal clad cable. Use of metal clad cable is limited to 30 amps, single-phase circuits.

4. Wet or damp interior locations: Use building wire in raceway.

5. Exterior Locations: Use building wire in raceway.

6. Underground Installations: Use building wire in raceway.

7. Solid Conductors: Use 10 AWG and smaller.

8. Control Circuits: Use stranded conductors.

9. Minimum Conductor Sizes: use 12 AWG for power and light, and 14 AWG for control circuits.

10. Material: All conductors shall be copper.

11. Insulation Type: THHN/THWN for branch wiring, single conductor for feeders.

12. Temperature Rating: 90 degrees for wet or damp locations and 90 degrees for dry locations.

13. Metal Clad Cable: Use galvanized steel armor jacket with interlocked metal tape and green insulated grounding conductor.

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14. Ground wire: provide a separate green isolated ground wire in each feeder and branch circuit and other conduits containing current carrying conductors.
15. Dedicated neutral: each single-phase branch circuit shall consist of respective phase conductor and a dedicated neutral conductor, unless specifically indicated otherwise on the plans.
16. Identification: Identify each conductor with its circuit number and/or other designations.
17. Testing: Test all wiring for continuity and insulation resistance in accordance with NETA Standards.

## **D5030.50 Wiring Devices**

### **A. Codes and Qualifications**

1. Wiring devices such as switches, dimmers and receptacles shall comply with the latest editions of NECA 1, NEMA WD 1, NEMA WE 6 and NFPA 70. Provide products listed and classified by UL, Inc. as suitable for the purpose specified.
2. Manufacturer qualifications: Company specializing in manufacturing wiring devices with a minimum of five years documented experience.
3. Supplier Qualification: Authorized distributor of specified manufacturer with minimum five years documented experience.

### **B. Criteria / Wiring Devices**

1. All wiring devices shall be heavy duty specification grade. Wall dimmers shall be T-Star rated.
2. Wall plates: type 302 brushed finish stainless steel, .035 gauge thick. Cover plates for emergency receptacles shall be red in color.

### **C. Criteria / Classrooms Receptacles**

1. Classroom receptacles for general instruction shall be provided with convenience outlets in accordance with DOE standards, specific equipment requirements, and the furniture layouts. Receptacles shall be 20-amp, 120-volt duplexes, specification grade.
2. Kindergarten, and pre-kindergarten classrooms, safety type receptacles shall be installed. Also all toilet rooms serving these classrooms shall be GFI protected.
3. All receptacles serving computer stations, printers and scanners shall be surge suppression type. Receptacles shall be rated for a minimum of 1000joules.

### **D. Criteria / Corridors, Lobbies, Places of Assembly, Parapets, Pipe Chases and Roofs**

1. Receptacles for maintenance shall be 20 Amp, 120 Volt, Specification grade, duplex type and spaced so that all areas are accessible by a 50' extension cord. Exterior receptacles shall be lockable and GFCI protected.

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## **E. Criteria / Telecommunications Room**

1. Minimum of ten quadruplex dedicated receptacles shall be provided at the Main Telecommunications Room data racks and cabinets. The receptacles shall be placed near the data racks and cabinets, a minimum of two quadruplex receptacles for each rack or cabinet. Unless otherwise required by specific equipment, two 20-amp, 220-volt circuits with L6-20R twist lock receptacles shall be provided in the MDF Room at the main data rack to power the switch.
2. IDF Room: Three duplex, dedicated 20 Amp, 120 Volt receptacles shall be provided at least two feet apart near the IDF.

## **F. Criteria / Building Management System**

1. Provide four dedicated duplex receptacles at least two feet apart in the room housing the BMS control system.
2. Provide a dedicated duplex receptacle in other locations housing BMS equipment requiring power.

## **G. Criteria / Coordination**

1. Building Management System (BMS) requirements shall be coordinated with specific equipment requirements in addition to the following:
2. All data and BMS design documents, including riser diagram and floor plans, shall be submitted to the NJSDA Systems Integrator for review and approval during the appropriate construction document phase.

## **H. Criteria / Kitchen Electrical Requirements**

1. Electrically and mechanically operated gas valves shall be installed in kitchens and interlocked with auxiliary systems and kitchen equipment to provide proper control and safe operation as well as emergency features. The interlocks and control schemes shall be as follows:
  - a. Exhaust Fan Interlock with Appliances
  - b. NFPA requires the energy source (gas or electric) producing heat for each appliance under hood to be interlocked with exhaust fan.
  - c. In general, each gas appliance contains an integral gas shut down solenoid. Appliances with a gas pilot must be provided with a pilot bypass. The solenoid control circuit is factory wired to the main electrical supply for the appliance. Therefore, with gas or electric operated appliances, the main electrical supply shall be interlocked with the exhaust fan.
  - d. The power for the equipment under the hood shall be served from a dedicated power panel sub-fed from the main kitchen power panel and equipped with as many branch circuit breakers as required. This power panel shall be controlled via an auxiliary contact from the hood exhaust fan motor starter incorporated in the switching control circuit of a remote control switch.



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## 2. Fire Extinguishing System/Appliance Shutdown

- a. When the fire extinguishing system is activated, the energy source for the appliances under hood must be shut down. However, the exhaust fan must continue to operate so as to aid in the dispersing of the extinguishing agent.
- b. To accomplish this, a normally closed pressure activated micro switch, supplied by the fire extinguishing system contractor and shall be wired to the control loop of the relay. This will shut down panel when the extinguishing system is activated. In addition, a second micro switch contact shall be provided to notify Fire Alarm Control Panel when extinguishing system is activated.
- c. The main gas supply is shut down by a mechanically operated valve, activated by the extinguishing system. This valve has no electrical connections.

## 3. Kitchen Master Control Gas Valve

- a. The Master Control Gas Valve shall be capable of shutting off all gas flow to the kitchen in case of emergency. This sub-system is comprised of a 120 Volt 60 Hz AC valve, a relay control panel, and a control station. The control station shall contain a key switch to energize the gas valve and a red mushroom push-button labeled "Emergency Gas Shutoff."
- b. The Master Control Gas Valve shall be controlled by a control station located near the equipment. Additionally, control stations shall be located at each means of egress of the Kitchen. The Master Control Gas Valve shall control the gas supply to all gas-fired appliances, including the pilot lights, when the Kitchen is closed for long periods of time and for an emergency shut-off situation.

## 4. General Electrical Requirements for the Kitchen

- a. Exhaust hood light fixtures provided by the Kitchen Equipment Contractor shall be installed and connected to a switch by the Electrical Contractor. The switch provided by the Electrical Contractor shall be installed next to the exhaust fan switch.
- b. All disconnect switches in kitchen area shall be in NEMA 4 enclosures to provide protection against splashing water. Surface mounted switches shall be provided with waterproof hubs.
- c. All kitchen receptacles shall be GFCI protected, 20 Amp, 125 Volt specification grade. GFCI protection may be provided at the panel in lieu of the receptacle.
- d. The Kitchen Power Panels shall be located in an area adjacent to the kitchen, but not in the kitchen itself.

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## D5040 Lighting

### D5040.10 Lighting Controls

#### A. Lighting Controls – Design Approach

1. All interior lighting shall be automatically controlled by a Digital Lighting Management System except for the emergency lighting. Provide Lighting Control Panels in Electric Closets on each floor connected to Lighting Panels for automatic shut-off within **20** minutes of occupants leaving interior spaces.

#### B. Codes – Qualifications

1. Lighting control system shall be based on current presiding codes in accordance with ASHRAE 90.1, and NFPA 70. Provide equipment with labels or certifications from applicable testing agencies as required by codes and referenced standards.
2. Manufactures Qualifications: Company specializing in manufacturing Digital lighting control systems shall have a minimum of five years documented experience with service facilities within 100 miles of project.

#### C. Criteria

1. Components shall plug together in any configuration with preassembled RJ45 connectors/category 5e cables.
2. Lighting control system shall be networked for scheduled control and remote system management.
3. Lighting control methods shall be provided in accordance with the table below:

AREA	LOCAL SWITCH CONTROL	LOCAL-AUTOMATIC CONTROL/SENSOR	COMMENTS
<b>AUDITORIUM/MULTIPURPOSE</b>			
Circulation Paths	Line-voltage switch	Not required	Switches at entrances and stage area to control minimal entry/circulation illumination.
Seating Area	Line-voltage Switch	Not required	Switches to control house lighting to be located at the stage.
Stage Area	Line-voltage Switch	Not required	Switches to control non-theatrical stage lights to be located at the stage.
Gym	Not required	Occupancy sensors	Ceiling mounted sensors to automatically turn lights on/off.

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## Design Requirements

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Cafeteria/Lunchroom	Not required	Occupancy sensors	Ceiling mounted sensors to automatically turn lights on/off.
Kitchen	Low-voltage switch	Vacancy sensor	Switches at entrance.  Ceiling mounted vacancy sensors.  Manual-on/Auto-off
Classrooms	Low-voltage switches	Vacancy sensor  Daylight sensor	Main switch bank at entrance: Daylight zone switch (row nearest windows) Non-daylight zone switch (rows away from windows).  Teaching Control Center switch bank (three switches); Whiteboard-on/off switch, General-uplights or downlights switch, Quiet time-1hr override switch.  Ceiling mounted sensors
Conference/Work rooms	Line-voltage	Vacancy sensor	Wall mounted sensor/switch. Manual-on/Auto-off
Control rooms	Line-voltage	Not required	

Dance Studios	Low-voltage switch	Vacancy sensor	Ceiling mounted sensor. Manual-on/Auto-off.
Media Center	Low-voltage switch	Vacancy sensor Daylight sensor	Main switch bank at entrance: Daylight zone switch, Non-daylight zone switch.  Ceiling mounted sensor
Individual Offices	Line-voltage switch	Vacancy sensor	Wall mounted sensor. Manual-on/Auto-off
Records Room	Occupancy sensor/switch	Occupancy sensor	Wall mounted sensor/switch. Manual-on/Auto-off
Staff – Lunchroom/Lounge	Low-voltage switch	Vacancy sensor	Ceiling mounted sensor. Manual-on/Auto-off.
<b>SERVICES/UTILITIES</b>			
Electric Closets	Line-voltage switch	Not required	
Elevator Machine Room	Line-voltage switch	Not required	
Janitor Closets	Line-voltage switch	Not required	
Mechanical Areas – Service Areas	Line-voltage switch	Not required	
Pipe Chases/Crawl Spaces	Line-voltage switch	Not required	
Shops & Areas with	Line-voltage switch	Not required	

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## Design Requirements

## Electrical - Section D50

Machinery			
Storage Rooms	Occupancy sensor/switch	Occupancy sensor	Wall-mounted sensor/switch. Manual-on/Auto-off.
Switchboard Rooms	Line-voltage switch	Not required	
Telecommunication Rooms	Occupancy sensor/switch	Occupancy sensor	Wall-mounted sensor/switch. Manual-on/Auto-off
<b>CIRCULATION AREAS</b>			
Lobby /Main Entrance	Not required	Not required	Lights controlled by control panel.
Corridors	Key-operated switch (emergency lights only)	Not required	Key operated switch located at main entrance for emergency lighting in corridors only. Other lights controlled by control panel.
Stairs	Key-operated switch (emergency lights only)	Not required	Key operated switch located at main entrance for emergency lighting in stairs only. Other lights controlled by control panel.
<b>PHYSICAL EDUCATION</b>			
Locker/ Shower Rooms	Not required	Occupancy sensor	Ceiling mounted sensors to automatically turn lights on/off.
Swimming Pools	Not required	Occupancy sensor	Ceiling mounted sensors to automatically turn lights on/off.
Exercise room	Not required	Occupancy sensor	Ceiling-mounted sensors to automatically turn lights on/off.
<b>TOILETS</b>	Occupancy sensor/switch	Occupancy sensor	Wall-mounted sensor/switch. Manual-on/Auto-off.

### D. Testing:

1. Upon completion of control system, manufacturer shall commission system and document that system is installed and functions in accordance with contract documents. All testing documentation shall be submitted for review and acceptance.

## D5040.50 Lighting Fixtures

### A. Codes and Qualifications

1. Lighting fixtures shall comply with the requirements of NEC (NFPA 70), 101, ANSI, NECA/IESNA 500 (application, installation, and safety) and products listed and classified by United Testing Laboratories, Inc.
2. Provide lighting levels based on current presiding codes designed in accordance with recommendations of N.J.A.C. 6A:26-6.3, 6.4, ANSI/IES-RP3-and ASHRAE 90.1.
3. Provide luminaries that do not collect dirt rapidly and are readily cleanable in

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accordance with IESNA Category 1, 2, or 5 for minimum dirt accumulation and Luminaire Dirt Depreciation (LDD) factors.

4. Power Consumption and Efficiency shall comply with Lighting Power Density (LPD) requirements in accordance with ASHRAE 90.1, Table 9.6. (Space by space method) and provide LPD for entire school.

5. LED Drivers shall comply with ANSI C82.15-2021(where applicable), FCC rules and regulations, Title 47 Part 15 Class A or B and be manufactured in a factory certified to ISO 9001 quality standards.

6. LED drivers shall carry a ten year full replacement warranty from date of manufacture.

7. Manufacturers Qualifications: Company specializing in manufacturing interior lighting products that meet the requirements of these standards with a minimum of 10 years experience.

## **B. Criteria**

1. General: Lighting fixtures shall be appropriate for their specific location, taking illumination level and quality, efficiency and ease of maintenance into consideration. Lighting Power Densities (LPD) should not exceed 80% of the values listed in ASHRAE 90.1.

2. Fixture Types number of different fixture types shall be limited to as few as possible. Custom fixtures shall not be used. All lighting fixtures must be of a design that permits re-lamping by the custodian without the use of special tools or equipment with the exception of vandal proof fixtures.

3. Lamps: Linear fluorescent lamps shall not be used. Mercury Vapor Lamps; Low and High Pressure sodium lamps shall not be used. The use of incandescent lamps shall be limited to theatrical lighting.

4. LED Drivers: provide high-efficiency drivers with less than 10% total harmonic distortion and high power factor greater than 0.98. Provide 0-10v analog continuous dimming from 0% to 100% for all lighting under occupancy or daylight sensor control.

5. Portable Lamps: The use of portable lamps (not permanently attached to the building or other building furnishings) may not be used to accomplish required interior lighting unless specifically specified.

6. Lighting Layouts: Provide lighting layouts in accordance with the geometry of the space and the location of visual tasks.

7. Visual Comfort: Provide lighting systems for achieving visual comfort with the following characteristics:

a. Luminance Ratio: maximum luminance of luminaire does not exceed average luminance by ratio of more than 4:1 at 45,55,65,75 and 85 degrees from nadir for

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crosswise and lengthwise viewing.

b. Maximum luminances of luminaires crosswise and lengthwise do not exceed the following values:

- 1.) 45 degrees above nadir 7500 cd/sq m.
- 2.) 55 degrees above nadir: 5000cd/sq m.
- 3.) 65 degrees above nadir: 3500 cd/sq m.
- 4.) 75 degrees above nadir: 2200cd/sq m.
- 5.) 85 degrees above nadir: 1500cd/sq m.

c. Spatial Luminance: Provide luminous environments throughout project in which brightness ratios are maintained within the following ranges:

- 1.) Task Area and Adjacent Darker Surroundings: 3:1
- 2.) Task Area and Adjacent Lighter Surroundings: 1:3
- 3.) Task Area and More Remote Darker surfaces: 5:1
- 4.) Task Area and More Remote Lighter Surfaces: 1:5

d. Lamp Color: provide light sources throughout project with color temperatures and Color Rendering Indices (CRI) as listed below. Other color temperatures may be considered subject to SDA approval.

- 1.) Linear Fluorescent Lamps: 3500 Degrees K; CRI 80 minimum.
- 2.) Compact Fluorescents Lamps: 3500 Degrees K; CRI 80 minimum.
- 3.) Metal Halide Lamps: 4000 Degrees K; CRI 65Mimumum.
- 4.) LED Lamps: 3500 Degrees K; CRI 80 minimum

e. Light Source: Provide lamps with average lamp efficacy rating not less than the following:

- 1.) Tungsten- Halogen Lamps: 25 lumens / watt
- 2.) Compact Fluorescent Lamps: 69 lumens / watt
- 3.) Linear Fluorescent Lamps: 90 lumens / watt
- 4.) LED Lamps: 110 lumens / watt

f. Lighting Calculations: Calculations shall be prepared by a registered electrical engineer along with associated product data for lamps and luminaires. As the basis for the calculations use room reflectance of 80/50/20 (ceilings/walls/floors)

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and a total light loss factor of not less than 0.75. Foot-candle calculations shall be average maintained based on a work plane of 30" AFF.

## C. Lighting Fixture Requirements by Space

1. Cafeteria/Lunchroom: Pendant 96"x11"x5" industrial LED linear fixture with white steel cross baffle and frosted acrylic lens.
2. Classrooms:

Pendant rectilinear, linear LED direct/indirect (30% up / 70% down) lighting units with white cross blade baffle, baffles spaced 0.5" apart

3. Classroom Whiteboard:
  - a. Recessed single lamp fluorescent extruded wall washer with 25-gauge Alano<sup>®</sup> semi-specular aluminum asymmetric reflector with 94% high reflectance finish. Seismic brackets shall be integrated into the fixture assembly.
  - b. When pendant direct / indirect scheme is chosen, provide oval pendant mounted single lamp fluorescent wall washer with 25-cell white cross blade baffles, optical chamber painted with 96% reflective white paint. Body shall be extruded aluminum, with 18-gauge steel end brackets and no exposed fasteners, holes or knockouts. Length as required for whiteboard illumination. Classroom fixtures shall have a minimum efficiency rating of 85% as measured by independent testing laboratory.
4. Computer Rooms: See classroom direct/indirect fixture for description.
5. Corridors: Recessed 2'x4', LED volumetric luminaire with smooth acrylic diffuser.
6. Elevator machine room: surface heavy duty 4-foot pendant/surface LED fixture with symmetrical white reflector with 10% uplight and replaceable diffuser.
7. Gymnasium and Multipurpose Room: High bay LED fixtures .
8. Janitor Closets: See elevator machine room for fixture description.
9. Kitchen Areas, Kitchen, Store rooms and Served Areas: recessed 2'x4' LED luminaire with prismatic K12 lens, and UL listed for wet location. Vermin proof, with silicone sealant on all seams.
10. Media Center / Library: Pendant direct/indirect (85% down/15% up) LED linear fixtures with 0-10v analog dimming for daylight zone. Excludes entrance, circulation desk. Provide number of lamps in accordance with foot-candle requirements.
11. Mechanical / Electrical / Telecommunication Rooms: 48" long pendant/surface LED fixture with symmetrical white reflector with 10% uplight, and replaceable diffuser.

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13. Office: Recessed 2' x 4' indirect volumetric LED fixture with "gull-wing" shape.
14. Records Room: See Office *for fixture description*.
15. Shower Room: See Kitchen for fixture description.
16. Stairs-main/intermediate landings: 18" surface-mounted LED with vandal-resistant lens.
17. Stairs-underside: Surface 4' x 8" LED with vandal-resistant lens.
18. Exits: Exit signs shall LED type, low profile; cast aluminum with red letters, white finish and universal arrows.
19. Toilet / Locker Room: recessed tamper resistant 2'x2', LED luminaire with prismatic high impact K12 lens.
20. Refer to Performance Specifications Section D5040.30 for additional project-specific lighting requirements.

## **D. Emergency Lighting- Design Approach**

1. Provide power for Emergency Lighting through the Emergency Systems automatic transfer switch for all areas listed in Section D5010.10.

## **E. Criteria**

1. Illumination Levels required for emergency lighting shall be measured at the floor as follows:
  - a. Places of Assembly
    - 1.) General .....1.0FC
    - 2.) Aisle.....2.0FC
    - 3.) Exit Doors.....2.0FC
  - b. Corridors, exits, exit discharges, Areas of Rescue Assistance .....2.0FC
  - c. Exterior exit lights immediately adjacent to exit doorways.....5.0FC
  - d. Safe Areas, including all stairs, ramps, within the area.....5.0FC
  - e. Fire Rescue Areas/Areas of Rescue Assistance.....1.0FC
  - f. Corridor sign for Fire Rescue Area/Area of Rescue Assistance.....25.0FC



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## **F. Exit Signs-Design Approach**

1. Exit signs shall be placed by the Architect of Record to be code compliant. Means of egress shall be clearly marked by illuminated exit signs with 8" letters so that exits and path of egress are easily recognized from any point in a corridor or Place of Assembly.

## **G. Criteria / Exit Signs**

1. Exit Signs placement shall be such that no point in an exit access corridor is more than 100 feet or the UL listed viewing distance for the sign whichever is less, from the nearest visible exit sign.
2. Wall mounted exit signs are preferred over pendant mounted exit signs.
3. Pedant mounted exit signs should be strictly limited to meet visibility requirements and only when additional wall mounted units may not suit the need.

## **D5040.50 Stage and Platform Lighting**

### **A. Design Approach and Codes**

1. The Stage and Platform Lighting requirements contained herein represent a minimum standard that shall be met. In the event that the Design Consultant and their Sub-Consultants has a justifiable reason to increase any of these requirements, the justification must be presented both verbally and in writing and approved by the NJSDA at the earliest stage in the Design Phase(s) as possible.
2. A dimming system shall be provided for auditorium/stage area/platform lighting. The dimming system shall control spotlights and border lights via a stage control panel mounted on the stage area/platform and a remote portable control console that can be plugged into remote outlets. (Emergency lighting is not part of the dimming system and shall not be dimmed.)
3. The lighting and dimming systems shall be in accordance with the local district and Department of Education requirements, NFPA 70 and UL.

### **B. Criteria/Lighting**

1. Coordinate exact location and mounting height of all fixtures with the Architect.
  - a. Spotlights
    - 1.) Provide two (2) sets of spotlights, Each set shall consist of four (4) 6" adjustable zoom (beam angle 25-50 degrees) type ellipsoidal reflector spotlights. Fixtures shall be paired to light the Left, Center and Right portions of the stage, with the fourth fixture pair as a Front Special. Fixtures shall use 575 watt tungsten, 2000 hour life lamps. All spots to be dimmer controlled.
  - b. Border Lights
    - 1.) Border Lights: Provide two rows of track lights above platform. Each track shall consist of lamp sockets 6" on center with permanent glass color filters and 100 watt lamps. Each track shall be wired for four colors

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(Clear, Red, Amber, Blue) on four alternating circuits (every fourth lamp). Minimum of two circuits per color.

2.) Control: One dimmer per circuit, one control channel per color.

c. Worklights: Provide 4 foot LED strip lights above the platform, switched separately from the dimming system.

## C. Criteria/Dimming System

### 1.) Dimmer Racks

a.) Dimmer racks shall be wall mounted dead front type. They shall accept plug-in electronic control modules and be designed to contain up to 24 plug-in dimmer modules each rated at 2.4 KW.

b.) Dimmer racks shall be provided with a lockable door.

c.) Dimmer racks shall be 120/208V, 3-phase, 4-wire, 60 Hz A.C.

### 2.) Portable Control Console

a.) Control console shall be microprocessor-based with 24 channels for two scene preset and manual operations, and switchable to 96 channels, 500 cues for advanced operation. Each dimmer shall be individually controllable with the control console. Console shall allow Sub-Master grouping of control for multiple circuits such as border light colors. Console shall also have display and on-screen help menus.

### 3.) Stage Control Panel

a.) Stage control panel shall be equipped with faders and master intensity control to provide easy playback and recording of a minimum of 8 lighting presets. Manual sliders shall be provided for Left, Center, Right and Front Special spotlights, Overhead Clear, Amber, Red and Blue Border lights, two Overhead Specials and Two Stage Specials.

b.) Stage control panel shall be wall mounted inside a lockable enclosure located on stage. Enclosure to be flush mounted.

### 4.) Entry Stations

a.) Provide additional single gang control stations at entry doors. Entry Stations shall have a key lockable cover and allow selection of the first preset and off.

c. Worklights: Provide industrial fluorescents above the platform, switched separately from the dimming system.

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## **D5040.50 Exterior/Site/Security Lighting (Refer also to G4050 Site Lighting)**

### **A. Design Approach**

1. Exterior/Site/Security Lighting shall be provided on the building, around the perimeter of the school and on playing fields for safe passage of students and staff to deter theft and vandalism. Lighting design shall minimize light trespass from the building and site, reduce sky glow, improve nighttime visibility through glare reduction and reduce development impact on the nocturnal environment. Provide building elevations and site plan to clearly depict the location and mounting height of each fixture.

### **B. Codes and Qualifications**

1. The exterior lighting shall be designed in accordance with IESNA Handbook-2000, 9th addition, ANSI/ASHRAE/IESNA Standard 90.1-2007-Exterior Lighting Section, and the International Dark-Sky Association (IDA).
2. Exterior lighting fixtures to be IDA approved as "Dark Sky Friendly"
3. Provide luminaires of IESNA Category 1, for minimum dirt accumulation and luminaire dirt depreciation (LDD) factors.
4. Manufacturers Qualifications: Company specializing in manufacturing Exterior lighting products that meet the requirements of these standards with a minimum of 10years experience

### **C. Criteria**

1. Light Levels: Provide average maintained foot-candle levels for exterior spaces that are based on the primary visual tasks to be accommodated with a maximum deviation of 15% when measured at grade level. Uniformity ratios are average to minimum as follows:
  - a. Bldg. Entrance Areas (exits, walkways,(uniformity 4:1).....5.0FC
  - b. Building Perimeter (20-foot depth from the building-(uniformity, 4:1) .....1.0FC
  - c. Pedestrian Sidewalk (uniformity ratio, 10:1).....1.0FC
  - d. Pedestrian Stairways (uniformity ratio, 10.1).....1.0FC
  - e. Site (playgrounds, yards, and athletic fields security lighting).....0.6 FC
2. Light Quality: Glare minimization, provide exterior area lighting that minimizes the incidence of discomfort glare and avoids disability glare under all normal conditions of use in accordance with IESNA recommendations. Provide light sources throughout project with Color Rendering Index of not less than 70.
3. Calculations: Calculations of illuminance levels and uniformity ratios for representative exterior areas shall be prepared by a registered electrical engineer along with associated product data for lamps and luminaires. Measurement of actual installation shall be in accordance with procedures referenced in ANSI/IESNA RP-8-(R05).

# Model Schools: Materials and Systems Standards

4. Outdoor Operating Temperature: Provide lighting systems that operate at temperatures as low as -10 degrees F.

5. Tamper Resistance:

- a. Parts not easily removed without the use of special tools
- b. Luminaires mounted at minimum height of 12ft above grade
- c. Lenses of tempered glass or high impact acrylic.
- d. Metal gratings for protection of optical assemblies.

## **D. Lighting Fixture Equipment**

1. In general, site lighting luminaires shall be wall surface mounted. Building parapet mounted lighting fixtures shall be utilized only with permission from the NJSDA. Lighting levels shall be achieved utilizing the following equipment.

2. Luminaires shall have high reflectivity segmented optical system with minimum efficiency of (66%). Lighting distribution NEMA Type 3 and Type 4 shall be used.

3. Luminaires shall have a minimum IP 65 ratings, a minimum 2G vibration tested and shall be UL 1598 listed for 25 degrees C ambient temperature application.

4. Luminaire Type: Semi-direct, Semi-indirect, and indirect lighting units shall not be used. Light distribution by direct methods only. Use reflectors or refractors for optical control.

5. Mounting: Provide luminaires with cutoff optical system. The Use of non cutoff luminaires shall not be utilized and may be permitted for construction lighting, historic restoration lighting and lighting for architectural features and sculptures.

6. Mounting System: Provide mounting system for exterior area lighting that is capable of withstanding 3-second wind gusts in excess of 100mph.

7. Finish: Material and finish of housing compatible with mounting and exterior building elements.

8. Poles: The usage and quantities of poles shall be limited and shall be used only with the written approval of the NJSDA.

9. Lamps: Use Compact fluorescent or metal halide lamps. No other lamp types shall be used.

10. Lighting Controls: Site security lighting shall be master controlled by the building lighting management system.

# Model Schools: Materials and Systems Standards

## D5080 Miscellaneous Electrical Systems

### D5080.10 Lightning Protection

#### A. Lightning Protection - Design Approach:

1. At the Schematic Design Phase, a Lightning Risk Assessment is not required.
2. The engineer of record shall engage the services of an LPS manufacturer's Engineering Department for assistance in the design of the system.

#### B. Codes and Qualifications

1. An Early Streamer Emission lightning protection system shall be provided for new schools and additions, in accordance with NFPA-70 and DOE specifications after the lightning risk analysis indicates a LPS is justified.
2. The Equipment supplier and installer shall comply with the Manufacturer's Installation Standard HBP-21 and Travelers Insurance Co requirements.
3. Applied Research Laboratories, Inc. (independent, nationally recognized testing laboratory) shall list the components, inspect and certify the installation for compliance with Manufacturer's Installation Standard HBP-21.
4. The installing contractor shall make a video recording capturing the entire installation of all accessible, inaccessible, concealed and buried components/connections and submit to the ESE manufacturer for evaluation, certification, archiving and documentation.
5. The Manufacturer shall forward the video to Applied Research Laboratories for inspection and certification.
6. Supplier and Installer shall have a minimum of 25 years documented experience with service facilities within 100 miles of the project.

#### C. Criteria

1. The lightning protection system shall be installed so that the completed work does not detract from the buildings appearance. The system shall consist of the following major components:
  - a. Strike Termination Device(s) (air terminal), mast, base and supports provided on the rooftop .The flagpole may be utilized as the mast.
  - b. Copper Ground conductors (down conductors) or Electrically Continuous Structural Steel. Provide a maximum of two down conductors per mast.
  - c. Ground Electrodes consisting of rods, plates, or ground loop installed a minimum of 1ft below grade and a minimum of 2 ft away from the foundation.
  - d. The lightning protection grounding system shall be bonded to the electrical grounding system electrode.

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- e. Surge suppression devices, shall be provided on the incoming service for electrical, telephone, antenna and TV cable systems. Provide a reaction time of less than one (1) nanosecond for the antenna and TV cable systems.
- 2. The ground resistance of the completed system shall be measured using the IEEE "Fall of Potential Method" in the presence of the Engineer of record and shall be forwarded to the ESE manufacturer.
- 3. The Ground resistance shall be ten (10) ohms or less.
- 4. All work within the building shall be concealed.
- 5. All work installed in accessible locations shall be properly guarded and protected.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section D60: Communications**

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# Model Schools: Materials and Systems Standards

Design Requirements

Communications - Section D60

## D60 Communications

### D6010 Data Communications

#### A. Codes, Standards, and Regulations

1. Communication design shall comply with Federal and State codes, regulations, and standards with variances adopted as standards by the NJSDA and School District Board. Applicable state and National Standards include the latest editions of:

- a. ANSI/NFPA 70 National Electrical Code with New Jersey Amendments
- b. BICSI CO-OSP Customer Owned Outside Plant Manual
- c. BICSI 15th Edition Telecommunications Distribution Methods Manual
- d. BICSI 6th Edition Customer Owned Outside Plant Design Manual
- e. EIA Standard EIA-230 - Color Marking of Thermoplastic Wire
- f. FCC Rules and Regulations:
  - 1.) J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications National Electrical Safety Code
  - 2.) NFPA 101: Life Safety Code REA Standards for Engineering, Construct
  - 3.) TIA 526-14-A Optical Power Loss Measurements for Installed Multimode Fiber Cable Plant-OFSTP-7
  - 4.) TIA 568-C Commercial Building Telecommunications Cabling
  - 5.) TIA 569-B Commercial Building Standard for Telecommunications Pathways and Spaces
  - 6.) TIA Standard ANSI/TIA/EIA-607-A - Commercial Building Grounding and Bonding Requirements for Telecommunications
  - 7.) TIA 604 Standards on Fiber Optic Connector Intermateability
  - 8.) TIA 606-A Administration Standard for Commercial Telecommunications Infrastructure Standard
  - 9.) TIA 758-B Customer Owned Outside Plant Telecommunications Cabling Standard
  - 10.) TIA Telecommunication Systems Bulletin TSB67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems
  - 11.) TSB-140 Additional Guidelines for Field Testing Length, Loss and Polarity of Optical Fiber Cabling Systems

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# Model Schools: Materials and Systems Standards

2. In the event of a conflict between the Electrical Standards (D50, D60 and D70) and other guidance documents, the Education Specifications, the SDA's Kit of Parts, Bridging Documents also known as the Design Builder's Information Package and presiding codes shall take precedence.

**B. Main Distribution Frame (MDF) / Intermediate Distribution Frame (IDF) / Main Telecommunications Room (MTR) / Intermediate Telecommunications Room (ITR) Description / Design Approach:**

1. Main Distribution Frame (MDF) - A Main Distribution Frame shall be provided to distribute connectivity to the IDF, station cabling as required and to house the main control equipment of the following systems:

- a. Local Area Network (LAN)
- b. Wide Area Network (WAN)
- c. Carrier / Service Provider Interconnections
- d. Telephone System
- e. Paging / Intercom System
- f. Clock Systems
- g. Internet Protocol Digital Video Surveillance (IPDVS) System
- h. Digital Video Distribution System
- i. Building Management System (BMS)

2. Any station cabling that does not exceed 80-Meters (262 Feet) in length shall be homerun to the Main Distribution Frame.

3. Intermediate Distribution Frame (IDF) - Intermediate Distribution Frame shall be provided to distribute core connectivity from the MDF to station cabling where cable distances exceed 80-Meters (262 Feet) to the MDF

4. The designated MDF shall have a single room UPS capable of supporting all devices within the room for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.

5. For room based UPS Systems a bypass mode shall be included and must provide an alternate path for utility power to the connected load in the event of planned maintenance activities or a UPS malfunction.

6. IDF's and Server cabinets outside of the MTR/MDF with access to building generator power shall have rack based UPS systems capable of supporting all devices within the rack/cabinet for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity including the ability to manage and view UPS statistics via IP Based connectivity.

# Model Schools: Materials and Systems Standards

**B. Main Distribution Frame (MDF) / Intermediate Distribution Frame (IDF) Description / Design Approach:**

7. IDF's and Server cabinets outside of the MDF with access to building generator power shall have rack based UPS systems capable of supporting all devices within the rack/cabinet for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.

8. All server cabinets housed in the MDF shall have 48 Port Category 6 Compliant 110-type rack-mounted patch panels provided on the "rear" of the cabinet. This panel shall terminate on a 2 post telecom/network rack to supply network connectivity for devices inside the cabinets.

9. Controlled access to the Main Telecommunications Room and Intermediate Telecommunications Closet shall be provided. This can be accomplished with a lock, card reader or other approved mechanism.

10. The Main Telecommunications Room shall be built in accordance with "DCA Best Practices Standards for Schools under Construction or Planned for Construction."

**D6010.10 Data Communications Network Equipment**

**A. Routing – at a Minimum Routers Must Support:**

1. Open Shortest Path First (OSPF)
2. Enhanced Interior Gateway Routing Protocol (EIGRP)
3. Routing Information Protocol (RIP), and RIPv2
4. Two (2) - 10/100/1000-T Copper based
5. One (1) - Small form-factor pluggable (SFP) based slot
6. Four (4) - Enhanced High-Speed WAN Interface Cards (EHWIC)
7. Three (3) Digital Signal Processors (DSP) slots
8. One (1) Internal Services Module (ISM) slot
9. Flash: Support up to 4 GB (Gigabytes)
10. RAM: Support up to 2.5 GB (Gigabytes)
11. RJ-45 Console serial port and USB Console Serial Port
12. Management Capabilities via IP / SNMP / Telnet / SSH / HTTP(S)

**B. Switching - at a Minimum Switches Must Support:**

1. MDF – A core switch housed within the MDF must meet these minimum requirements:

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2. Modular Chassis Switch with 7, 9 or 13 Slots
3. Supervisor engine redundancy
4. 19" (19-inch) rack compatible
5. Redundant 4200W Power Supply
6. IEEE 802.3af/at compliant PoE/PoEP
7. Hot swappable
8. 280-Gbps (Gigabits per second) switching capacity
9. IP routing protocols: Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path
10. First (OSPF), Routing Information Protocol (RIPv2)
11. IEEE 802.1Q VLAN Encapsulation
12. 802.1s, 802.1w, 802.3ad
13. 802.3af/at (PoE)
14. Ether Channel bonding across line cards
15. Port Aggregation Protocol (PAgP)
16. Voice VLAN and VLAN ID (VVID)
17. Jumbo Frames (up to 9216 bytes)
18. Traffic Storm Control and/or Broadcast/Multicast Suppression
19. Bridge Protocol Data Unit (BPDU) Guard
20. Link Layer Discovery Protocol (LLDP)

**C. IDF - Switches Housed Within the IDF Must Meet These Minimum Requirements:**

1. Stackable with each node member switch being able to serve as a master, creating a 1:N availability scheme for network control.
2. Inter-connection via a channel or bus cable
3. 1100W (minimum) Power Supply
4. Power Over Ethernet (PoE+) capable on all copper based ports. 802.3af and 802.3at Standards
5. All ports must support 10-Gigabit Ethernet (GbE) connectivity.

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6. Internet Protocol (IP) routing protocols: Routing Information Protocol (RIPv2)

**D. Wireless Data (Wi-Fi) Communications System** - A wireless access network shall span all occupy able spaces through the entire facility.

1. Must utilize a WiFi communications system controller located in the MTR/MDF that allows management of wireless network as a whole.

a. Allow for THC management of all individual access points.

b. Application of all site wide wireless access policies.

2. Shall be capable of providing:

a. IEEE 802.1ac, 802.11a, 802.11b, 802.11g, 802.11n

b. Encryption WEP and TKIP-MIC; SSL and TLS; AES (CCM, CCMP)

c. Authentication, Authorization, and Accounting (AAA); IEEE 802.1X; RADIUS; PPP EAP-TLS; Extensible Authentication Protocol (EAP) with RADIUS

3. Wireless Node Isolation.

4. IEEE 802.1Q VLAN tagging; intra-VLAN security; VLAN Isolation

## D6020 Voice Communications

**A. Telephone System Description / Design Approach**

1. General

a. The intent is to provide a school wide Voice over IP (VoIP) Telephone System with voicemail capabilities. The Telephone System and the Data Systems shall share physical cabling mediums and strive for maximum integration.

2. Equipment and Locations

a. All processing and head end systems required for voice communications shall be housed in the Main Distribution Frame (MDF) room.

b. Telephones outlet and handset shall be provided in all administrative areas, class rooms, offices, security desks and other specified locations as specified in the DBIP.

c. Wall telephone outlet without lock box and handset shall be provided in utility rooms, storage rooms greater than 200 sq. ft., mechanical rooms, elevator machine room, supply rooms and vault type/secured storage type rooms.

d. Dedicated phone lines (not through the IP Private Branch Exchange (PBX)) shall be provided for the Intrusion Alarm System, Fire Pump, and Elevator Intercom System.

e. A loud Bell for the Voice over internet protocol (VoIP) and dedicated phone

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lines is to be placed in noisy areas including the auditorium, gymnasium, Gymnasium, student cafeteria, kitchen and the boiler room. A loud bell may be required in other noisy areas; however, this will be addressed on a case by case basis and will be determined by the contract documents and DBIP.

## **D6020.10 Voice Communications Switching and Routing Equipment**

### **A. Internet Protocol Private Branch Exchange (IP PBX) Minimum Requirements**

1. H.323 and SCCP protocol support
2. IP Based SIP, Digital (PRI / BRI) and POTS line carrier interface (Trunk)
3. Analog Telephone Adaptor (ATA)/ Foreign eXchange Subscriber (FXS) Adapter support
4. Up to 20 line appearances per phone
5. Support of fallback service phone auto-registration
6. IP Handsets; Software phone client.
7. Foreign eXchange Office (FXO) interface for analog systems.
8. E911 with two emergency location numbers per zone; unlimited zones per site
9. Paging: Internal through IP phones or to external paging system
10. Ad-hoc conferencing
11. Push Button intercom and Night Bell capabilities.
12. Multiple music-on-hold (MoH) streams (internal/external)

## **D6020.20 Voice Communications Terminal Equipment**

### **A. Telephone Set Type: Minimum Capabilities, Requirements**

1. Executive / Administrative offices
  - a. Six (6) Physical Lighted Line Appearance keys
  - b. Two way Speaker Phone
  - c. Support for expansion module with additional line keys
  - d. 802.3af Power Over Ethernet (PoE+) support.
  - e. Integrated 10/100 switch.
2. Classroom / Shared Spaces
  - a. Two (2) Physical Lighted Line Appearance keys

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- b. Two way Speaker Phone
  - c. 802.3 af Power Over Ethernet (PoE+) support.
  - d. Integrated 10/100 switch.
- 3. Public areas / Miscellaneous Spaces
  - a. 1 line (May use 0 line keys)
  - b. 802.3 af Power Over Ethernet (PoE+) support.
- 4. Conference Rooms / Conference Phones
  - a. Support for external microphone kit
  - b. 802.3 af Power Over Ethernet (PoE+) support.
  - c. Door Phone / Push button Intercom
  - d. Door Intercom w/ doorstrike release
  - e. Vandal resistant / Hardened
  - f. Phone system integrated
- 5. Elevator Intercommunication System
  - a. Elevator car stations shall have an auto-dialer and a time-clock switch programmable to dial primary and secondary numbers.
  - b. Connect the automatic dialing, hands-free station in the elevator car to a dedicated telephone line. The elevator car station shall automatically dial a programmed number to alert the school personnel that there is a problem in the elevator and identify visually which elevator is initiating the call.
  - c. The primary number shall ring in the General Office, while the secondary number shall ring the elevator installer. Dedicated phone lines (not through the Private Branch Exchange (PBX)) shall be provided for the Elevator Intercommunication System
  - d. Provide a telephone set within Elevator Machine Rooms, as part of school telephone system.

## **D6030 Audio-Video Communication**

### **D6030.10 Audio-Video Systems**

#### **A. Projectors Used in Classrooms and Assembly Areas Must at a Minimum Provide:**

- 1. Support Native HD 720p and minimum of WXGA (1280 x 800) resolution

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2. 2500+ ANSI Lumens
3. 2000:1 Contrast Ratio
4. Rated for 3000+ hour lamp life in standard mode
5. Input / Output
6. 1x VGA
7. 1x HDMI
8. 1x Composite
9. 1x RCA stereo input
10. 1x Stereo 3.5mm Mini Jack input
11. 1x RCA and/or Stereo Jack output
12. \*\*1x F-Connector for Coaxial cable OR Provide External TV Tuner with Composite output.\*\*
13. Integrated 7W speaker and audio out capabilities
14. Digital Keystone shift
15. Remote control for power, input selection and function control.
16. Network Interface for projector management.

## **B. Projectors All Spaces**

1. All projectors must be supplied with an integrated or external TV Tuner with IR Remote control capabilities.
2. Projector inputs must be extended to a readily accessible point within the room. Placement decisions should match furniture or general room layout plans.

## **C. Classroom Voice Reinforcement (Sound Enhancement) System and Speakers**

1. Classroom Voice Reinforcement (Sound Enhancement) System and Speakers shall be supplied in all classrooms and instructional space and must provide at a minimum:
  - a. Instructor voice level of 67 dB throughout the classroom.
  - b. Rechargeable, Wearable input microphone with On/off/Mute capabilities.
  - c. 9 hours of continuous operational time.
  - d. MUST not interfere with other voice reinforcements within close proximity.
  - e. 3+ auxiliary audio inputs in addition to microphones to support output from

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projectors / PC / Televisions, etc.

f. Classroom Voice Reinforcement (Sound Enhancement) system shall be overridden during general page activation and all emergency alert situations.

## **D6060 Distributed Communications and Monitoring**

### **D6060.10 Distributed Audio-Video Communications Systems**

#### **A. Distributed Audio-Video Communications Systems Description / Design Approach**

1. Public Address (PA) / Paging system - A building / campus wide PA/paging system shall be supplied and must be accessible from standard telephone sets. The paging system shall also be accessible through dedicated microphones/access terminals independent of the telephone system. At a minimum the paging system should supply the following capabilities:

- a. Time and Calendar based Bell Scheduling
- b. Class / Scheduled Change Tones
- c. Ability to Control / Integrate with Facility Clocks
- d. Integrate with IP and Analog telephone systems
- e. Minimum of 4 Zones with expansion capability
- f. All Call or Group Zone Paging
- g. Programmable Features Per Zone
- h. Emergency notification
- i. Pre-Recorded Emergency/Automated Messages
- j. Controlled Levels of access
- k. IP capable

2. The PA / Paging system shall cover the Main Building, all Additions, Mini-Buildings, Temporary Classroom Units and Temporary Classroom Buildings, Auditorium, Media Center Gymnasium, Multi-purpose Room, Cafeteria, Dance Studios and all other Places of Assembly.

3. A Television and Video distribution system shall deliver television signals received from a cable or satellite feed housed within the Main Telecommunications Room, Main Distribution Frame (MTR/MDF) to all locations capable of displaying video. At a minimum the Television and Video distribution system should supply the following capabilities:

- a. Must use Category 6 (CAT6) cable to deliver video from MDF/IDF to video displays.



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- b. Broadcast locally generated video using camcorders or studio equipment to all display endpoints.
- c. Broadcast video from PC's and other digital sources.
- d. Provide video on-demand capabilities.
- e. Provide multiple Television channels and allow channel selection at the display unit.

## **D6060.50 Distributed Systems**

### **A. Clock Systems Description / Design Approach**

1. All clocks shall be 802.3af Power Over Ethernet (PoE+) compatible.
2. Time must be synchronized using Network Time Protocol (NTP) or Simple Network Time Protocol (SNTP) over the existing data communications network.
3. Automatic Daylight Savings Time (DST) adjustments shall be made based on Network Time Protocol (NTP).
4. All clocks shall display current time within one (1) minute of accuracy to the Network Time Protocol Server.
5. Single faced clocks shall be provided in all Areas of Instruction, all Classrooms, Offices, Teacher's Cafeteria/Lounge and Places of Assembly (Auditorium, Cafeteria/Lunchroom, Media Center and Gymnasium).
6. Analog and Digital clocks shall be equipped to display Hour, Minute and Seconds.
7. Double-Faced Clocks shall be provided in the middle of corridors and other common areas where the clock is viewable from opposing sides.
8. A Category 6 (CAT6) Data outlet shall be provided to support clock function in all areas of instruction, Classrooms, Offices, Teachers' Cafeteria/Lounge, and places of assembly (Auditorium, Cafeteria/Lunch Room, Gymnasiums, Media Center), , Temporary Classrooms, , Multi-purpose Rooms, , Dance Studios and all other Places of Assembly.
9. All clocks located in Corridors and Places of Assembly (Auditorium/Cafeteria/ Lunch Rooms/Gymnasiums) shall be equipped with vandal resistant wire guards.
10. All clocks shall be powered through IEEE 802.3af standard Power over Ethernet (PoE+) utilizing CAT6 cabling.

## **D6090 Communications Supplementary Conditions**

### **D6090.10 Supplementary Conditions**

#### **A. General Requirements**

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1. Data Outlets, as required by the DBIP, shall be provided at every area of instruction, every office including all cubicles, places of assembly, media centers, vault room, security desk and where required by the Point of Sale (POS) System.
2. Conduits for communications cables shall not have bends with a radius of less than 10 times the diameter of the conduit. The total degrees of bend in conduit(s) between pulling points should not exceed 180 degrees. Bends which reduce the inner diameter of the conduit are not permitted. The number of bends should be minimized.
3. Conduits shall not be shared between differing cable types. All cabling distribution shall be installed in separate conduits. For example, copper and fiber cables are not to be mixed in a conduit.
4. Entrance Cabling - To ensure the ability to add lines in the future, the designer will request the local telecommunications provider, internet service provider, and cable television Service Company to provide a service cable to the building demarcation point (DMARC). The building demarcation point (DMARC) shall be the main point of entry (MPOE) for all services and shall be extended to the Main Telecommunications Room (MTF) and the Main Distribution Frame (MDF) and must be separate spaces.
5. The engineer shall transmit two copies of the Site Plan indicating the requested Point of Entry and the location of the Main Telecommunications Room / Main Distribution Frame along with the request letter.
6. Four (4) conduits of 4" (4-Inch) diameter suitable for data communications grade copper, fiber and or coaxial cable shall be provided from the building Minimum Point of Entry (MPOE) to the building demarcation point (DMARC) located in the designated Main Telecommunications Room (MTF) and the Main Distribution Frame (MDF) room.
7. Telecommunications Services
  - a. Copper: 100 pair service cable from the local telecommunications company is to be requested and terminated in the MTF/MDF on four (4) Modular 66M Cross Connect Blocks which are mounted in sequence on  $\frac{3}{4}$ " (3/4-Inch) fire rate plywood.
  - b. Fiber: Fiber based services should be delivered on a minimum of 6 Pair (12 Strand) from the provider. Fiber must be terminated in the ITB/IDF on rack mounted interconnects. Fiber based services must be delivered to CPE via Multimode Fiber or Copper RJ45 Ports for Data services and as Coaxial for Video / Cable TV Services.
8. Cable Television Provider
  - a. The local cable provider should deliver television services to the main distribution frame MDF and have the capability to supply up to 12 outputs on standard RG-11 jacks with a level of 20dBmV Flat and MER of 32dBm or greater.
  - b. The District shall submit a service request in writing to the Local Cable Television Company serving the area. This request shall include two copies of the site plan indicating the suggested point of entry for supplying a "basic cable" service to the Main Telecommunications Room and the Main Distribution Frame, which should match the same general building demarcation point (MPOE) as other telecommunications service.

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c. Should the Cable Company indicate that the school is outside the Cable Service Network or extra installation charge will incur to bring the service to the school, then the design should incorporate a Standard Satellite Dish installation. All other devices shall be directly wired to the Main Distribution Frame via conduits and shall conform to all other requirements of this Design Requirement.

## 9. Two (2) Post Telecom / Network Racks

- a. EIA standard 2-post racks shall be used for mounting of patch panels, wire management, and network equipment in the MDF and IDF's.
- b. Racks shall be 7 feet high, 3-inch channel depth and EIA standard 19-inch mountable with EIA standard hole spacing. They shall be bolted to slab at front and rear flanges and tied to overhead ladder rack for additional stability with threaded rod and unistrut and grounded by a #6 AWG wire with green insulation to approved telecommunications ground. Use lug type connectors at each end.
- c. Equipment mounting screws shall be provided at the base of each rack consisting of 50 minimum per rack.
- d. Horizontal and Vertical Cable Management shall be provided in accordance with standards

## 10. Server Cabinets

- a. Four (4) post fully enclosed industry standard server cabinet with Universal Mounting Rails (square holes), locking doors, split rear access doors and the ability to mount vertical 0U power distribution units.
- b. Supply at least 42U of total space
- c. Support RETMA 19 inch standards and house any third-party equipment designed to mount on standard 19 inch wide.

## 11. MTR / MDF / ITR / IDF Room Grounding System

- a. The MDR/MDF and ITR/IDF rooms shall have a telecommunications main grounding bus (TMGB) bar installed in accordance with generally accepted standards.
- b. All cabinets, racks, cable routing system, and other electrical components must be connected to the TMBG.
- c. Ensure continuity of ground from all system entering, existing, and housed within the MDF/IDF telecommunication rooms.
- d. Utilize jumper cables of sufficient low impedance and sufficient current-carrying capacities to interconnect adjacent equipment.

## 12. Cable Management

- a. Horizontal and Vertical Cable Management Trays shall be used to organize patch cables within equipment and distribution racks.

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b. A Vertical Cable Management Channel must be installed on the ends of and/or as a separator on adjacent 2 post equipment/distribution racks. These Vertical Channels shall be:

- 1.) 2" Wide Channel
- 2.) 2"+ Deep channel
- 3.) Double Sided w/ cable management from Front and Back of racks.
- 4.) Cable guide finger spaced 1U+ apart.

c. Snap-on cover that opens 180° to both sides with latching mechanism

d. A Horizontal Cable Management Tray must be installed between each patch panel and/or equipment. These Horizontal panels shall be:

- 1.) EIA standard 19-inch rack mountable
- 2.) 2U (rack units) high
- 3.) 5+ inch(s) deep
- 4.) Snap-on cover that opens 180° up or down with adjacent installation
- 5.) Cable guide finger space 1.5"+ apart.

13. Ladder type or welded wire cable tray must be used in the MDF and IDF's to provide distribution between the telephone backboard, equipment racks, backbone conduits, and the distribution cable tray and cabinets.

#### 14. Vertical / Riser Cabling

- a. Each ITR/IDF shall be supplied with the following connectivity from the MTR/MDF:
- b. 12 Pair (24-Strand) .50/125 OM4 Multimode Fiber.
- c. Eight (8) RJ-11 Coaxial cable runs.
- d. One (1) 100 Pair CAT6A cable terminated at both ends on a Modular 66M Cross Connect Block and labeled appropriately.
- e. One (1) conduit of 2" (2-Inch) diameter (for future use).

#### 15. Horizontal Cabling

- a. Horizontal data cable is blue jacketed category 6 (CAT6A) cable which supports the following Ethernet standards: 10Base-T, 100Base-T and 1000Base-T.
- b. Horizontal data cabling is to be terminated in the MDF or an IDF according to engineering drawings or as prescribed by other relevant documentation.

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- c. All cable components (including jacks, patch cables, patch panels, and cross-connects) must meet CAT6A specs.
- d. Data cabling shall be routed through the horizontal installation pathway via wire trays, ladder racks, 'J' hooks, or ceiling straps.
- e. The following must be observed when installing category 6 cable:
  - 1.) All horizontal copper data cable runs shall be continuous runs, with no splices, with no length exceeding 80 meters (262 Feet).
  - 2.) All cable runs must maintain 5 foot service loops at both ends of the cable. The service loops at the work area end of the cable is placed in the ceiling.
  - 3.) All cables must be labeled and color coded according to the labeling standard approved by the school district or NJ SDA.

16. Conduits must have a poly-twine drag to be left in the conduit to facilitate future cable pulls. Unless otherwise specified, conduits must be at least 2" (2-Inch) in diameter. Conduits for Communications cables shall not have bends with a radius of less than 10 times the diameter of the conduit. The total degrees of bend in conduit(s) between pulling points should not exceed 180 degrees. Bends which reduce the inner diameter of the conduit are not permitted. The number of bends should be minimized.

## 17. Termination(s)

- a. Copper Cabling: For end-point or end-user (Outlets) devices, terminations must be performed using an 8-pin (RJ45 type) connector, configured as per (TIA/EIA) T568B jack designation and rated for Category 6 (CAT6) or the category of the installed cable.
- b. Distribution cable must be terminated at the MDF or an IDF on 110-type rack-mounted patch panels compliant with Category 6.
- c. Category 6 maximum horizontal data cable length shall not exceed 80 meters (262 feet) from outlet to patch panel.
- d. Fiber optic: Distribution fiber cable must be terminated at the MDF or in an IDF using rack mounted interconnects with TIA/EIA "SC" type connectors.

18. Patch panel and Outlet labeling must be done in accordance with TIA/EIA-606A. Telecommunication rooms, Cabinets, 2 post racks, patch panels, patch ports, vertical fiber and copper distribution cables and end point outlets must be uniquely numbered in a logical easily identifiable manner.

## 19. Labels

- a. All labels must be mechanically printed – no hand written labels!
- b. Identifiers must have a consistent format.
- c. Labels should be resistant to environmental conditions at the point of use.

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d. Label should have a life span equal to the labeled component.

e. A Labeling Plan must be submitted and approved by the school district or NJ SDA.

## **B. Quality Assurance**

### **1. Testing and Certification**

a. All telecommunications cable, installed as part of a project, must be tested to the commercial standards for that cable system. All test results and certifications must be provided in an electronic format report upon completion of installation. Wire Map reports must indicate the cabling has no shorts, opens, mis-wires, split, reversed, or crossed pairs, and end-to-end connectivity is achieved. Testing results must show circuit ID, test specification used, length, date of test, and pass/fail result for each row. Category 6 maximum horizontal data cable length shall not exceed 80 meters (262 feet) from outlet to patch panel.

b. Unshielded Twisted Pair Tests: All metallic cable pairs must be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals must be corrected. Correct color-coding and termination of each pair must be verified in the communications closet and at the outlet. Horizontal wiring must be tested from and including the termination device in the communications closet to, and including the modular jack in each room. Backbone wiring must be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective telecommunications closets.

c. Category 6 Cables: All category 6 circuits must be tested using a test set that meets the accuracy requirements of TIA/EIA-568-B.1 and TIA/EIA-568-B.2-1. All test requirements must be completed as specified in TIA/EIA-568-B.1 and TIA/EIA-568-B.2-1.

d. Fiber Optic Cable: All category fiber optic circuits must be tested using a test set that meets the accuracy requirements of TIA/EIA-568-B.1 and TIA/EIA-568-B.3. All test requirements must be completed as specified in TIA/EIA-568-B.1 and TIA/EIA-568-B.3.

e. Unless stated otherwise, tests must be performed from both ends of each circuit. Connectors must be visually inspected for scratches, pits or chips and must be re-terminated if any of these conditions exist.

### **2. Warranty / Guarantee**

a. Installers must provide in writing a warranty that 100% of the installation meets the manufacturer's specifications Post-Installation, Testing and Certification.

b. A manufacturer's warranty certificate for a twenty five (25) year warranty on all Copper and Fiber cable plant infrastructure must be provided.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section D70: Electronic Safety and Security**

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# Model Schools: Materials and Systems Standards

Design Requirement

Electronic Safety and Security - Section D70

## **D70 Electronic Safety and Security**

### **D7010 Access Control and Intrusion Detection**

#### **A. Internet Protocol Digital Video Surveillance System Description/Design Approach**

##### **1. General**

- a. An Internet Protocol (IP) Digital Video Surveillance (IPDVS) system using Category 6 or 6A cabling shall be integrated with the cabling infrastructure components to minimize duplication of cable, wiring and communications infrastructure. A separate power outlet shall be provided for outdoor camera's heater and/or blower from a local power supply (IDF or MDF). The finished infrastructure shall serve to deploy an IP-based signaling and control format in the infrastructure as built.
- b. For Capacity projects the IPDVS System shall be installed in Stand-alone building additions, meeting at least one of the following criteria:
  - 1.) Provide IPDVS for the addition and the existing school building when the existing building is rated a high or medium priority school as determined by the District.
  - 2.) Provide IPDVS for the addition and the existing school building when the addition exceeds 50% of the total area of the existing building.

##### **2. Equipment and Locations**

- a. The Contract Documents shall provide for digital video cameras and Category 6 or 6A cabling to telecommunication rooms, including wiring, raceway, boxes, outlets, patch panels, Power components as well as equipment cabinets in the telecommunication closets and cabinet in Main Telecommunication Room. The main viewing station for CIP projects may be in a secure office or at the main entrance. A console may be required if the main viewing station is to be located at the main entrance.
- b. The System Integrator (SI), contracted by the General Contractor or Design-Builder, will furnish and install the system hardware, including video encoder, network switch(es), router(s) and application server(s) running proprietary software to process and manage the video feeds. Additionally SI will furnish and install a computer with monitor(s) for the main viewing station. Routers and switches will be provided by the SDA. The Design-Builder shall coordinate with the SDA for all required networked device configurations which are necessary for proper operation of the systems provided by the Design-Builder.
- c. Cameras shall be provided in accordance with the SDA and NJDCA Division of Codes and Standards requirements.



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## **D7030 Electronic Surveillance**

### **A. HVAC Remote Annunciation System Description/Design Approach**

#### **1. General:**

- a. A remote annunciation system connected to the school's intrusion alarm system is to be provided. Indicate the required wiring on the Construction Documents. The contractor will program the intrusion alarm digital communicator (auto-dialer) to initiate a specific code. The central alarm monitoring station will follow a specified protocol.

#### **2. Schools with full Building Management System (BMS) / Direct Digital Control (DDC) systems:**

- a. A twisted pair of conductors (AWG#16, dry contact) is to be connected to the ilon 100 of the BMS and run to the intrusion alarm panel and connected.

#### **3. Boiler Replacement Projects, Intrusion Alarm Replacement Projects:**

- a. A twisted pair of conductors (AWG#16, dry contact) shall be run in parallel from each of the boiler control panels to the intrusion alarm panel.

- 1) For Boiler Replacement projects without a funded Intrusion Alarm Replacement project: the twisted pair is to be indicated on the Drawings to be left unconnected, with the note, "Connection to intrusion alarm panel by others." (The Division of School Facilities or its assigned intrusion alarm Contractor will subsequently connect to the intrusion alarm panel and program the digital communicator to provide the required messaging).

- 2) For Boiler Replacement projects with a funded intrusion alarm replacement component, the twisted pair is to be connected to the system.

## **D7030.10 Video Surveillance**

### **A. Video Surveillance**

1. Video surveillance cameras shall be installed throughout the exterior and interior of the building, including adjacent parking. Coverage areas shall include but not limited to the following:

- a. Building approach areas for vehicles and pedestrians.

- b. Areas outside the building that is not readily visible.

- c. Loading Areas.

- d. Infrequently occupied areas that are not locked or alarmed such as but not limited to:

- 1.) Multi-Purpose Room

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- 2.) Cafeteria
- 3.) Gymnasium
- e. Main entrances and lobbies.
- f. Corridors and stairways
- 2. Video Surveillance storage capability for review.
  - a. Export video to easily transportable format.
- 3. Internet Protocol Digital Video Surveillance System Signage
  - a. Provide a video surveillance signage at all entrances (indoor & outdoor) and school main lobby. The signage shall read "This building is under video surveillance that may be monitored and I or recorded at any time."

## **B. Products**

- 1. Video Surveillance Control and Management Systems
  - a. Supports a broad range of IP and analog cameras, codecs, viewing platforms, and network topologies.
  - b. Support PTZ and Alarm inputs.
  - c. Support storage and archiving policies based on cameras / streams. I.E Footage from main entrance cameras are stored for 60+ days but footage from corridors are only stored for 30+ days.
  - d. Sufficient and expandable storage sub systems for recordings. (Direct attached and iSCSI based storage systems.)
  - e. Simultaneous multi format encoding. (Minimum MJPEG and MPEG-4)
  - f. Looping and event-based video recording.
  - g. Motion based recording.
- 2. Video Surveillance Monitoring and Supervisory Interfaces
  - a. Intelligent Video Analysis (IVA)
  - b. Licensed video motion and content analysis option.
  - c. Ability to predefine behavior of objects such as doors and gates.
  - d. Provides operator alerts.
  - e. Tamper detection.

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f. Delivers metadata information in both live and stored video.

g. IP Based Remote viewers.

### 3. Digital Video Recorders and Analog Recording Devices (Video Media Server / Recorder).

a. IP Based.

b. Record-on-motion and clipping capabilities

c. Archives at different frame rates, durations, and locations

d. Support for encoders and cameras (fixed or PTZ).

e. Support up to 64 Cameras Streams over IP Multicast.

f. Support up to 4 simultaneous viewers / operators.

1.) Deliver low-latency, high-quality video

### 4. Video Viewing Stations

a. IP based viewers

b. Stationary video viewing stations shall be provisioned at the security desk, emergency control center (ECC), and backup emergency control center.

c. Ability to configure multiple modes of viewing:

1.) Individual camera view loops.

2.) Grid display of up to eight (8) cameras.

3.) Looping grid displays.

4.) Pause looping.

5.) Display select cameras.

### 5. Video Surveillance Systems Infrastructure.

a. Switches, which will be provided by the SDA, shall be stackable with each node member switch being able to serve as a master, creating a 1:N availability scheme for network control.

b. Inter-connection via a channel or bus cable.

c. 1100W (minimum) Power Supply

d. Power Over Ethernet (PoE+) capable on all copper based ports. 802.3af and 802.3at Standards

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- e. All ports must support 10-Gigabit Ethernet connectivity.
- f. MDF to IDF Uplinks must utilize 10Gigabit Ethernet Connectivity.
- g. IP routing protocols: Routing Information Protocol (RIPv2).
- h. Multiple VLAN's to ensure security, performance and ease of management.
- i. Infrastructure server running Windows Server to supply DHCP, DNS, and authentication.
- j. Video Surveillance Network systems will be utilized for IP connectivity to building infrastructure systems such as, HVAC / Building Management Systems (BMS), Access Control Systems, Paging Systems, Video Distribution System management etc.
- k. Cameras shall be physically cabled to the MDF where possible or to the IDF on the First Floor.

### 5. Video Surveillance Remote Positioning Equipment

- a. Exterior cameras shall be protected from natural elements and shall be provided with heating components to ensure operation in low temperatures.
- b. All Cameras shall be tamper resistant.

### 6. Video Surveillance Remote Devices and Sensors

- a. Video cameras used shall be powered by IEEE 803.af Power Over Ethernet (PoE+)
- b. Support Resolution and Frame Rate of:
  - 1.) 720 x 480/576 @ 30/25 fps (D1)
  - 2.) 704 x 480/576 @ 30/25 fps (4CIF)
  - 3.) 352 x 240/288 @ 30/25 fps (CIF)
- c. Progressive Scan CMOS technology for image clarity.
- d. Must utilize TCP/IP Multicast technology to deliver RTP Video/Audio Streams.
- e. Support Quality of Service (QoS) policy application to streams.
  - 1.) Ability to use differentiated services code point (DSCP) values to distinguish between Video and Audio Streams.
- f. Support H.264, MPEG-4, MJPEG Codecs.
- g. Web access protected by user ID and password.

### 7. Maintain a log of management access and source of access.

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8. Maintain an "Up Log" showing power on time.

## **D7030.50**

### **Electronic Personal Protection**

#### **A. Sound Intercommunication and Teacher Activated Security System Description/Design Approach:**

##### **1. General**

a. A school-wide Sound, Intercom and Teacher Activated Security System (Sound System) shall be provided with the following functions:

1.) Public Address system for general announcements.

2.) Two-way communication system between two stations and between station and any speaker

3.) Privacy system to prevent eavesdropping through classroom speaker.

4.) Tone generation for emergency call from classrooms to central station.

5.) All spaces, as well as each speaker in the corridor, shall be assigned a space number and the zone to which it is to be assigned. This designation shall be indicated on the plans.

b. The system shall cover the Main Building, all Additions, Mini-Buildings, Temporary Classroom Units and Temporary Classroom Buildings, where applicable. For projects such as additions where the existing PA system is relatively new and is to remain and a new system is added for the new building portion, the new PA unit is to match the existing so they may be interconnected.

c. Places of Assembly, such as Auditorium, Gymnasium, Gymatorium, Multi-purpose Room, Cafeteria, Cafetorium, Media Center, and Dance Studios shall have their own Local Sound System. Each of these Local Sound Systems shall incorporate hearing impaired capability and shall be fully interconnected to the Main Sound System.

d. The Main Sound System shall automatically override any Local Sound System for general announcements. The system shall have the capability to make a general announcement from any station connected to the Main System or from a dedicated microphone connected to the Local Sound System.

##### **2. Gymnasium:**

a. A Gymnasium without a partition requires a single sound system with a single channel amplifier.

b. A Gymnasium that is partitioned into sections requires a single local sound system configured with a dual channel amplifier so that announcement can be made individually for each section of the Gymnasium and combined for the entire gymnasium.

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- c. The Gymnasium and Cafeteria each require one local sound system with an amplifier to drive two dedicated set of speakers:
  - 1. When being used as the gymnasium, the designated gymnasium amplifier shall drive the ceiling speakers utilized for the gymnasium function. If the Gymnasium is partitioned, the amplifier shall be a dual channel and configured so that announcements can be made individually for each section.
  - 2. When being used as the auditorium, the designated auditorium amplifier shall drive the wall mounted speakers utilized for the auditorium function.
  - 3. The mixer shall be used to control the switching operation between the two amplifiers.
- d. Provide an integrated Sound/Clock System in new construction and in retrofit application where the approved Scope of Work (SOW) provides that the existing clock system is to be replaced.
- e. Where the Sound and Clock Systems are not to be integrated, as in the case of a retrofit application where the existing Clock System is to remain, provide a separate independent Sound System.
- f. When replacing the Sound system in retrofit installations and the existing system is in working condition, the drawings shall state the existing system is not be removed until the new system is complete and accepted by the SDA.

### 3. Equipment and Locations

- a. Central Control Sound Rack shall be placed in the Main Telecommunications Room (MTR) where available; otherwise in or near General Office. For system replacement in existing buildings, Central Control Sound Rack shall be installed at the same location.
- b. Combination Speaker/Clock Assemblies (integrated speaker/clock assemblies) shall be provided in new construction and in retrofit applications where the existing Clocks System is being replaced. Install in areas of instruction, offices, and teacher's cafeteria/lounge.
- c. Speaker Assemblies shall be provided in Dance Studios and Places of Assembly such as Auditorium, Cafeteria, Gymnasium, Multi-purpose Room, Media Center, and Cafetorium. Horn type speakers shall be provided in corridors, play-yard, mechanical rooms and large storage spaces.
- d. Privacy / Call-in Switches shall be provided in each classroom, areas of instruction, teacher's lounge and teacher's cafeteria. Locate switch in the front of classroom near the corner adjacent to the exterior wall. The privacy/call-in switches shall not be mounted near the door.
- e. Volume Control for Speaker (In High Schools only) shall be provided in each office.
- f. Administrative Control Stations (ACS) shall be provided in Main Office, Vice

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Principal Offices, Principal's Office and Custodian's Office. Outlets for ACS shall be installed at 18" A.F.F. near the desk.

- g. Local Sound Systems shall be provided in Places of Assembly such as Auditorium, Gymnasium, Multi-Purpose Room, Media Center, Gymnasium, Cafeteria/Lunchroom, Cafetorium, and Dance Studio's. The amplifiers shall be installed in a secure area not readily accessible to the public.
- h. Auditorium and Cafetorium sound system shall be provided with four microphone outlets, mounted in front of the stage at 18" A.F.F. All other local sound systems shall each be provided with three microphone outlets mounted at 18" A.F.F., except when Gymnasium is partitioned, for which two (2) microphones shall be provided in each section.

#### 4. Audio Amplification System for the Hearing-Impaired

- a. An Audio Amplification System for the hearing-impaired shall be provided in conjunction with each Local Sound System. The system shall be FM broadcast type mounted in a common rack with the local sound system. Each system shall have its own designated frequency to obviate miscommunication between different spaces. When Gymnasium is partitioned into sections, Audio Amplification Systems shall be provided within the same cabinet for all sections. When Gymnasium is partitioned into three sections, one Audio Amplification system shall be provided in the Auditorium sound system and two Audio Amplification Systems shall be provided in the Gymnasium sound system.
- b. A transmitting antenna shall be located in each space. The auditorium transmitting-antenna shall be located above the proscenium arch.
- c. Single channel receivers with headsets, teleloops, and silhouette coils shall be furnished in accordance with Code required minimums.

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## **D7050 Detection and Alarm**

### **D7050.10 Fire Detection and Alarm System for School Buildings**

#### **A. Fire Detection and Alarm System for School Buildings Description/Design Approach:**

1. The fire detection and alarm system for school buildings shall be a Manual and Automatic Fire Alarm System with Central Office Connection provided. This system shall be a fully supervised, microprocessor-based multiprocessing system with individually addressable devices connected to a central Emergency Control Center (ECC) and Remote backup Emergency Control Center (ECC), as enforced by DCA and required by presiding Codes.

#### **a 2. Fire Alarm System Coding the manual and automatic fire alarm system shall operate as Coded System.**

##### **3. Smoke Control**

a. Smoke control systems shall be provided.

b. Smoke control systems shall be activated by any of the following:

1.) Automatically by area or duct smoke detectors

2.) Automatically by sprinkler water flow switches

3.) Manually by the Fire Fighter's Smoke Control Station

4.) Smoke control system activation shall be immediately initiated after receipt of appropriate automatic or manual activation command.

5.) Activation of the smoke control system shall send an alarm to the Central Station.

c. The smoke control system shall be connected to the Fire Activated Control Panel (FACP) via a UL 864 listed Fire Fighter's Smoke Control Station. This station shall provide status and manual override control of all automatic smoke control devices associated with the smoke control system, as well as manual control of Post-Fire Smoke Purge systems (where applicable). The Fire Fighter's Smoke Control Station shall override any other building controls which may be controlling smoke control equipment from any control point other than the Fire Fighter's Smoke Control Station.

4. System shall be designed in accordance with NFPA, NEC and all other presiding code requirements.

5. Fire Alarm Control Panel (FACP), including Post-Fire Smoke Purge controls, where required, and Fire, Fighter's Smoke Control Station.

6. Remote Annunciator Placed in the Main Office

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7. Manual Pull Station Placed in accordance with, NFPA and NEC requirements, provided at each door leading to legal exit in corridors, lobbies, places of assembly and as required to meet code travel limitations of 200'. The height of the manual pull stations shall be a minimum of 3'-6" and maximum of 4'-0" measured vertically from the floor level to the activating handle. All manual pull stations shall be single-action type. False alarm stopper covers shall be provided over all manual pull stations.

8. Audible Notification Appliances (Horns) -Placed in accordance with code requirements, they shall be placed in all corridors and elsewhere, where required by Code.

9. Visual Annunciator (Strobes) -Placed in accordance with NFPA and NEC requirements. Specifically, they shall be wall-mounted in places of instruction, corridors, places of assembly, library, shops, music rooms, toilets and elsewhere where required. Strobes shall be unobstructed by other objects, visible from any position in the area and shall be a maximum of 15 ft. from end of the corridor. Strobes shall be wall-mounted such that the entire strobe lens is located 96" above the finished floor or 6" below the ceiling, whichever is less in height. Strobe lights shall not be required in staircases. If three or more strobes are in the same room or adjacent space within the field of view, they shall be synchronized. Ceiling-mounted strobes are allowed where wall-mounted strobes cannot provide proper coverage.

10. Audible and Visual Notification Appliances (Horn/Strobes) -Where horn location coincides with strobes, use combination horn/strobe type. Horn/Strobes shall be wall-mounted such that the entire lens is located 96" above the finished floor or 6" below the ceiling, whichever is less in height. If three or more strobes are in the same room or adjacent space within the field of view, they shall be synchronized.

11. Area Smoke Detector -Placed in all mechanical rooms, oil tank rooms, electrical switch gear rooms, electric closets, telecommunications room and closets, audio/video storage rooms, paint storage, elevator lobbies, top of elevator shafts, elevator machine rooms, locations requiring smoke control systems (stage, atriums, etc), storage rooms containing flammable materials (book storage, grounds equipment room, custodian's storage) and over cross-corridor doors where magnetic door holders are provided. Smoke detector layout shall comply with NFPA 72. Spacing shall not exceed the limitations of UL listing for the specific smoke detectors.

12. Metal Wire Guards -Provide in all gymnasiums and playrooms for visual and audible notification appliances. Also provide guards for such devices in corridors, bathrooms and locker rooms for high schools where the devices are below the 8'-0" requirement or accessible from a window sill or other similar structure.

13. Digital Alarm Communicator Transmitter (DACT) and Central Station Monitoring -Shall be provided as follows:

14. For any new fire alarm system installations and fire alarm panel replacements -all manual and automatic detection devices connected to the fire alarm system shall send the following signals to the Central Station:

- a. Manual Alarm -manual pull stations,
- b. Sprinkler Alarm -sprinkler system water flow switches,

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- c. Automatic Fire Alarm -area smoke detectors, duct smoke detectors, heat detectors, flame detectors, kitchen Ansul systems,
- d. Carbon Monoxide Detectors -system-connected CO detectors.
- e. Supervisory signals -sprinkler system tamper switches, fire/sprinkler booster pump status (power failure, pump running, phase reversal), water tank low air pressure.
- f. Trouble signals -general trouble signal from the Fire Alarm Panel.

15. When there is a sprinkler booster pump/fire pump installation in an existing building without fire alarm panel replacement, supervisory signals; sprinkler system tamper switches, fire/sprinkler booster pump status (power failure, pump running, phase reversal), water tank low air pressure shall be monitored by the Central Station. If existing panel does not have central station monitoring, provide an external DACT.

16. When there is no sprinkler booster pump/fire pump in the fire protection system and there are more than 20 sprinkler heads being installed in an existing building per fire zone, the sprinkler system water flow switches and tamper switches shall be monitored by a central supervisory station. If existing panel does not have central station monitoring, provide an external DACT.

### **B. Intrusion Alarm System Description / Design Approach**

#### **1. General**

- a. An Intrusion Alarm System shall be designed and installed (in accordance with the DCA "Best Practices Standards For Schools Under Construction or Being Planned For Construction" to detect intruders when the school is unoccupied and to control the exterior doors while the school is occupied. The Intrusion Alarm System shall be programmed to independently and individually control each of the following spaces: kitchen/cafeteria, computer rooms, corridors and exterior doors.

#### **2. Equipment and Locations**

- a. Main Control Panel with digital communicator for central station monitoring shall be provided in the ECC and Backup ECC.

#### **3. Detectors with protective guards shall be provided:**

- a. In all Corridors on all floors to protect the entire length
- b. Boiler Room with accessible windows, only
- c. Rooms and areas with windows having valuable equipment such as Sound System and Video Equipment
- d. Computer Rooms, Laboratories and Shops
- e. Rooms and areas accessible from, or adjacent to low roofs

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- f. Rooms with more than four computers on First Floor not on street side of building
- g. Principal's Office, Main Office and Custodian's Office
- h. Kitchen and Food Storage Rooms with Windows
- i. Auditorium
- j. Magnetic Contact Switches shall be located at all exterior doors
- k. Entry Doors to Food Storage, Vault Room and Record Storage Rooms, if not provided with detectors
- l. Doors to rooms and closets storing valuable equipment such as computers, sound and video equipment and musical instruments
- m. Initiation device(s), electronic button ("panic button") shall be located at Main Office, Security Desk(s), Emergency Control Center, and Remote Backup Emergency Control Center. Panic buttons shall be capable of transmitting a silent alarm to the Local Police Department Central Station, or other identified emergency responder via the digital communicator.
- n. Alphanumeric Consoles shall be provided at Control Panel with ability to control each partition
- o. Main Entrance Vestibule
- p. Custodial Entry (if different than Main Entrance Vestibule)
- q. Kitchen Entry (if different than Custodial Entry)
- r. Security Station
- s. Alarm Devices
- t. Exterior Siren and Strobe shall be provided on exterior wall at minimum 20 feet above grade, mounted inconspicuously on either side of the main entrance at second floor level.
- u. Interior Sirens shall be provided in Lunchroom, in corridor near the Main Office and in corridors on each floor.
- v. All sirens shall be equipped with cut-off switches and battery backup power.

#### 4. Zones

- a. Each passive infrared detector shall be connected to a separate zone with a unique address. If having each detector as a separate zone exceeds the zone capability of the main control panel, then multiple detectors in the same space may be wired as a zone. Computer Rooms located close to each other may be in one zone. Kitchen and kitchen storage rooms located close to each

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other may be in one zone. Door switches for a given entry vestibule with multiple doors may be wired as a zone.

## 5. Monitoring

- b. The system shall have a programmable chime option, which provides a three-beep tone at the alphanumeric console (located at the Security desk) whenever a perimeter door is violated while the system is disarmed. This chime feature shall provide School Security with the ability to monitor perimeter doors from a Central Monitoring Station. The chime mode shall be turned on/off directly through the keypad by entering a valid security code.

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## **D7090 Electronic Safety and Security Supplementary Components**

### **D7090.10 Supplementary Components**

#### **A. Survivability From Attack By Fire**

1. Alarm/evacuation systems must feature survivability from attack by fire as mandated by NFPA 72.
2. Survivable fire alarm systems shall be designed and installed such that attack by fire within an evacuation signaling zone shall not impair control and operation of the notification appliances outside the evacuation signaling zone. Loop isolators shall be utilized on every floor whenever a Data Gathering Panel serves more than one floor or fire zone.
3. All circuits necessary for the operation of the notification appliances shall be protected until they enter the evacuation signaling zone that they serve. Any of the following methods shall be considered acceptable as meeting the requirements of this subsection:
  - a. A 2-hour rated cable or cable system
  - b. A 2-hour rated enclosure
4. Survivability from attack by fire shall meet the following requirements:
  - a. Alarm/evacuation systems must feature survivability from attack by fire as mandated by NFPA 72
  - b. Survivable fire alarm systems shall be designed and installed such that attack by fire within an evacuation signaling zone shall not impair control and operation of the notification appliances outside the evacuation signaling zone. Loop isolators shall be utilized on every floor whenever a Data Gathering Panel serves more than one floor or fire zone.
  - c. All circuits necessary for the operation of the notification appliances shall be protected until they enter the evacuation signaling zone that they serve. Any of the following methods shall be considered acceptable as meeting the requirements of this subsection:
    - 1.) A 2-hour rated cable or cable system
    - 2.) A 2-hour rated enclosure

#### **B. Vibration and Seismic Control**

1. Seismic Design Criteria Description / Design Approach
  - a. New School buildings and additions shall be designed for seismic forces. Mechanical and Electrical components shall meet the requirements of ASCE 7. If an existing building is required to meet seismic requirements, and a waiver cannot be obtained, the electrical retrofit work must then meet such requirements.

# Model Schools: Materials and Systems Standards

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## Design Requirement

## Electronic Safety and Security - Section D70

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- b. For new additions projects, any items in the existing building shall also meet the seismic requirements of the addition if they are integrated with systems in the new addition that are required to function after an earthquake.
  - 1.) Seismic Design Category shall be determined by the project structural engineers. *Verify* seismic design requirements with the structural engineer.
  - 2.) Component Importance Factors ( $I_p$ ) are prescribed in ASCE 7.
- c. Life safety components required to function after an earthquake. This includes fire alarm, emergency generator systems, automatic transfer switches, UPS, transformers for life safety systems, emergency and exit lighting, etc. Functioning after an earthquake means just long enough to evacuate the building as opposed to functioning as a disaster relief center. Life safety equipment required to function after an earthquake shall be seismically certified by the manufacturer with a Certificate of Compliance.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section E: Equipment and Furnishings**

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# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section E20: Furnishings**

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# Model Schools: Materials and Systems Standards

## E20 Furnishings

### E2010.20 Window Treatments

#### A. Description / Design Approach:

1. As is typical of any window-shading device the purpose of the interior window shading device is to provide privacy, control daylight or reduce sunlight, glare and heat transmission into the space, or darken a room. Interior shading devices are also used for added privacy from corridors or adjoining spaces or to reduce or control light transmission to adjoining spaces when necessary.
2. The application of interior window treatments shall be specified and detailed to be unobtrusive in a cost effective manner. Utilize manufacturer's standard methods for concealing window treatments.
3. Utilize manufacturer's range of standard colors and materials for the window treatment system(s) selected.

#### B. Window Blinds

1. Specify blinds that are composed of slats that are either 5/8" (15 mm) or 1" (25 mm) aluminum. The tilting mechanism shall be equipped with a slip control. All tilting of blinds shall be performed without accessing the blinds. The head and sill rails for blinds shall be extruded aluminum.
2. Exterior windows with integral internal blinds are generally discouraged. Exterior windows with integral internal blinds in a triple glazed application the insulating glass may be considered in order to meet day-lighting control, other related criteria, and must meet all presiding code requirements. This application typically consists of deeper frame window system, a 1" insulating glass unit, a 5/8" (15 mm) or 1" (25 mm) aluminum horizontal slat blind, and a monolithic removable take out panel with removable stops. The recommended selection of a triple glazed window unit with integral blinds must be justified by the Design Consultant. The use of exterior aluminum windows with internal integral blinds is subject to approval by the NJSDA.

#### C. Window Shades

1. Specify the type of shade appropriate for the window type selected as well as one which meets all other required performance criteria. Single or double roller type shades operated with side cords are typically provided for exterior double hung windows and chain operated single roller type shades are typically provided for project in hopper windows. Window shades shall also be applied to transom, sidelight or other interior windows to control artificial light leakage and distractions from corridors.
2. Materials
  - a. Window shades are typically either single or double roller type shades made of shade cloth that is a woven fabric or double-coated vinyl plastic.
  - b. Specify shades that indicating the selections respective criteria:

# Model Schools: Materials and Systems Standards

- 1.) Solar heat control
- 2.) Daylighting control
- 3.) Ultraviolet protection
- 4.) Privacy
- 5.) Ease of operation
- 6.) Soil and dust resistant
- 7.) Uniform appearance
- 8.) GreenGuard indoor air quality certified
- 9.) Insulating
- 10.) Verify motorized operation is available in permitted locations
- 11.) Cost effective
- 12.) Suitability for window height and width

3. Locations: Window shades, excluding blackout shades, are typically provided for all interior spaces *except as follows*:

- a. Auditoriums
- b. Gymnasiums
- c. Kitchens (as well as other areas involving the preparation of food – NYC Health Code)
- d. Lobbies, Vestibules, and Stairs
- e. Natatoriums (pool areas)
- f. Toilets and Shower Rooms

4. A separate system of blackout shades is permissible to black out sunlight from any space requiring the associated room to be darkened. The decision to provide black out shades shall be determined by the functions to take place in the space as described by the DOE approved Educational Specifications.

## **D. Window Draperies**

1. The use of drapery is discouraged. The Design Consultant may specify window shades, and window draperies in the Principal's Office, Main Conference Room and Administrative Office Areas to provide privacy, darken a room, or to reduce sunlight, glare and heat transmission into the space. The use of drapery is to be considered only if a specific District request and approved by the NJSDA as early as possible during the Design Phases and prior to 50% complete construction documents.

# Model Schools: Materials and Systems Standards

Design Requirements

Furnishings – Section E20

**E. Remote Controlled Shading Devices**  
**(For example: Auditoriums, Gymnasiums, Cafeterias, Multipurpose Rooms)**

1. Remote Controlled window-shading device shall only be used in hard to control locations. Hard to control locations are primarily spaces where manual operation of the window treatment(s) is not possible because of window location or size, or the room is of a size or windows of a quantity that manual operation is not feasible. For example; rooms with a clerestory(s), skylight(s), borrow or transom windows, and rooms or spaces that meet the above criteria and have windows requiring window treatments in larger high bay specialized spaces such as Auditoriums, Gymnasiums, Cafeterias, Multipurpose, Media Center, or instructional spaces such as Music and Instrumental suites where high bay volumes which may have higher windows for daylighting.



# Materials and Systems Standards Manual

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## Design Requirements

### Section G: Sitework

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# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section G20: Site Improvements**

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# Model Schools: Materials and Systems Standards

Design Requirements

Site Improvements – Section G20

## **G20 Site Improvements**

### **A. General Description/Design Approach**

1. Provide safe and cost effective designs focused on pedestrian and vehicular circulation. The design must minimize circulation conflicts both on-site and off-site. Proper design and separation of site access and circulation routes will minimize conflicts between vehicular and pedestrian traffic. Quality designs and proper material selection will maximize the life of the improvements.

### **B. Materials**

1. The materials being utilized shall be in accordance with the most recent version of the New Jersey Department of Transportation's (NJDOT) standards except where superseded by these standards.

### **C. Related Standardized Details**

1. G2012-11-1 Paving and Surfacing Details
2. G2013-11-1 Concrete Curb Details
3. G2031-11-1 Concrete Walkway Details

## **G2010 Roadways / Driveways**

### **A. General Description/Design Approach**

1. Clearance criteria have been established based upon the vehicle types that access and circulate the site and to accommodate the most restrictive vehicular requirements. School buses and emergency service vehicles are the two most restrictive vehicle types. The following requirements shall be imposed on routes accommodating these vehicles:

- a. The minimum vertical clearance for structures extending into travel ways shall be 15 feet;
- b. The minimum inside turning radius is 45 feet maintained within the cartway without interfering with opposing traffic;
- c. The minimum cartway width, for one-way circulation shall be 15 feet;
- d. Roadway and driveway access points to public roadway systems shall be a minimum of 20 feet wide for one-way cartways and 24 feet wide for two-way cartways extending 25 feet into the site before being transitioned.

2. On-site circulation routes shall be labeled with the appropriate signage and striping in accordance with the most current version of the Manual on Uniform Traffic Control Devices and the IBC.

# Model Schools: Materials and Systems Standards

## **G2010.10 Paving and Surfacing**

### **A. General Description/Design Approach**

1. Bases and sub bases shall conform to the most recent version of the standards established by the New Jersey Department of Transportation's (NJDOT). Base materials will be limited to 6" thick layer of Dense Graded Aggregate (DGA) under roadways and parking areas and coarse aggregate No. 57 for concrete curbs, walkways, ramps and steps.

2. The following pavement thicknesses are based on the sub-grade achieving a 95% compaction rate. Thickness for pavements over fill areas and/or soils incapable of achieving 95% compaction must be investigated and a pavement design recommended and approved by the Authority prior to incorporation into the design.

3. The minimum slope to be utilized in paved areas shall be 1.0%.

### **B. Materials**

#### **1. Resurfacing of Pavement:**

a. Resurfacing will be performed on existing pavements by milling off 1 inch of the existing pavement. Upon completion of the milling operations the surface must be prepared and repaired prior to the installation of a tack coat and prime coat. Install Hot Mix Asphalt, 1 inch thick, Surface Coarse over the existing pavement. All preparation and installation work must be performed in accordance with New Jersey Department of Transportation (NJDOT) standards.

#### **2. Bituminous Pavement, Full Depth:**

a. The full depth pavement shall consist of hot mix asphalt, 1-1/2 inch thick, surface coarse over hot mix asphalt, 4-1/2 inch thick, base course constructed over the base and sub base as defined in G2010.10.

b. The full depth pavement shall be utilized for on-site roadways, driveways and parking areas. Longitudinal and transverse joints will be omitted from the NJDOT's requirements.

c. Off-site roadways shall adhere to the local, county and/or state regulations.

#### **3. Reinforced Concrete Pavement:**

a. Concrete pavement subject to heavy loads such as service and loading docks, garbage refuse and utility pad areas shall as a minimum consist of 6 inch thick reinforced concrete. The slab reinforcement and concrete mix design must be as defined by the design engineer. Concrete pavement shall be constructed over base and sub base as defined in G2010.10.

b. Joints shall be installed in accordance with the requirements imposed by the design engineer.

# Model Schools: Materials and Systems Standards

## Design Requirements

## Site Improvements – Section G20

### **B. Materials**

#### **4. Pavement and Curbs within a public Right-of Way:**

a. The pavement and curbs located within these areas must adhere to the standards established by the local, county and/or state agency governing said Right-of-Way.

b. All improvements proposed within the public Right-of-Way must be reviewed and approved by the Authority and the respective jurisdiction Code prior to implementation into the design.

### **G2010.20 Roadway Curbs and Gutters**

#### **A. General Description/Design Approach**

1. Vehicular traffic shall be separated from pedestrian traffic and areas through the installation of concrete curb to delineate the two. Breaks in the curb will be permitted whenever pedestrian and vehicular traffic intersect. The right-of-way priority will be given to the pedestrian. The curb shall be depressed and constructed flush with the pavement in accordance with the standards set forth by the Americans with Disabilities Act and the NJ Barrier Free Sub code.

2. The dimensions shall be 6 inches at the top widening to 9 inches at the bottom with a depth of 20 inches. The curb shall be constructed with 6 inches of exposed face toward the cartway side of the roadway, driveway or parking area.

3. Provide ½" expansion joints every 20'-0" maximum, but not less than 5 feet of a corner.

4. Curbs and walkways shall be located adjacent to or a minimum of 2 feet from one other to accommodate a viable landscape area.

#### **B. Materials**

1. Site curb to be cast-in-place, air entrained 3,500 PSI concrete.

### **G2010.40 Roadway Appurtenances**

#### **A. General Description/Design Approach**

1. On-site circulation routes shall be labeled with the appropriate markings and signage in accordance with the most current version of the Manual on Uniform Traffic Control Devices, the Americans with Disabilities Act, the NJ Barrier Free Sub code, the Local Fire Marshal and the IBC.



# Model Schools: Materials and Systems Standards

## **G2020 Parking Lots (Parking Stalls and Drop off Areas)**

### **A. General Description/Design Approach**

1. Parking areas shall be designed to provide safe and efficient traffic circulation and parking facilities. Dead end aisles shall be avoided whenever possible however when unavoidable a turn around area shall be provided for displaced vehicles.
2. The minimum parking stall sizes shall be 9 feet wide and 18 feet long measured to the centerline of stripe or face of curb. Parking facilities for people with disabilities shall be designed in accordance with the standards established by the Americans with Disabilities Act and the NJ Barrier-Free Sub code.
3. Concrete curb will be utilized to delineate landscape areas internal to the parking area, if deemed necessary, and to control the encroachment of vehicles onto pedestrian areas along its perimeter. Surface mounted concrete wheel stops will be avoided in parking areas whenever possible.
4. Parking stalls shall be delineated utilizing 4 inch wide painted stripes.
5. Walkways located adjacent to parking areas shall be installed a minimum of 2 feet from the curb or shall be a minimum of 6 feet wide if installed against the curb to accommodate a 2 foot vehicle overhang and 4 feet of clear area for pedestrian traffic.

## **G2020.10 Parking Lot Pavement**

### **A. General Description/Design Approach**

1. Refer to G2010.10 of the standards.

## **G2020.20 Parking Lot Curbs and Gutters**

### **A. General Description/Design Approach**

1. Refer to G2010.20 of the standards.

## **G2020.40 Parking Lot Appurtenances**

### **A. General Description/Design Approach**

1. Refer to G2010.40 of the standards.

# Model Schools: Materials and Systems Standards

Design Requirements

Site Improvements – Section G20

## **G2030 Pedestrian Plazas and Walkways**

### **A. General Description/Design Approach**

- 1.The requirements of this section pertain solely to on-site pedestrian facilities. Off-site facilities shall adhere to the standards established by local, county and/or state agency governing said facilities;
- 2.Walkways shall be a minimum of 4 feet wide with a ¼" per foot cross slope;
- 3.Building access points shall be sloped away from the building with a minimum slope of 1.5%.

## **G2030.10 Pedestrian Pavement**

### **A. General Description/Design Approach**

- 1.Walkways, courtyards and plazas will be designed in accordance with these standards. The finish will consist of a broom finish in accordance with New Jersey Department of Transportation (NJDOT) standards.

### **B. Materials**

- 1.Construct walkways with 4 inch thick cast in place concrete, 3,500 PSI, air entrained, reinforced with 6 inch by 6 inch welded wire mesh over 4 inch compacted coarse aggregate No. 57 base, over the sub base material as defined in G2010.10.

## **G2030.20 Pedestrian Pavement Curbs and Gutters**

### **A. General Description/Design Approach**

- 1.Refer to G2010.20 of the standards.

## **G2030.30 Exterior Steps and Ramps**

### **A. General Description/Design Approach**

- 1.Exterior steps and ramps shall be constructed to accommodate grade changes in parking lot and building access routes. Their location shall be centrally located to accommodate pedestrian traffic approaching from different directions where possible.
- 2.The exterior structures shall be designed and constructed independent of the building structure. The ramps and steps shall be designed and constructed in accordance with by the most recent version of the International Building Code, New Jersey edition and the Barrier-Free Subcode.
- 3.Railings shall be provided on both edges/sides of steps and ramps, as minimum, and intermediately as required by the most recent version of the International Building Code, New Jersey edition and the Barrier-Free Subcode. Railings shall project beyond the ramp and the steps in accordance with the Barrier-Free Subcode. The projection shall return and tie-into the last post installed at the end of the ramp or the last tread,

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whichever the condition. The beginning and end post shall be anchored into the foundation of the ramp or steps to maximize support.

4. All railings and gripping surfaces shall be 1 ½ inch diameter, round tube/pipe railing including barrier-free.

5. Close ended sleeves shall be embedded and anchored into the concrete as part of the steps and ramps for the installation of railings. Railings shall be installed in the pipe sleeves with grout and then sealed.

6. Exterior steps providing controlled and/or limited access to loading docks, roof areas or mechanical equipment areas not being utilized by students may be constructed of galvanized steel or aluminum.

### **B. Materials**

1. Exterior ramps and steps shall be constructed with cast in place concrete, 3,500 PSI, air entrained, reinforced in accordance with the design. Each step structure shall be constructed in one continuous pour independent of sidewalks, buildings and adjacent step structures to allow for future repair and replacement. Ramp construction shall be phased to allow for the construction of the ramp walls followed by interior placement and compaction of back-fill material between the walls. The ramp surface shall be constructed lastly over the backfill and ramp walls.

2. All concrete work shall be installed on 6 inches coarse aggregate No. 57 as defined by NJDOT achieving 95% compaction.

3. All exterior railings shall be galvanized steel or clear aluminum material 1 ½ inches in diameter, 16 gauge, fabricated with welded joints. No mechanical joints will be permitted other than those installed for expansion and contraction as designed and spaced by the engineer.

4. The railings, gripping surfaces and steps, if constructed of metal, shall be constructed of the same material type. Mixing of different material types is not permitted.

# Model Schools: Materials and Systems Standards

## **G2050 Athletic, Recreational, and Playfield Areas**

### **A. General Description/Design Approach**

1. Athletic, recreational and playfield areas shall be age appropriate, and shall be provided with the appropriate access control, fencing and furnishings.
2. All non-competition fields shall be designed for maximum overlap of functions (multi-purpose fields).
3. Athletic facilities shall be designed in conformance with American Society for Testing and Materials (ASTM) and National Federation of State High School Associations.
4. Field orientation shall take into consideration the daily travel path of the sun. Baseball and softball fields should be oriented with the axis, the line from home plate to second, oriented in an East to Northeast position. Rectangular fields utilized for soccer, football, rugby, lacrosse and others shall be oriented in a North to South player orientation.
5. Rectangular playing fields will be provided with drainage along the perimeter, exterior to the playing field, located a minimum of 10 feet from the foul lines. The fields shall be crowned with a 2% cross slope toward the perimeter drainage.

## **G2050.30 Recreational Areas**

### **A. General Description/Design Approach**

1. The facilities shall be designed in accordance with the United States Consumer Product Safety Commission (CPSC), 2010 Edition as adopted and revised by the New Jersey Uniform Construction Code, Playground Safety Subcode, N.J.A.C. 5:23-11.1.
2. All equipment shall be properly anchored to foundations installed below the finished grade. The thickness of the safety surface installed above the foundation shall be equal to the fall protection required for the play area.
3. It is recommended that the equipment and safety surface colors be lighter in color to limit the amount of heat generation from the equipment and safety surfacing.

### **B. Materials**

1. Safety surfaces shall be limited to unitary materials comprised of mats, tiles or poured in place material that adheres to the requirements of ASTM F1292-22 (or current version). These materials provide a greater level of consistency with respect to impact attenuation since they are held together by a binder maintaining a constant thickness. Loose fill surfacing material is not permitted.
2. Equipment shall be anchored to foundations installed in accordance with the manufacturer, Geotechnical Engineer and the Structural Engineer.
3. Safety surfaces shall be installed in accordance with the manufacturer's recommendations on 6 inches of coarse aggregate No. 57.

# Model Schools: Materials and Systems Standards

## G2060 Site Development

### G2060.20 Fences and Gates

#### A. General Description/Design Approach

1. Fences and gates will delineate and/or separate the school property from public and private owned properties.
2. There shall be 4" clear between the bottom of the fence fabric and the finished grade directly below the fence to accommodate landscaping and maintenance.
3. Fence height size restrictions will be imposed as follows:
  - a. Fence installed along property and right-of-way lines fronting on play areas shall be 16 feet in height;
  - b. Fencing installed along property, right-of-way lines and internal to the property for the purpose of limiting access to parking, exterior storage, utility pad and play ground areas shall be 6 to 8 feet in height;
  - c. Fencing installed internal to the site for the purpose of controlling and/or limiting access to age appropriate play ground areas shall be 6 feet in height.
4. Centerline of posts shall be located a minimum of 8 inches from the property line.
5. Posts for fences up to 8 feet in height shall be installed and incased in 3,500 PSI concrete, 1 foot in diameter to a depth of 2 1/2 feet below the finished grade for fences. Fences exceeding 8 feet in height will require a footing design based upon soil conditions and fence height.
6. Fencing being installed in solid rock may be installed utilizing reduced requirements as recommended by the engineer and approved by the Authority.

#### B. Materials

1. Chain Link Fence
  - a. Chain link fence will be utilized to delineate and separate areas requiring controlled access or separation due to age appropriateness requirements.
  - b. Chain link fence gates shall be hinged up to a maximum width of 6 feet and will be cantilevered rolling gates for sizes exceeding 6 feet in width.
  - c. Chain link fence fabric shall be aluminum type.
  - d. The fence fabric, fittings and hardware shall conform to AASHTO M 181 for types, grades and classes. The fittings and hardware shall conform with Grade 1 AASHTO standards.
  - e. Sizing for the material shall be as follows:

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- 1.) Terminal, corner and gate posts shall be AASHTO Grade 1 and have a minimum 3 inch outside diameter;
- 2.) Line posts shall be AASHTO Grade 1 and have a minimum 2 1/2 inch outside diameter;
- 3.) Top, bottom or brace rails shall be AASHTO Grade 1 and have a minimum 1 5/8 inch outside diameter.

### 2. Welded Wire Fence and Gates

- a. See Project Specific Performance Specifications Section G2060.00

### 3. Steel Picket Fence and Gates

- a. See Project Specific Performance Specifications Section G2060.00

## **G2060.60 Retaining Walls**

### **A. General Description/Design Approach**

1. Retaining walls shall be cast-in-place concrete designed as per the requirements of the latest version of the International Building Code, New Jersey edition. It is recommended that fences be installed behind the wall and adjacent to them when required for controlling access and fall protection. The retaining wall and the fence posts shall be two separate and distinct structures.

2. Provide 3/4" expansion joints every 40'-0" maximum, with joints within 10 feet of corners. Expansion joint layout is to be shown on the plans.

3. Provide drainage mat and weep holes (or perforated drainpipe connected to the storm sewer) behind the wall to prevent saturation of the backfill.

4. The use of modular block masonry retaining wall systems, typically comprised of a reinforced earth system and interlocking loose laid decorative blocks is to be investigated for each project during the design. The NJSDA must approve the use of a modular block masonry wall system prior to it being implemented in the design.

5. Foundations for retaining walls to be installed along property lines and/or easements shall be designed to be constructed solely within the property limits.

6. Retaining walls shall avoid creating lower or higher voids, as measured from the wall top or bottom, which make it difficult to access or maintain areas from the school's property. If such a condition is unavoidable, then a means of ingress and egress shall be provided to the void in accordance with the latest version of the International Building Code, New Jersey edition and OSHA regulations.

### **B. Materials**

1. The retaining walls shall be constructed of cast-in-place air entrained concrete as design by the Geotechnical and/or Structural Engineer. The walls shall have a smooth finish, free of voids and defects.

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## Design Requirements

## Site Improvements – Section G20

### G2080 Landscaping

#### A. General Description/Design Approach

1. The plantings proposed as part of the design shall be coordinated and shall adhere to the requirements of the New Jersey Soil Conservation Districts having jurisdiction over the school facility.
2. Careful consideration should be given when planning landscape arrangements and plant selections on school property. Effective landscape design can create a noise and visual buffer that will help insulate interior spaces and outside play areas from nearby busy streets. Absorption of high decibel levels of noise before it reaches school is always a benefit.
3. Consideration is to be given to providing trees, shrubs, and plants that are low maintenance, low water and drought tolerant. Native plantings that do not need permanent irrigation should be selected. Temporary irrigation, if necessary, should be limited up to one year after installation.
4. Existing on-site trees to be saved shall have tree protection installed around the tree 1 foot outside of the tree's drip line.
5. The landscape design shall take into consideration the design grades, utility design and layout, lighting layouts, plazas, walks, drives, service areas, fencing, playfields, site furnishings, planting palette, irrigation design, maintenance considerations, vandalism, and expansion provisions.
6. Landscaped areas and other turf areas shall receive a minimum of 4-inch of topsoil.
7. Plant material with thorns, stickers, aggressive root systems, or which are poisonous shall not be utilized.
8. Plantings shall be set back a minimum of 20 feet from any active recreation field to prevent injury or game related conflicts.
9. Verify landscaping requirements of the applicable municipality for additional items.

#### G2080.10 Planting Irrigation

##### A. General Description/Design Approach

1. Planting irrigation is not permitted.

#### G2080.20 Hydroseeded Grasses

##### A. General Description/Design Approach

1. Temporary and permanent hydroseed grass shall adhere to the requirements of the local New Jersey Soil Conservation Districts having jurisdiction over the school facility.

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2.Design and install trees 20-30 feet apart to discourage ball playing in open space areas.

3.Artificial turf is not permitted in place of grass.

4.Use low spreading shrubs and vine-type plants on slopes only.

### **G2080.30 Plants**

#### **A. General Description/Design Approach**

1.Plants shall be drought-tolerant, with durable, long-lived plants requiring the least amount of maintenance.

2.Planters, if proposed, shall be planted with Perennial type plants. Annual type plants shall not be used.

### **G2080.40 Trees and Shrubs**

#### **A. General Description/Design Approach**

1.Trees shall be planted on school grounds. However, such plantings shall not be within fifteen feet of entrances to the building or paved play areas. In addition the tree's full size growth shall be taken into account so that branches do not hit the building or provide access to upper floors, roofs and impacting building foundations, driveways and sidewalks.

2.Tree grates will not be utilized around trees. Install wood mulch or grass around the tree's base to a point 2 inches from the tree trunk.

3.Place shrubs and trees so as not to obstruct visibility or create a hazard to the normal flow of pedestrians and/or vehicular traffic.

4.Avoid trees and shrubs that flower and/or trees that drop excessive fruit or pods.

5.Locate trees to provide shelter from extreme weather and out of drainage flow lines.





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## **Design Requirements**

### **Section G30: Liquid and Gas Site Utilities**

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# Model Schools: Materials and Systems Standards

## **G30 Liquid and Gas Site Utilities**

### **A. General Description/Design Approach**

1. Provide utility services that meet the facilities demand requirements and a useful life equal to or exceeding that of the school facility. The conveyance systems shall be designed in accordance with local, state and federal design requirements including but not limited to the New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Community Affairs (NJDCOA), International Fuel Gas Code, National Standard Plumbing Code, National Fire Protection Association, and local Utilities Authority providing the service.

2. The utilities shall be located as close as possible to the main service lines in an effort to reduce installation costs.

3. Intersecting utility services shall be plotted in plan and profile to evaluate their alignment and proximity both horizontally and vertically.

### **B. Materials**

1. The materials being utilized shall be in accordance with the most recent version of the New Jersey Department of Transportation's (NJDOT) standards except where superseded by these standards.

### **C. Related Standardized Details**

1. None provided

## **G3010 Water Utilities**

### **A. General Description/Design Approach**

1. The school facilities shall be provided with independent fire and domestic service. The following requirements shall be imposed on water supply:

a. The requirements of this section pertain solely to on-site water supply facilities. Off-site facilities shall adhere to the standards established by local, county and/or state agency governing said facilities;

b. The fire service shall be ductile iron pipe installed in accordance with the building code, National Fire Protection Association (NFPA), National Standard Plumbing Code (NSPC), local municipal utilities authority and New Jersey Schools Development Authority (NJSDA) guidelines. When the requirements differ the most restrictive shall govern;

c. The width of the trench shall be limited to the outside diameter of pipe plus 3 feet to a point 6 inches above the top of pipe;

d. Utility intersections where the clearance is less than 18 inches vertically or 10 inches horizontally shall be encased with a minimum of 6 inches of 4,500 psi concrete. In no event shall the clearance be less than 6 inches;

e. Changes in direction for 4 inch diameter pipe and larger shall be anchored with 4,500 psi concrete thrust blocks poured against undisturbed earth. Install a 6 mil. Poly shield between fittings and the concrete thrust block.

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f. The water supply piping shall be provided with a minimum of 4 feet of cover.

2. Domestic and fire water services provided in exterior building enclosures shall be equipped with the following:

a. Above ground enclosures shall be heated to prevent freezing;

b. Below grade vaults shall be equipped with sump pumps, lighting and ground fault interrupted electric power.

## **G3010.10 Site Domestic Water Distribution**

### **A. General Description/Design Approach**

1. Piping placed on undisturbed subgrade shall be placed over 6 inches of compacted bedding material comprised of  $\frac{3}{4}$  inch stone and coarse sand. Disturbed subgrade areas shall be provided with a 12 inches of compacted bedding material comprised of  $\frac{3}{4}$  inch stone and coarse sand.

2. The backfill material shall consist of  $\frac{3}{4}$  inch stone and coarse sand to a point 12 inches above the top of pipe. The remainder of the backfill material shall consist of onsite when available and recommended by the geotechnical engineer or off-site suitable backfill material compacted in 12 inch lifts.

## **G3010.30 Site Fire Protection Water Distribution**

### **A. General Description/Design Approach**

1. Refer to G3010.10 of the standards.

## **G3020 Sanitary Sewerage Utilities**

### **A. General Description/Design Approach**

1. The following requirements shall be imposed:

a. The requirements of this section pertain solely to on-site sanitary sewerage facilities. Off-site facilities shall adhere to the standards established by local, county and/or the New Jersey Department of Environmental Protection (NJDEP);

b. The sanitary sewer shall be fabricated and installed in accordance with the building code, National Standard Plumbing Code (NSPC), local municipal utilities authority, NJDEP, New Jersey Department of Transportation Standards (NJDOT) and New Jersey Schools Development Authority (NJSDA) guidelines. When the requirements differ, the most restrictive shall govern;

c. Utility intersections where the clearance is less than 18 inches vertically or 10 inches horizontally shall be encased with a minimum of 6 inches of 4,500 psi concrete. In no event shall the clearance be less than 6 inches;

d. The sanitary sewer line shall be provided with a minimum of 4 feet of cover.

# Model Schools: Materials and Systems Standards

## **G3020.10 Sanitary Sewerage Utility Connection**

### **A. General Description/Design Approach**

1. Utility connections shall be performed in accordance with the requirements of the governing municipal utilities authority for the sewerage area.

## **G3020.20 Sanitary Sewerage Piping**

### **A. General Description/Design Approach**

1. Piping shall be installed in accordance with the requirements of the governing municipal utilities authority for the sewerage area, the NJDOT and the NJDEP.

2. The school facilities shall be provided with Ductile Iron Pipe (DIP) sanitary sewer laterals in accordance with the Building Code and the National Standard Plumbing Code (NSPC).

3. The width of the trench shall be limited to the outside diameter of the pipe plus 3 feet to a point 6 inches above the top of pipe

4. Sanitary sewer lines shall be provided with a clean out at a point located 2 feet outside the building and then every 75 feet until the connection to the main.

## **G3020.50 Sanitary Sewerage Structures**

### **A. General Description/Design Approach**

1. Manholes shall be precast concrete with channeled bottoms and benched sides constructed of 3,000 psi concrete to direct flow downstream. The channel shall be constructed to a height equal to 0.8 times the diameter of the pipe and have a minimum thickness of 2 inches where it meets the pipe's low point. The bench shall be sloped toward the channelized area via a 2 inch grade drop.

2. Manholes shall be installed at points where the sanitary sewer changes direction and at the connection to the main.

3. Cast iron circular frames and covers will be provided at the finished grade level in accordance with the local municipal utilities authority.

4. The frames and covers can be adjusted to finished grade with precast concrete grading rings or course brick. The number of courses shall be limited to a maximum of 2.

5. The manholes structures shall be provided with copolymer polypropylene plastic ladder rungs in accordance with NJDOT standards.

6. Sanitary sewerage structures shall be fabricated in accordance with NJDOT Standards, NJDEP and the local Municipal Utilities Authority.

# Model Schools: Materials and Systems Standards

## **G3030 Storm Drainage Utilities**

### **A. General Description/Design Approach**

- 1.The requirements of this section pertain solely to on-site storm water facilities. Off-site facilities shall adhere to the standards established by local, county and/or the state agency governing said facilities;
- 2.The storm sewer distribution and conveyance system shall be constructed of concrete material;

## **G3030.10 Storm Drainage Utility Connection**

### **A. General Description/Design Approach**

- 1.All preparation, installation and bedding materials must be in accordance with New Jersey Department of Transportation (NJDOT) standards.

## **G3030.20 Storm Drainage Piping**

### **A. General Description/Design Approach**

- 1.All preparation, installation and backfill material must be in accordance with New Jersey Department of Transportation (NJDOT) standards.

## **G3030.30 Storm Drainage Culverts**

### **A. General Description/Design Approach**

- 1.All preparation, installation and backfill material must be in accordance with New Jersey Department of Transportation (NJDOT) standards.

## **G3030.40 Site Storm Water Drains**

### **A. General Description/Design Approach**

- 1.All preparation, installation and backfill material must be in accordance with New Jersey Department of Transportation (NJDOT) standards.
- 2.Drainage structures located in vehicular areas or exposed to vehicular loads shall be constructed of concrete materials in accordance with NJDOT Standards.
- 3.Drainage structures not exposed to vehicular traffic shall be sufficient in size and properly equipped to provide access and entrance for operation, inspection and maintenance.

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Liquid and Gas Site Utilities – Section G30

**G3030.50 Storm Drainage Pumps**

**(RESERVED)**

**G3030.60 Site Subdrainage**

**(RESERVED)**

**G3030.70 Storm Drainage Ponds and Reservoirs**

**A. General Description/Design Approach**

1. All preparation, installation and backfill material must be in accordance with New Jersey Department of Transportation (NJDOT) standards.

2. Storm water detention, infiltration and/or retention facilities shall be designed in accordance with NJDEP Stormwater Best Management Practices Manual and the agency having jurisdiction over the system. When the requirements differ, the most restrictive shall govern.

3. Drainage structures and conveyance systems entering the basins shall be equipped with the appropriate grating or covers to control access.



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## **Design Requirements**

### **Section G40: Electrical Site Improvements**

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# Model Schools: Materials and Systems Standards

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Electrical Site Improvements – Section G40

## **G40 Electrical Site Improvements**

### **G4050 Site Lighting**

#### **A. General Description/Design Approach**

1. The school facilities shall be provided with sufficient lighting to meet the requirements of the International Building Code, New Jersey Edition and National Electrical Code Subcode of the Uniform Construction Code:

a. The requirements of this section pertain solely to on-site lighting facilities. Off-site facilities shall adhere to the standards established by local, county and/or state agency governing said facilities;

b. Means of egress exit discharge illumination levels shall be in accordance with Section 1008 of the International Building Code, New Jersey Edition;

c. Site lighting shall consist of surface mounted building fixtures and pole mounted fixtures utilized to illuminate walkways and parking lot areas;

d. Pole mounted lighting shall be installed on precast concrete foundations extending a minimum of 2 feet above the finished grade;

e. Parking lot lighting shall be installed around the parking lot perimeter and within interior islands, 2 feet from the edge of paving areas to protect against vehicular impact;

f. Exterior lighting circuits shall be operated via photovoltaic sensors mounted on the each pole;

g. A point to point lighting design and wiring diagram shall be prepared for the exterior lighting system.





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## **Appendix A:**

### **Industry & Governmental Resources**

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# Model Schools: Material and Systems Standards

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Governmental and Industry Resources Appendix A

## A. Industry and Governmental Resources:

### 1. Publications

- Bachman, L. Integrated Buildings: The Systems Basis of Architecture. Washington, DC: John Wiley & Sons, 2002.
- Ramsey and Sleeper, Architectural Graphic Standards; published by John Wiley & Sons with The American Institute of Architects, Twelfth Edition

### 2. Online Resources

- American Society for Testing of Material [www.astm.org](http://www.astm.org)
- Acoustical Society of America <http://www.acousticalsociety.org/>
- American Concrete Institute (ACI) <http://www.concrete.org/general/home.asp>
- American Institute of Steel Construction ,Steel Construction Manual, <http://www.aisc.org/>
- Fenestration & Glazing Industry Alliance (FGIA) <https://fgiaonline.org/>
- American National Standards Institute; Standards such as “Specifications for Sectional Overhead Type Doors” [www.ansi.org/](http://www.ansi.org/)
- Brick Industry Association: Technical Notes on Brick Construction Series, Brick Briefs, etc. <http://www.bia.org/> [www.gobrick.com](http://www.gobrick.com)
- EPA Energy Star Program. <http://www.energystar.gov> (March 2009)
- Federal Energy Management Program. <http://www.eere.energy.gov/femp> (March 2009)
- International Masonry Institute’s Masonry Detail Series, Technical Briefs, Life Cycle Cost Analysis, etc. <http://www.imiweb.org/>
- Concrete Masonry and Hardscapes Association (CMHA) <https://www.masonryandhardscapes.org/>
- National Institute of Standards and Technology (NIST) Building Life Cycle Cost (BLCC) Software: [http://www1.eere.energy.gov/femp/information/download\\_blcc.html](http://www1.eere.energy.gov/femp/information/download_blcc.html)
- National Fire Protection Association (NFPA) “Standard for Fire Doors and Windows” [www.nfpa.org/](http://www.nfpa.org/)
- New Jersey Stormwater Best Management Practices Manual [www.state.nj.us/dep/stormwater/bmp\\_manual2.htm](http://www.state.nj.us/dep/stormwater/bmp_manual2.htm)

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## Governmental and Industry Resources Appendix A

- New Jersey Department of Environmental Protection(NJDEP) Historic Preservation Office  
<http://www.nj.gov/dep/hpo/>
- New Jersey Department of Environmental Protection(NJDEP)  
<http://www.state.nj.us/dep/>
- New Jersey Schools Development Authority  
[www.njsda.gov/](http://www.njsda.gov/)
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)  
<http://www.smacna.org/>
- State of New Jersey Department of Community Affairs Division of Codes and Standards  
<http://www.nj.gov/dca/divisions/codes/index.html>
- State of New Jersey Department of Education, The Office of School Facilities;  
<http://www.state.nj.us/education/facilities/>
- State of New Jersey, Department of Transportation Manuals, Roadway Design Manual, Traffic Mitigation Guidelines, Bridges and Structures Design Manual  
<http://www.state.nj.us/transportation/eng/>
- State of New Jersey, Pinelands Commission, Pinelands Comprehensive Management Plan  
[www.state.nj.us/pinelands](http://www.state.nj.us/pinelands)
- Steel Door Institute ANSI/SDI-100 Recommended Specifications: Standard Steel Doors and Frames” [www.steeldoor.org/](http://www.steeldoor.org/)
- Steel Stud Manufacturers Association [www.ssma.com](http://www.ssma.com)
- Tile Council of North America, Inc.: 2024 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation <https://tcnatile.com/products/publications/2024-tcna-handbook-for-ceramic-glass-and-stone-tile-installation/>
- Underwriters Laboratory [www.ul.com](http://www.ul.com)
- U. S. Department of Energy;  
<http://energy.gov/> and EQuest Quick Energy Simulation Tool  
<http://doe2.com/equest/index.html>
- U.S. Department of Energy. National Best Practices Manual for Building High Performance Schools  
<https://www.energy.gov/sites/prod/files/2013/11/f5/nationalbestpracticesmanual31545.pdf>  
(November 2013)
- U.S. Department of Justice 2010 ADA Standards for Accessible Design  
[www.ada.gov/2010ADASTandards\\_index.htm](http://www.ada.gov/2010ADASTandards_index.htm)
- U.S. Department of Labor, Manual on Uniform Traffic Control Devices for Streets and



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Governmental and Industry Resources Appendix A

Highways [https://mutcd.fhwa.dot.gov/pdfs/11th\\_Edition/mutcd11thedition.pdf](https://mutcd.fhwa.dot.gov/pdfs/11th_Edition/mutcd11thedition.pdf)

- United States Gypsum [www.usg.com](http://www.usg.com)
- Research; The Whitestone Facility Maintenance and Repair Cost Reference <https://secure.whitstoneresearch.com/>
- Whole Building Design Guide. <http://www.wbdg.org>. Product Information by CSI Format Available.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

## **Variance Request Form**

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## Variance Request Form: Appendix B

**Contract No.:** \_\_\_\_\_  
**CMF if applicable:** \_\_\_\_\_  
**Variance Number:** \_\_\_\_\_  
**Sub Consultant:** \_\_\_\_\_

	Design Phase	Section No.	Requirement
1.			

	Design Phase	Section No.	Reason(s) / Justification (provide separate attachment if required)
1.			

	Design Phase	Section No.	(provide separate attachments as required)
1.			

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Variance Request Form: Appendix B

Recommended:					
NJSDA:	Signature	<input type="checkbox"/>	Recommended	<input type="checkbox"/>	Not Recommended
	NJSDA Program Officer; (Printed Name)		Date:		

Approved:					
NJSDA:	Signature	<input type="checkbox"/>	Approved	<input type="checkbox"/>	Not Approved
	NJSDA Director; (Printed Name)		Date:		
NJSDA:	Signature	<input type="checkbox"/>	Approved	<input type="checkbox"/>	Not Approved
	Advisory Group Leader or Design Studio Director; (Printed Name)		Date:		
NJSDA:	Signature	<input type="checkbox"/>	Approved	<input type="checkbox"/>	Not Approved
	NJSDA Vice President; (Printed Name)		Date:		





# **NJSDA Model Schools Program**

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## **Materials and Systems Standards Manual**

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# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Introduction & General Requirements**

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# Model Schools: Materials and Systems Standards

## A. Introduction

The NJSDA's Model Schools Program's: "**Materials and Systems Standards Manual**" and "**Construction Details Manual**" have been developed in response to an ongoing internal effort to implement standardized designs for NJSDA projects. The use of standardized design elements has the potential to afford efficiencies in the design and construction of school facilities. Standardized design will facilitate expedited design reviews and code inspections for faster delivery of school projects.

The following is an excerpt from the New Jersey Schools Development Authority's (NJSDA) 2011 Capital Program Report dated March 2, 2011: Section 3: Implementation Approach, which is related to standardized systems & materials:

"In 2011, the NJSDA plans to pursue standardization through three phases". The third phase as stated in the Capital Program Report includes the "**identification of standard systems and materials**".

The NJSDA has proceeded with the continued development of design and construction guidance to assist the Professional Consultant Community. Based upon the directives above, the NJSDA has proceeded with the development of the "**Materials and Systems Standards Manual**" and "**Construction Details Manual**" which "*identify standard materials and systems*" to be implemented in conjunction with other procedures and their respective component parts to establish a "Standardized Model or Prototypical School Design Approach".

## B. Model Schools Program: Materials and Systems Standards & Construction Details Manuals

The NJSDA's "**Materials and Systems Standards Manual** and **Construction Details Manual**" have been prepared for and shall apply to Public School Facilities Projects in the State of New Jersey that are managed by the New Jersey Schools Development Authority (NJSDA) as defined by the "Educational Facilities Construction and Financing Act" (EFCFA).

With the NJSDA's "**Materials and Systems Standards Manual** and **Construction Details Manual**", it is NJSDA's full intent to establish a uniform approach to School Facilities Project design such that we accomplish the following key goals:

- Attain parity amongst all New Jersey Abbott School Districts by the implementation of Model School or prototypical designs thru the use of standardized materials and systems.
- Establish an approach that requires the repeated use of defined materials and systems standards as a cost effective and common sense means of constructing all 21st Century Schools for New Jersey.
- Establish a means for NJSDA managed School Facilities Projects to be built in an educationally appropriate, community focused, cost effective, sustainable, energy efficient, safe, secure, clean, and environmentally friendly manner.

The NJSDA's "**Materials and Systems Standards Manual**" contains "**Design Requirements**" sections which define the materials and systems to be implemented; the "**Construction Details Manual**" contains related select key reference standardized construction details. The development and implementation of these requirements is one key step in establishing a new design and procedural norm for Pre-K through 12 school facilities while simultaneously establishing the NJSDA as one of the nation's key resources for knowledge relative to lessons learned in constructing School Facilities Projects for both urban and suburban areas.



# Model Schools: Materials and Systems Standards

## Design Requirements

## Introduction & General Requirements

The NJSDA's *"Materials and Systems Standards Manual and Construction Details Manual"* are living documents that will be updated and issued in phases as NJSDA project teams learn more efficient and effective ways to design and construct School Facilities Projects for New Jersey in the face of the specific environmental and site challenges that exist within the NJSDA Program. The development and issuance of "NJSDA's *"Materials and Systems Standards Manual and Construction Details Manual"* are centered around NJSDA's commitment to build on the Best Practices and lessons learned from our program, as well as the experiences of others throughout the nation, who have implemented the design of pre-K through 12 schools. Thus the related goals are to achieve cutting edge School Facilities Project design and to implement proven standards that have met the test of time.

NJSDA has integrated the goals and criteria above and has developed the *"Materials and Systems Standards Manual and Construction Details Manual"* to encourage design creativity. The manuals simultaneously provide guidance for uniformity in the overall approach to materials and systems selection during the design phases of a project. By implementing the elements included within the *"Materials and Systems Standards Manual and Construction Details Manual"*, the Project Team will be taking a significant step forward in creating the physical conditions in which the learning process can thrive. This, in essence, is a key component of what defines a 21st Century School for New Jersey.

### C. Organization of this document: Refer also to the Table of Contents and Sections herein

1. The *"Design Requirements"* sections which follow in the *"Materials and Systems Standards Manual"* utilize The Construction Specifications Institute's (CSI) *"UniFormat: A Uniform Classification of Construction Systems and Assemblies, Levels 1-4"* for their organization. Uniformat is a nationally recognized organizational format for construction materials and products grouped by assemblies, systems and component parts.
2. The *"Construction Details Manual"* contains select key *"Standardized Construction Details"* for the Materials and Systems recommended in the other manual. The construction details are also referenced with the same respective UniFormat section designations as the Design Requirements. These construction details are for reference only and are to be reviewed by the Design Consultant and its Sub-Consultants for applicability prior to inclusion in the construction documents for any respective project.

### D. Content

1. The focus of the "NJSDA *"Materials and Systems Standards Manual"* is to require the Design Consultant and its Sub-Consultants to choose materials and systems defined therein. These standards have been developed around the requirements of NJSDA and New Jersey school districts by selecting high quality, durable products, and materials and systems which are easy to maintain, and reflect the budgetary constraints of a relatively low initial cost. The NJSDA's *"Construction Details Manual"*, is a newly developed technical reference for the Design Consultant and its Sub-Consultants.
2. The materials and systems to be used in the design and construction of School Facilities Projects shall typically be limited to those materials and systems which are defined in these sections of the NJSDA's *"Material and System Standards Manual"* and associated *"Design Requirements"* sections.
3. All Design Consultants and their Sub-Consultants shall adhere to these NJSDA Model Schools: *"Materials and Systems Standards Manual"* and utilize the associated *"Construction Details Manual"* as a reference source, as applicable, in the design of contractually assigned specific School Facilities Projects. The standards herein apply to all Sub-Consultants, employees, and others retained by the Design Consultant; The Design Consultant shall be responsible for all actions of its Sub-Consultants and other team members in accordance with these standards.

# Model Schools: Materials and Systems Standards

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## Design Requirements

## Introduction & General Requirements

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4. ALL MATERIALS AND SYSTEMS INDICATED AS “SUBJECT TO APPROVAL BY THE NJSDA” MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION DOCUMENTS.

5. In the event of a conflict between the Materials and Systems Standards and other guidance documents such as, the Education Specifications, the NJSDA’s Kit of Parts content, Bridging Documents also known as the Design Builder’s Information Package, and presiding codes shall take precedence.

6. This document does not contain a complete or comprehensive reference to any ASTM, UL, or other standard testing methods, nor does it contain a complete listing of ASTM and other quality assurance reference standards for any of the Materials or Systems Standards specifically defined herein.

7. In the event that the Design Consultant or District requests substitution of a material or system other than those defined within the NJSDA Model Schools “*Materials and Systems Standards Manual*,” and associated technical “Construction Details Manual”, it is the Design Consultant and / or the District’s responsibility to demonstrate to the NJSDA, utilizing the Variance Request Process defined below, that their suggested substitution is justifiable. The use of any materials and / or systems not identified in this document is subject to approval by the NJSDA.

### E. Disclaimer

1. The drawings, details, tables, data, and other information in this product have been obtained from many sources, including government organizations, trade associations, suppliers of building materials, and professional Design Consultants or architectural firms and professional organizations. The NJSDA has made every reasonable effort to make this reference work accurate and authoritative, but does not warrant, and assumes no liability for, the accuracy or completeness of the content or its fitness for any particular purpose. It is the responsibility of the Design Consultant and its Sub-Consultants to apply their professional knowledge in the use of information contained in this product, to consult the original sources for additional information when appropriate.

### F. General Requirements

1. As a general rule, Design Consultants and its Sub-Consultants shall conform to NJSDA’s Design Requirements and the content herein.

2. The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards () and all other Federal, State, County, Municipal, and Local codes, ordinances, laws, requirements, etc. having jurisdiction over this project. Renovations and restorations shall meet the requirements of the NJUCC and its Rehabilitation Sub-code and relevant amendments. In addition, the Design Consultant and their Sub-Consultants shall comply with all existing presiding requirements of the Department of Education, The Office of School Facilities; () and related New Jersey Administrative Code (N.J. A.C.) Title 6A:26.

3. The Design Consultant and its Sub-Consultants shall only include in the Construction Documents products that meet ‘Made in America’ criteria as defined by the Federal Trade Commission.

4. All ‘new’, ‘alteration’, ‘reconstruction’, renovation and/or ‘change of use’ of Instructional Spaces, as defined by the NJDOE facilities efficiency standards, shall meet the maximum noise levels, minimum Reverberation Time (RT), and Sound Transmission Coefficients (STC) requirements as described in ANSI / ASA Standard S12.60 (current version), “Acoustical Performance Criteria, Design Requirements



# Model Schools: Materials and Systems Standards

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## Design Requirements

## Introduction & General Requirements

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and Guidelines for Schools” as applicable or as modified by the contractually related version of the 21st Century Schools Design Manual: Design Criteria 1, “Acoustic Comfort”.

### G. The Variance Request Process

1. In limited, defensible, special situations as defined below, if either the District or the Design Consultant proposes a design that varies from NJSDA's “*Design Requirements*” in the “*Materials and Systems Standards Manual*” and the “*Construction Details Manual*” and the content herein, approval must be obtained from the NJSDA by the Variance Request Process and shall meet the requirements listed below. The Design Consultant shall submit the required Variance Request Form (Refer to “Appendix B”) and all support data and information as soon as possible but no later than end of the Design Development phase. The Design Consultant shall not incorporate the material, system, or technology in their construction documents until NJSDA approval has been granted.

2. The NJSDA will consider a proposal for a Variance Request under any or all of the following circumstances:

- a. The proposed product, material, or system provides equal or better performance of all comparable characteristics at a savings, equal cost, or at a minimal incremental greater cost.
- b. The proposed product is a new material, system, or technology that has better performance characteristics.
- c. The proposed product is a new material, system or technology and is a standard product used by the district consistently in their schools and meets the requirements of a. above.

Note: The Variance Request Process does not apply to proprietary product requests which are addressed below in Section: I below.

3. In order for the NJSDA to review a proposal for a Variance Request the following information must be provided by the District or the Design Consultant

- a. A completed Variance Request Form found in Appendix “B”.
- b. A report or comparison with all justification, product performance data, literature, and analysis demonstrating how and why the proposed material or system alternative provides improved performance
- c. If the proposed product is a new material, system or technology that has better performance characteristics, provide information about how long it has been available for application, where it has been used (preferably in other schools), and any resulting performance testing of the product in situ.
- d. The total cost impact of this material, system, or technology as it applies to the specific school facilities project. A detailed construction cost estimate reflecting the level of development of the design solution should be presented in UniFormat 2011 or MasterFormat 2011 to facilitate comparison between the baseline alternative and various options selected.

4. The NJSDA shall, in its sole discretion, approve or reject the Variance Request in writing within 30 days. The Design Consultant shall not incorporate the material, system, or technology in their construction documents until NJSDA approval has been granted.

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5. Completion and submission of a Variance Request Form and inclusion of a substituted material or system into the Contract Documents is the Design Consultant's sole responsibility and shall be accomplished at no cost to the NJSDA for professional services associated with the Variance Request Process.

## **H. Sustainable/Green Design Criteria**

1. The Design Consultant and its Sub-Consultants shall comply with the NJSDA's Sustainable/Green/USGBC LEED Design requirements and goals. Revised NJSDA Sustainable Design Guidance is currently under development. For new Design Consultant procurements refer to the respective contract for professional scope of services for Sustainable/Green/LEED Design Criteria and associated requirements. For earlier Design Consultant procurements refer to the associated contract and NJSDA guidance to Design Consultants for these requirements.

2. The focus of the content herein does not currently define specific materials' and systems' requirements or features with regard to sustainability and green design. However, the materials and systems defined herein may inherently have such features by the nature of their specified typical composition, components, use, assembly, application, or the requirements described herein.

## **I. Requirements for Specifications and Proprietary Specifications**

1. The Design Consultant and its Sub-Consultants shall use the current version of MasterFormat (currently 2011) in the development of their School Facilities Projects' technical specifications.

2. The use of proprietary specifications is prohibited; therefore, whenever a "brand name" item is specified, the specification must list, by name, at least three (3) comparable manufacturers followed by the words "or approved equal". If these comparable "equal" manufacturers are not available, NJSDA must have previously approved the specifications prior to issuance for bids.

3. To ensure that the word "equal" cannot be misinterpreted in the course of bidding, the Design Consultant and their Sub-Consultants must thoroughly describe in the technical specifications all essential performance and/or physical features which must be incorporated into the specified item or system to meet its minimum functional needs and space limitations. Minor features of the preferred products that do not have an impact upon the product performance for this use shall not be specified as required criteria for bidding. Accessories and/or minor component associated with systems and/or assemblies, as defined by the current version of MasterFormat's designated specifications sections, may be identified as a single manufacturer followed by the words "or approved equal". The listed manufacturer of a minor product must not void any warranty offered by a company for a comprehensive system, not decrease performance or quality, and shall be compatible with the system or assembly which it may be part of.

4. Variances from this requirement may be granted, including restricting bids to certain select manufacturers, subject to the following stipulations:

a. No known readily available products, other than the specified, are capable of providing the salient physical, functional, and/or other characteristics, including cost, essential to the minimal needs of the Client School District.

b. Where existing systems are being extended (fire alarm, etc.) and single-system integrity can only be preserved or compatibility assured by resorting to the designated products. This applies

# Model Schools: Materials and Systems Standards

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## Design Requirements

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to new construction, additions to existing buildings and when major renovations to an existing building are planned, if the School District has a 'District-Wide' system where the single system integrity would be lost by adding an incompatible generic system. Focus for an exception to the requirement of a non-proprietary system should be prioritized by importance. Importance factors (from highest): Fire/Life Safety systems, Occupant Safety and Security, followed by long-term ease of building Operations and Maintenance.

c. The Design Consultant and its Sub-Consultants as well as the School District must request in writing to the NJSDA, a request for variance from the proprietary specification requirements at least thirty (30) days before inclusion in the Construction Documents. This request shall include a draft version of the proposed specification sections, any associated product cuts, data sheets, diagrams, pictures, or additional technical information necessary to completely describe the material or system for which the variance is requested and the relevant justification for this action.

d. Within ten (10) days of receipt, the request will be reviewed, and if approved, the NJSDA Project Manager will grant authorization in writing to proceed. Upon receipt of authorization, the Design Consultant shall include in the Construction Documents the name of the desired manufacturer to be used by the contractor in its base bid.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section A: Sub Structure**

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# Model Schools: Materials and Systems Standards

## A Sub Structure

### A. General Requirements

1. The design and selection of materials and systems, as well as the resulting assemblies and detailing reflected in the Construction Documents shall comply with all presiding codes.
2. When applicable, the Design Consultant shall consult with a Geo-technical Engineer and the Licensed Site Remediation Professional (LSRP), and Structural Engineer and each shall review the Geo-technical Report to determine soil types and groundwater levels as well as their effect on drainage ~~and~~ waterproofing methods as well as footing, slab, and foundation system design ~~recommendations~~. If a Geo-technical report exists, follow the report's recommendations for dampproofing and/or waterproofing requirements, excavation, backfill material, and subgrade drainage, and compaction. Consult a waterproofing specialist to determine a specific design approach for problem soils, contaminated soils, or other atypical conditions.
3. All School Facilities Projects shall comply with the presiding NJ Uniform Construction Code, Radon Hazard Sub-Code: Subchapter 10 when applicable.

### B. Materials

1. Choice of materials must be guided by building budget and the following requirements:
  - a. The materials to be used in the design and construction of the school's exterior facades, interiors, and below grade conditions shall typically be limited to those materials which are specified in the Authority's Standards and the parameters established herein.
2. ALL MATERIALS AND SYSTEMS INDICATED AS "SUBJECT TO APPROVAL BY THE NJSDA" MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION **DOCUMENTS**.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section A10: Foundations**

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# Model Schools: Materials and Systems Standards

## A10 Foundations

### A. General Requirements

1. The foundation design shall be based on the recommendations in the geotechnical engineering report prepared for the project.
2. Specify and detail code compliant thermal resistance and continuity of the thermal envelope around all exterior ~~basement~~**below grade** foundation walls / wall / roof assemblies.
3. For all sites and particularly contaminated sites, clearly specify and detail the passive/active vapor barrier/venting system on the construction documents. This system shall be in compliance with all presiding codes and subcodes.

### A1010 Standard Foundations

#### A. General Requirements (Refer to A1010.10 Below)

#### A1010.10 Standard Wall Foundations

##### A. General Requirements

1. Standard foundation wall construction shall include a properly reinforced concrete continuous footing and walls constructed of either reinforced concrete or concrete masonry units, reinforced with appropriately sized reinforcing bars and grout filled when required. The foundation shall be sized to resist all lateral and vertical forces acting upon it and designed to meet all presiding code requirements. If soil bearing capacity is not acceptable to utilize conventional spread footings, special foundation system alternatives shall be investigated and analyzed based upon the following: lowest first cost, existing site soils type(s), code requirements and any related water table issues. The alternative system shall be selected and designed accordingly. Refer to A10 Foundations, A1020 Special Foundations for additional information.

##### B. Related Standardized Details:

1. Refer to the following details for additional information: **(Details are for reference only).**
  - a. B2010-11-02 Section @ Foundation: Brick Exterior Cavity Wall w/ CMU Backup
  - b. B2010-11-07 Section @ Foundation: Brick Veneer/CMU Backup: w/ Basement
  - c. B2010-11-10 Section @ Foundation: CMU Exterior Cavity Wall w/ CMU Backup
  - d. B2010-11-15 Section @ Foundation: Brick CMU Veneer /CMU Backup: w/Basement
  - e. B2010-11-27 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - f. B2010-11-31 Section @ Foundation: CMU Exterior Cavity Wall w/ Metal Stud Backup

# Model Schools: Materials and Systems Standards

## **A1010.30 Standard Column Foundations**

### **A. General Requirements**

1. Standard column foundations shall consist of a reinforced concrete footings concentrically located below its supported column. Anchor bolts for steel columns or reinforcing dowels for concrete or masonry columns shall be embedded in the footing prior to concrete placement. Steel columns whose footing top is located more than 1'-0 below the slab on grade above shall bear on a pedestal of reinforced concrete or reinforced concrete masonry to support it. Footings shall be sized to support all vertical and lateral loads, including uplift and overturning moment.

## **A1010.90 Standard Foundation Supplementary Components**

### **A1010.90.1 Dampproofing**

#### **A. General Requirements**

1. Where a slab-on-grade, standard footings and foundations are provided, or other conditions where waterproofing is not required, and a high water table is not present, provide dampproofing on the outside of wall surfaces of the foundation walls and other below-grade elements. Provide a drainage panel on the exterior of all walls to the bottom of footing to reduce build-up of hydrostatic pressure from saturated soils. At pervious areas, provide perforated pipe at the footing elevation connected to the storm system to collect water and carry it away from the building.

#### **B. Dampproofing**

##### **1. Dampproofing Alternatives**

###### **a. Volatile Solvents-based Dampproofing**

- 1.) Brush or spray application: Asbestos-free solvent based, asphalt compound with fibers (ASTM D4479 Type 1).
- 2.) Trowel mastic application: Heavy bodied, asbestos-free, solvent based, asphalt compound (ASTM D4586 Type 1).

###### **b. Non-volatile Emulsion Based Dampproofing**

- 1.) Brush or spray application: Asbestos-free emulsion manufactured with asphalt, clay emulsifiers, and fibers (ASTM D1227 Type 2, Class 1 and ASTM D1187 Type 1).
- 2.) Trowel mastic application: Heavy bodied, asbestos-free emulsion manufactured with asphalt, clay emulsifiers, and fibers (ASTM D1227 Type 2, Class 1 and ASTM D1187 Type 1).

###### **c. Protection Board**

- 1.) Mineral-fortified asphalt core formed between two outside layers of asphalt-impregnated reinforced mats (ASTM D6506 Class A, Type 2) placed over the dampproofing.
- 2.) Perimeter insulation may not be used as protection board.



# Model Schools: Materials and Systems Standards

## A1020 Special Foundations

### A. General Requirements

1. Where soil conditions do not warrant the use of standard concrete spread column footings or continuous wall footings bearing on the in-situ soil or structural fill, special foundations shall be utilized.

2. Acceptable systems:

a. Drilled shafts of concrete with or without a permanent casing extending below grade to a suitable bearing stratum and/or to a depth to develop the required load capacity through skin friction. Grade beams of reinforced concrete or concrete-encased steel beams may be utilized to transfer vertical and lateral loads to the drilled shafts as deemed necessary and to support masonry and concrete walls.

b. Micropiles consisting of hollow steel sections drilled into the soil and filled with concrete and reinforcing bars as required to develop the load capacity specified through socketing in the underlying bedrock and/or through skin friction. Grade beams of reinforced concrete or concrete-encased steel beams or concrete pile caps may be utilized to transfer vertical and lateral loads to the piles as deemed necessary and to support masonry and concrete walls. A number of additional piles shall be installed to verify the load capacity through load testing. The design of this system shall be by a licensed engineer engaged by the foundation subcontractor.

c. Helical piles consisting of hollow or solid steel shafts with helical bearing plates that are installed by rotating the shaft into the soil to a depth to suitable to develop the specified load capacity. Grade beams of reinforced concrete or concrete-encased steel beams or concrete pile caps may be utilized to transfer vertical and lateral loads to the drilled shafts as deemed necessary and to support masonry and concrete walls. A number of additional piles shall be installed to verify the load capacity through load testing. The design of this system shall be by a licensed engineer engaged by the foundation subcontractor.

d. Driven timber, concrete, or steel sheet piles are permitted when the vibration produced by the procedure for driving the piles is not a major concern. Special care shall be taken when there are surrounding and or adjacent structures. When these systems are used and there are adjacent structures or structures in close enough proximity to the project site to be of concern a detailed existing conditions survey shall be produced. This detailed survey shall include all buildings that may be impacted by this process. This documentation should include, but not be limited to, a photographic survey.

e. Concrete mat foundation consisting of a continuous slab of concrete of appropriate thickness to distribute the vertical and lateral loads to the underlying soil so as to not exceed the soil's bearing capacity.

3. Unacceptable systems:

a. Rammed earth aggregate footings.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section A20: Subgrade Enclosures**

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# Model Schools: Materials and Systems Standards

## A20 Subgrade Enclosures

### A. General Requirements

1. The design and selection of materials and systems, as well as the resulting assemblies and detailing reflected in the Construction Documents shall comply with all presiding codes.
2. Structures are to be designed for the appropriate hydrostatic pressure and waterproofed for a design water table elevation three feet above the highest level given on the borings as a minimum. The geo-technical engineers are to study the historic data for the area, prepare an analysis, and determine if the design ground water elevation needs to be greater than three feet above the highest actual level shown on the borings.

### B. Materials

1. Choice of materials must be guided by building budget and the following requirements:
  - a. The materials to be used in the design and construction of the school's exterior facades, interiors, and below grade conditions shall typically be limited to those materials which are specified in the NJSDA's Standards and the parameters established herein.
2. ALL MATERIALS AND SYSTEMS INDICATED AS "SUBJECT TO APPROVAL BY THE NJSDA" MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION DOCUMENTS.

### C. Related Standardized Details:

1. Refer to the following details for additional information: **(Details are for reference only).**
  - a. B2010-11-07 Section @ Foundation: Brick Veneer/CMU Backup: w/ Basement
  - b. B2010-11-15 Section @ Foundation: Brick CMU Veneer /CMU Backup: w/Basement

## A2010 Walls for Subgrade Enclosures

- ### A. General Requirements (Refer to Section A10 Foundations and Section A1010)

## A2010.10 Subgrade Enclosure Wall Construction

### A. General Requirements

1. The majority of NJSDA projects do not contain basements and are typically slab-on grade with below-grade foundation walls and reinforced concrete footings. For those projects which contain basements or provide other below-grade facilities, waterproofing the exterior walls is critical if within a high water table. In addition; many NJSDA School Facilities Projects contain other slab-on-grade below-grade penetrations such as elevator pits, concrete enclosed pits for science room acid neutralization tanks, grease pits, etc. some of which also require waterproofing. The Design Consultant shall determine which below-grade components require waterproofing and which of the recommended systems are appropriate based upon the related site geo-technical conditions and other factors.

# Model Schools: Materials and Systems Standards

2. In certain instances, other soil or surrounding site conditions may require the selection of a vapor mitigation membrane system. Refer to A10 Foundations A2010.90 Standard Wall Supplementary Components and Vapor Mitigation Systems for further information.

## **A2010.10.1 Typical Basement Wall Construction**

### **A. General Requirements**

1. Typical basement wall construction includes a properly reinforced concrete spread footing, and walls made of either reinforced concrete or concrete masonry units reinforced with appropriately sized reinforcing bars and grout filled, sized to resist all lateral and vertical forces acting upon it and to meet presiding code requirements or concrete masonry units unfilled. If standard soil bearing capacity is not available to utilize conventional spread footings, special foundation system alternatives shall be investigated, analyzed based upon lowest first cost, soil types, water table issues, and selected and designed accordingly.

2. Provide adequate storm water drainage and waterproofing of walls to protect below grade slabs from water intrusion.

3. Provide adequate sub-surface drainage to transport water to discharging in storm drains or other appropriate detention.

## **A2010.90 Subgrade Enclosure Wall Supplementary Components**

### **A2010.90.1 Dampproofing**

1. For basement walls, concrete footings, and slabs which do not require waterproofing refer to Section A1010.90 Standard Foundations Supplementary Components; Dampproofing for further information.

### **A2010.90.2 Below Grade Waterproofing**

**A. General Requirements:** Guidelines for Waterproofing Design for Basement Walls in High Water Table Areas. These guidelines shall apply to basement footings and slabs as well as walls in high water table areas.

1. The preferred method of waterproofing is by positive-side application, consisting of a sheet membrane waterproofing system; however, the alternatives listed below are also acceptable if defensible by the Design Consultant, Geo-technical or Environmental Engineer or their report, or a waterproofing specialist and they are compatible with the project budget. Selection of an alternative system requires approval by the NJSDA. Utilities are to be designed such that they run within the building space (preferred) or are encased and placed above the waterproofing to avoid penetrations in the waterproofing to the greatest extent possible. Provide water stops at all joints.

2. Provide a mud-mat for concrete slabs over a six (6) inches minimum in thickness as a working surface for the installation of the waterproof system on a horizontal surface before the slab is poured. Utilize sand, pea gravel, or compacted earth as a working surface to facilitate installation of the waterproofing at horizontal applications for thinner slab.

# Model Schools:

## Materials and Systems Standards

3. Surfaces subject to constant water, such as elevator and sump pits are to have a waterproofing application consisting of a "crystalline" type waterproofing on the Interior side. This is in addition to the positive side application required for high water table.

**B. Waterproofing Alternatives:** Refer to related selected manufacturer's recommendations and product data for a complete system and its proper application. When appropriate for the soils and water table conditions utilize both the vertical and horizontal applications of these systems.

1. Provide a complete system consisting of self adhering sheet membrane waterproofing composed of a rubberized-asphalt sheet system typically with cross-laminated polyethylene film permanently bonded to the outer surface or buytl rubber and all related accessories and other auxiliary components.

2. Provide a complete system utilizing a slab sheet membrane waterproofing (Also for blind side formwork application) consisting of cold applied composite sheet of high density polyethylene film, synthetic adhesive and protective coating or buytl rubber and all related accessories and other auxiliary components. Material is placed so that concrete is cast against the protective coating.

3. Provide a complete system utilizing a roller applied waterproof membrane consisting of a water based asphalt emulsion modified with a blend of synthetic rubbers and special adhesives, reinforcing fabric, and all related accessories and other auxiliary components.

4. Provide a complete system utilizing a cold fluid applied single component, moisture cured, elastomeric, coal tar free, modified polyurethane waterproof membrane which cures to form a flexible monolithic waterproof membrane on vertical and horizontal surfaces above and below grade. Provide all related accessories and other auxiliary components.

5. Provide a complete system utilizing Bentonite clay waterproofing using corrugated cardboard panels with Bentonite clay material filling the corrugated voids. Provide at least a 6 mil polyethylene vapor barrier between the mud slab and gravel base to provide additional protection against water penetration.

6. For plaza / roof decks above building spaces: Provide a complete protected fabric-reinforced fluid-applied waterproof assembly including surface conditioner, a monolithic rubberized asphalt membrane, separator/protection course, drainage panels, geo-textile filter fabric, rigid insulation, and flashings.

7. Provide a complete system utilizing a crystalline or metal oxide waterproofing system which is chemically re-active when placed on concrete and creates a crystalline structure preventing the passage of water. This product is applied to the inside surfaces of the space to be waterproofed such as elevator pits. Provide proper pretreatment of surfaces before application.

**C. Other Key Auxiliary Components and Accessories:** Protect membrane waterproofing or coatings during construction and backfilling. Protection materials include the following (select according to soil, climate, and other requirements)

# Model Schools: Materials and Systems Standards

1. Drainage Board/Mat: Prefabricated composite drainage panels, manufactured with a permeable geo-textile facing laminated to a non-biodegradable molded plastic sheet drainage core with high strength backing. Composite protection board may also act as the protection course.
2. Protection Course / Board: Formed from an inert material such as fiberglass reinforced, asphalt treated asbestos free fiberboard that will not react with waterproofing meeting ASTM D6506, Class A, type 2. Other options include: extruded polystyrene board insulation, ASTM C578 Type VI vertical surfaces or VII for horizontal outdoor spaces), 1.8-lb/cu.ft. minimum density and 40 psi minimum compressive strength, 2 inch minimum thickness. Semi rigid sheets of fiberglass or mineral reinforced asphaltic core pressure laminate between two asphalt-saturated fibrous liners.
3. Provide prefabricated rubber gasket type or injectable hose-type water stops at all below grade construction joint breaks in the foundation system of habitable spaces and equipment spaces such as concrete footing to concrete wall foundation conditions, concrete slab to concrete wall conditions, etc.
4. Footing drains are required when groundwater level may rise above top of floor slab or when the foundation is subject to hydrostatic pressure after heavy rain. Composite drainage material conveys water to the drain tile, thus reducing hydrostatic pressure. Provide filter fabric over the top of the perimeter drain tile and seat in a soil shaped to form a gutter. Assure the perimeter drainage system is tied to the storm sewer system for the rest of the building and site.
5. Gravel: Provide gravel over the drainage tile and filter fabric. Provide additional gravel for additional drainage up vertically to grade when required per Geo-technical report and or Structural Engineers recommendations.
6. Provide a rigid, non-biodegradable cant at the intersection of the footing and foundation walls when perimeter drains are provided.
7. Grout, packed around pipes penetrating the foundation, should have a mixture of iron oxide. Iron oxide chemically alters the grout to be more water-resistant
8. Provide all other materials and accessories to make a complete system including but not limited to: Surface cleaners and conditioners, primers, sheet joint reinforcing strips, substrate patching membrane, protection sheets, flashing, filter fabrics, mastic, adhesives, tapes, termination bars, two part liquid membranes, joint sealants, backer rods, expansion joints, reglet bars, etc. per manufacturer's requirements for a complete system installation.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section A40: Slabs on Grade**

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# Model Schools: Materials and Systems Standards

## A40 Slabs on Grade

### A4010 Standard Slab on Grade

#### A. General Requirements

1. The typical project's grade condition includes a minimum of 4" cast-in-place concrete slab-on-grade reinforced with welded wire fabric. Typically, below that is a vapor barrier of not less than 6 mil polyethylene or polyvinyl chloride sheet on top of a minimum of 4- 6" clean gravel. A two foot (2'-0") or four foot (4'-0") section of 2" thick rigid vertical and horizontal perimeter insulation shall be provided under the slab and on the inside vertical surface of the foundation wall depending on the N.J. ASHRAE zone. The slab edge and or haunch shall be supported by the typical foundation wall composed of either reinforced concrete masonry units or poured in-place reinforced concrete.
2. The cast-in-place concrete slab-on-grade with welded wire fabric for reinforcement shall be determined by the Design Consultant and their Sub-Consultants to meet all requirements in response to soil conditions, loading, and other presiding code requirements.

#### B. Related Standardized Details:

1. Refer to the following details for additional information: (Details are for reference only).
  - a. B2010-11-02 Section @ Foundation: Brick Exterior Cavity Wall w/ CMU Backup
  - b. B2010-11-07 Section @ Foundation: Brick Veneer/CMU Backup: w/ Basement
  - c. B2010-11-10 Section @ Foundation: CMU Exterior Cavity Wall w/ CMU Backup
  - d. B2010-11-15 Section @ Foundation: Brick CMU Veneer /CMU Backup: w/Basement
  - e. B2010-11-27 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - f. B2010-11-31 Section @ Foundation: CMU Exterior Cavity Wall w/ Metal Stud Backup

## A4040 Pits and Bases

#### A. General Requirements

1. The typical project's requirements for pits shall be for subgrade depressions that service and/or structurally support mechanical equipment. Construction is to be of concrete sides and base, reinforced as appropriate, and consist of any of the following:
  - a. Elevators or handicap lifts – depth per manufacturer's requirements. The base slab shall be designed to resist the manufacturer's specified loading, including impact and lateral. A sump pit shall be provided in elevator pits complete with cover.
  - b. Other equipment, such as kitchen freezers (see A4090.10 for insulation) and floor trenches.
2. Bases shall be concrete protrusions, reinforced as appropriate, above elevated or slabs on grade to support and/or elevate any of the following:
  - a. Mechanical and electrical equipment that requires a pad for structural support, base separation from adjacent maintenance activities or water, or additional mass for vibration control.



# Model Schools: Materials and Systems Standards

Design Requirements

Slabs on Grade – Section A40

## **A4090 Slab-On-Grade Supplementary Components**

### **A4090.1 Under Slab Drainage**

1. Refer to the Section A10 Foundations and the referenced details for the typical under slab drainage requirements.

### **A4090.10 Perimeter Insulation**

#### **A. Under Slab Insulation**

1. Refer to the above General Requirements and the referenced details for the typical under slab insulation requirement.

### **A4090.20 Vapor Retarder**

#### **A. Vapor Mitigation Alternatives (Refer to above A4010.A.1. and Section A6020)**

### **A4090.30 Waterproofing (Refer to A2010.90.2 Below Grade Waterproofing)**

### **A4090.60 Sub Base Layer**

1. Refer to the above General Requirements and the referenced details for the typical under slab sub base requirement.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section A60: Water and Gas Mitigation**

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# Model Schools: Materials and Systems Standards

## Section A60 Water and Gas Mitigation

### A. General Requirements

1. The New Jersey Department of Environmental Protection (NJDEP) (<http://www.state.nj.us/dep/>) provides Vapor Intrusion Guidance, and the NJSDA has developed Best Practices to mitigate potential exposure to vapor intrusion at School Facilities Projects.

### A6010 Building Sub-Drainage

#### A6010.10 Foundation Drainage

##### A. Sub Base Layer

1. Refer to the above General Requirements and the referenced details for the typical under slab sub-base requirements in Section A40. The Design Consultant shall determine if any atypical geotechnical or environmental conditions exist requiring modification to this standard based upon the recommendations for mitigation by the NJSDA's Licensed Site Remediation Professional (LSRP) and other related consulting technical expertise.

#### A6010.20 Underslab Drainage

##### A. Sub Base Layer

1. Refer to the above in A6010.10. A.1

### A6020 Off-Gassing Mitigation

1. Vapor intrusion is generally defined as the underground migration of volatile organic compounds (VOCs) into overlying buildings. Common contaminants that may create a vapor intrusion concern include gasoline components (benzene) and dry cleaning and degreasing solvents. Common dry cleaning and degreasing solvents include perchloroethylene (PCE), and trichloroethylene (TCE). The presence of such contaminants does not always present a vapor intrusion concern. Physical factors, such as soil chemistry, groundwater conditions, subsurface features, and weather conditions play a factor in whether vapor intrusion occurs.

2. If environmental testing identifies the presence of a vapor intrusion concern, a recommendation for mitigation by the Licensed Site Remediation Professional (LSRP) will be included in the Remedial Action Work Plan (RAWP) for the site. The Design Consultant and their Sub-Consultants shall include the design for the recommended alternative in their Construction Documents. Depending on the site conditions, the design may include, but not be limited to the following:

- a. No mitigation is required if VOCs do not exceed health based screening levels.
- b. Design of a passive ventilation system, such as a passive radon mitigation system sub-slab ventilation system (see project specific performance specifications).
- c. Design of a passive ventilation system, such as a passive radon mitigation system, in conjunction with a chemical vapor barrier.

# Model Schools: Materials and Systems Standards

d. Design of an active sub-slab depressurization system in conjunction with a chemical vapor barrier.

#### 4. Chemical Vapor Barrier

a. **If directed by the NJSDA or recommended by the Design Consultant and the LSRP,** provide a complete installation utilizing a cold spray applied, water based, no VOC, seamless, impermeable 60 mil minimum thickness membrane system when recommended by the Design Consultant and the LSRP. Assure all approvals are in place (NJSDA and Office of the State Controller) for use of a proprietary system if three manufacturers of this system type cannot be found.

b. The use of a comparable sheet membrane system, if recommended by the Design Consultant and the LSRP, shall be permitted, but is subject to approval by the NJSDA. Prior to approval by the NJSDA, the LSRP or Design Consultant shall demonstrate that the use of an alternative chemical vapor barrier system is necessary, technically correct, and cost effective.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section B: Shell**

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# Model Schools: Materials and Systems Standards

## **B Shell**

### **A. General Requirements**

1. The design and selection of material and systems, and the resulting assemblies and detailing reflected in the Construction Documents, shall comply with all presiding codes.
2. The Design Consultant of Record shall review the current adopted State of New Jersey's presiding Energy Conservation Codes which define requirements for compliance of all required building systems and components. The presiding energy conservation codes also define procedures for demonstrating compliance with their respective requirements. All material and systems selections shall be informed by the associated compliance criteria.
3. The Design Consultant of Record shall review the current adopted International Energy Conservation Code 2021 (IECC) and ASHRAE 90.1-2019 (or current versions) requirements to define and establish the maximum percentage of window glazing to opaque wall for the building so that the minimum requirements of the IECC are met or exceeded.
3. Material and system selection shall place an emphasis on materials and systems that are durable, and easy to maintain.

### **B. Exterior Materials and Systems: General Requirements**

1. Provide code compliant thermal resistance and continuity of the thermal envelope around all exterior basement foundation walls / wall / roof assemblies.
2. For all sites and particularly contaminated sites, clearly detail the passive/active vapor barrier/venting system on the Drawings. This system shall be in compliance with all presiding codes and subcodes.
3. Electrical and Low Voltage Items
  - a. All electrical and low voltage items such as, but not limited to, horns, bells cameras, speakers and alarms shall be located and coordinated with all building elements and features as inconspicuously as possible on exterior building elevations.
4. Wall hydrants
  - a. Wall hydrants and hose bibs shall be provided on facades as required by code and for general maintenance purposes.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section B10: Superstructure**

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# Model Schools: Materials and Systems Standards

## B10 Superstructure

### A. General Requirements

1. The design and selection of materials and systems, as well as the resulting assemblies and detailing reflected in the Construction Documents shall comply with all presiding codes. Acceptable systems are listed in the subsections below and may be used interchangeably. The proposed use of unacceptable systems requires an SDA variance approval.
2. Provide structural elements, above grade and within basements, capable of supporting all anticipated loads without failure or damage.
3. The superstructure comprises:
  - a. Floor construction (B1010): Floor construction above grade and within basements, including balcony, mezzanine, and ramp floors, floors elevated for access, stair construction (B1080) if part of the structure, and roof decks intended for occupant live load; and the elements required for their support, insulation, and fireproofing.
  - b. Roofs (B1020): Roof construction, including canopies, and elements required for their support, insulation, and fireproofing.
4. Where superstructure elements also must function as elements defined within another element group, comply with requirements of both element groups.
5. In addition to the requirements of this section, comply with all applicable requirements of Section B - Shell.

### B. Amenity and Comfort

1. Vibration: Isolate structure from sources of vibration.

### C. Health and Safety

1. Fire: Provide members with combustibility, flame spread, and smoke generation characteristics not greater than allowed by code.
2. Fire Resistance: Provide materials with fire resistance in accordance with code and the **current versions of the** following:
  - a. Determine fire resistance rating by testing in accordance with ASTM E119-24.
  - b. Determine flame spread index by testing in accordance with ASTM E 84-23d.
  - c. Determine smoke developed index by testing in accordance with ASTM E84-23d.
  - d. Where fire resistance integrity of superstructure assemblies is impaired by subsequent installation of other construction elements, restore fire resistance using identical materials or other materials tested under ASTM E 814-24.
  - e. Provide fire-stopping at openings in fire-rated superstructure elements that is rated at not less than the required fire resistance of the penetrated element.



# Model Schools: Materials and Systems Standards

## **D. Durability**

1. Moisture Resistance of Load-Bearing Members: Use materials that are not damaged by contact with water or moisture vapor.
2. Impact Resistance of Load-Bearing Members: Use materials that are not easily damaged by common hand tools.
3. Applied Fireproofing Materials:
  - a. In Locations where concealed by Permanent Construction:
    - 1.) Density: 10 lb. / cu. ft. minimum.
    - 2.) Impact Strength: Passing ASTM E760/e760m-92(2023) or current version.
  - b. Exterior Locations, Where Exposed to Air but Out of Reach of Occupants (Above 10 ft. from Ground):

## **E. Material Requirements / Quality Assurance**

1. Concrete
  - a. Design of concrete to comply with ACI 318-19(22) (or current version), "Building Code Requirements for Structural Concrete". Design of precast plank to also comply with PCI MNL 120-17, "PCI Design Handbook--Precast and Pre-stressed Concrete."
  - b. Minimum design compressive strength  $f'_c$  to be 3000 psi at 28 days.
2. Concrete masonry units
  - a. Design of concrete masonry to comply with ACI 530/530.1-13 (or current version), "Building Code Requirements for Masonry Structures".
3. Structural steel
  - a. Design of structural steel to comply with AISC 360-22 (or current version), "Standard Specifications for Structural Steel Buildings".
  - b. Design structural steel floor beams to comply with AISC Design Guide 11, "Floor Vibrations Due to Human Activity".
4. Open-web steel joists
  - a. Design of open-web steel joists, joist girders, and long span steel joists to comply with
  - b. SJI K-1.1, SJI JG-1.1, and SJI LH/DLH-1.1, "2016 American Institute of Steel Construction Specification for Structural Steel Buildings".
  - c. Design open-web steel floor joists to comply with SJI Technical Digest 5, "Vibration of Steel Joist-Concrete Slab Floors".

# Model Schools: Materials and Systems Standards

## 5. Steel Deck

- a. Design of non-composite floor and roof deck to comply with the current versions of ANSI/SDI NC-2017 and ANSI/SDI RD-2017, respectively, AISI S100-16 “Specification for the Design of Cold Formed Steel Structural Members”, SDI “Floor Deck Design Manual” and ADI “Roof Deck Design Manual”.

### B1010 Floor Construction

#### A. General Requirements

1. Floor construction shall meet all the code requirements for structural load capacity, serviceability (vertical and horizontal deflection and vibration), and fire resistance.
  - a. Maximum deflection due to loading per code requirements, except as follows:
    - 1.) Members vertically supporting concrete masonry – the lesser of member span / 600 or 0.3” due to dead plus live loads.
2. Provide all floor construction above grade and within basements, including balcony, mezzanine, and ramp floors, floors elevated for access, stair construction if part of the structure, and roof decks intended for occupant live load; and the elements required for their support, insulation, and fireproofing, as well as finishing, if an integral part of the floor construction.
3. Where floor elements also must function as elements defined within another element group, meet requirements of both element groups.
4. In addition to the requirements of this section, comply with all applicable requirements of Section B - Shell, and Section B10 - Superstructure.

#### B. Durability

1. Exposed Interior Structural Floor Surfaces: Comply with requirements for floor finishes specified in Section C.
2. Exposed Exterior Structural Floor Surfaces: Comply with requirements for pavement finishes.

### B1010.10 Floor Structural Frame

#### A. Acceptable Systems

1. Vertical Gravity Load Support Elements
  - a. Load-bearing walls of reinforced concrete or reinforced/unreinforced concrete masonry.
  - b. Columns of structural steel, reinforced concrete, or reinforced concrete masonry.
2. Horizontal Gravity Load Support Elements

# Model Schools: Materials and Systems Standards

- a. Beams of structural steel (composite or non-composite), reinforced concrete, or open-web steel joists.

### 3. Lateral Load Support Elements

- a. Building frames of reinforced concrete or structural steel with rigid joints to resist wind and seismic loads (moment frames).
- b. Building frames of structural steel with diagonal bracing to resist wind and seismic loads (braced frames).
- c. Shear walls of reinforced concrete and reinforced/unreinforced concrete masonry.

## **B. Unacceptable Systems**

### 1. Vertical Gravity Load Support Elements

- a. Load-bearing walls of wood or cold-formed steel framing.
- b. Columns of built-up cold-formed steel or wood framing.
- c. Pre-engineered metal building frames.

### 2. Horizontal Gravity Load Support Elements

- a. Beams, joists, or trusses of cold-formed steel or wood framing.
- b. Pre-engineered metal building joists.

### 3. Lateral Load Support Elements

- a. Shear walls of cold-formed steel framing or wood studs and plywood.

## **B1010.20 Floor Decks, Slabs, and Toppings**

### **A. Acceptable Systems**

- 1. Concrete-filled steel deck.
- 2. Concrete-filled composite steel deck, minimum 2½ inches concrete thickness from top of steel deck.
- 3. Cast-in-place reinforced concrete slabs.
- 4. Precast concrete hollow core slabs covered with minimum 1-1/2 inches concrete.

### **B. Unacceptable Systems**

- 1. Plywood sheathing.

# Model Schools: Materials and Systems Standards

## B1020 Roof Construction

### A. General Requirements

1. Provide all roof construction, including canopies, and elements required for their support, insulation, fireproofing, and fire-stopping.
2. Where roof elements also must function as elements defined within another element group, meet requirements of both element groups.
3. In addition to the requirements of this section, comply with all applicable requirements of Section B - Shell, and Section B10 - Superstructure.
4. The Design Consultant and their Sub-Consultants shall include an allowance of an additional minimum of ten (10) pounds per square foot (lbs. / psf.), above and beyond all other presiding code and other requirements, in the structural design of the roof structure. This additional allowance is for the application of photovoltaic panels to the roof surface and structure. If the Design Consultant and their Sub-Consultants determine that the minimum allowance of an additional ten (10) lbs. / psf. is not sufficient for the support and application of photovoltaic panels to the roof surface and structure written justification and associated support documentation shall be provided to the NJSDA for review and approval of the requested increase in loading criteria.

### B. Health and Safety

1. Column-Beam Fire Resistance: Per Code.
2. Load-Bearing Wall Fire Resistance: Per Code.
3. Roof-Ceiling Fire Resistance: Per Code.
4. Other Members Fire Resistance: Per Code.

### C. Durability

1. Exposed Roof Deck Surfaces: Comply with requirements for roofing weather barrier specified in Section B3010.
2. Vapor Retarder Under Deck: Continuous separate membrane located on the warm side of the winter dew point.
  - a. Vapor Permeance: 1 perm, maximum when tested in accordance with ASTM E96/E 96M-24 (or current version).
  - b. Provide materials in accordance with ASTM E 1677-23 (or current version), including appendices, and ASTM C 755-20 (or current version).

## B1020.10 Roof Structural Frame

### A. Acceptable Systems

1. Vertical Gravity Load Support Elements

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a. Load-bearing walls of reinforced concrete or reinforced/unreinforced concrete masonry.

b. Columns of structural steel, reinforced concrete, or reinforced concrete masonry.

## 2. Horizontal Gravity Load Support Elements

a. Beams of structural steel (composite or non-composite), reinforced concrete, or open-web steel joists.

## 3. Lateral Load Support Elements

a. Building frames of reinforced concrete or structural steel with rigid joints to resist wind and seismic loads (moment frames).

b. Building frames of structural steel with diagonal bracing to resist wind and seismic loads (braced frames).

c. Shear walls of reinforced concrete and reinforced/unreinforced concrete masonry.

## B. Unacceptable Systems

### 1. Vertical Gravity Load Support Elements

a. Load-bearing walls of wood or cold-formed steel framing.

b. Columns of built-up cold-formed steel or wood framing.

c. Pre-engineered metal building frames.

### 2. Horizontal Gravity Load Support Elements

a. Beams of cold-formed steel or wood framing.

b. Pre-engineered metal building joists.

### 3. Lateral Load Support Elements

a. Shear walls of cold-formed steel or wood studs and plywood.

## B1020.20 Roof Decks, Slabs, and Sheathing

### A. Acceptable Systems

1. Concrete-filled steel deck.

2. Concrete-filled composite steel deck, minimum 2½ inches concrete thickness from top of steel deck.

# Model Schools: Materials and Systems Standards

3. Cast-in-place reinforced concrete slabs.
4. Precast concrete hollow core slabs.
5. Steel roof deck.

## **B. Unacceptable Systems**

1. Plywood sheathing

### **B1020.21 Flat Roof Construction (Reserved)**

### **B1020.22 Pitched Roof Construction (Reserved)**

### **B1020.23 Canopies**

#### **A. Canopies: General Requirements**

1. A canopy or a building overhang may be desired to provide protection for the building entrance immediately preceding the entrance doors. Such canopies, when provided, shall typically be an integral part of the building.
2. The use of prefabricated canopy structures may be considered in addition to custom designed structures.
3. Canopies and other structures of shelter from the elements attached to the building's facades shall be sloped to drain water away from or parallel to all building surfaces. Canopy structures that include roof surfaces that direct the flow of water towards the exterior vertical surfaces of the building facade are not permitted.
4. The area of a canopy shall be limited and kept to a minimum required to serve their associated purpose.
5. All canopy types, materials, sizes and locations are subject to approval by the Authority.

### **B1080 Stairs**

#### **A. General Requirements**

1. Stair construction shall meet all the code requirements for structural load capacity and serviceability (vertical and horizontal deflection and vibration). Stairs are to be self-supporting with landings and stringers supported on posts or bearing on stair walls or wholly or partially supported by a floor or roof structure. Any structural elements of a floor or roof providing support for stair framing are to be fireproofed to the code-required rating.

# Model Schools: Materials and Systems Standards

## **B1080.10 Stair Construction**

### **A. Acceptable Systems**

#### **1. Interior stairs**

- a. Metal Stairs of steel stringers and landing support framing with closed-riser, gage steel pan treads and landings with a minimum 2" concrete topping for treads, 3" for landings.
- b. Cast-in-place reinforced concrete.
- c. Precast concrete.

#### **2. Exterior stairs**

- a. Metal stairs of galvanized steel or aluminum stringers and landing support framing with galvanized grating or diamond-plate treads with a non-slip finish. Do not use dissimilar metals.
- b. Cast-in-place reinforced concrete with a non-slip finish.
- c. Precast concrete with a non-slip finish.

### **B. Unacceptable Systems**

- 1. Interior and exterior: Alternating tread or spiral stairs.
- 2. Wood- or cold-formed steel-framed stairs.

## **B1080.50 Stair Railings**

### **A. Acceptable Systems**

- 1. Metal railings, guards, and posts (galvanized for exterior use if not aluminum or stainless steel).

### **B. Unacceptable Systems**

- 1. Interior and exterior: Wood- or cold-formed steel



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section B20: Exterior Vertical Enclosure**

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# Model Schools: Materials and Systems Standards

## **B20 Exterior Vertical Enclosures**

### **A. General Description/Design Approach**

1. Building Facade – New Buildings and Additions: The aesthetic, scale, proportion and detail of building facades shall manifest the educational, social, cultural and civic importance of a neighborhood school, its community and be appropriate for the age of the student population as well as the context of the site.

### **B. General Requirements**

1. Choice of materials must be guided by building construction budget and the following requirements:

a. The materials to be used in the design and construction of the school's exterior facades shall typically be limited to those materials which are specified in the NJSDA's Standards and the parameters established herein.

b. All masonry dimensions shall be based upon modular masonry dimensions, preferably of four (4") and eight (8") inch increments. The intended result is to minimize the amount of irregular conditions and the amount of cutting required during construction.

c. Whenever possible per height and presiding codes, a typical all masonry cavity wall shall be 1'-4" thick composed of a four inch (4") outer wythe of masonry veneer, a four inch (4") cavity including the rigid insulation and air barrier, and eight inch (8") concrete masonry unit backup system of the appropriate required type and density. Utilize a thicker concrete masonry unit, and of the appropriate type and density when required by code and or proper structural design of the wall. Provide horizontal and or vertical reinforcing when required. No additional wiring, conduit, or other communication related items are allowed within the cavity wall.

d. A typical vertical cavity wall shall preferably consist of materials with the same general composition and similar coefficients of expansion, shrinkage, and contraction, particularly within the exterior vertical wythe. Minimize differential movement between dissimilar materials. Specify and detail proper separation and control /expansion jointing of dissimilar materials when necessary.

e. Specify and detail all required end dams, door and window heads and sills so that the cavity wall can breathe. Properly detail conditions of differential expansion and contraction at all relieving angles, bond beams, and lintels.

f. Specify and document required expansion and construction joint systems of veneer wall, at interior partition systems, at running lengths of walls, windows, doors, inside and outside corners, roof, and ceilings where movement occurs and with proper consideration of distances between joints, joint type, sealant type, and depth. Provide associated schedules when applicable.

g. All masonry systems shall be designed with proper reinforcing in accordance with all loading and presiding code requirements.

# Model Schools: Materials and Systems Standards

h. ALL MATERIALS AND SYSTEMS INDICATED AS “SUBJECT TO APPROVAL BY THE NJSDA” MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION DOCUMENTS.

## C. Related Standardized Details

1. Refer to the following details for additional information:

- a. B2010-11-01 Section: Brick Exterior Cavity Wall w/ CMU Backup
- b. B2010-11-02 Section @ Foundation: Brick Exterior Cavity Wall w/ CMU Backup
- c. B2010-11-03 Section @ Spandrel: Brick/CMU: Masonry Openings 8'-0" or Less
- d. B2010-11-04 Section @ Parapet: Brick/CMU Cavity Wall
- e. B2010-11-05 Section @ Spandrel: Brick/CMU Cavity Wall: High Windows
- f. B2010-11-06 Section @ Spandrel: Brick/CMU Cavity Wall: Relieving Angle
- g. B2010-11-07 Section @ Foundation: Brick Veneer/CMU Backup: w/ Basement
- h. B2010-11-08 Section @ Roof: Brick/CMU Cavity Wall: Curb: Built up Roof @ Wall
- i. B2010-11-09 Section: CMU Exterior Cavity Wall w/ CMU Backup
- j. B2010-11-10 Section @ Foundation: CMU Exterior Cavity Wall w/ CMU Backup
- k. B2010-11-11 Section @ Spandrel: CMU Veneer /CMU: Masonry Openings 8'-0" or Less
- l. B2010-11-12 Section @ Parapet: CMU Veneer/CMU Cavity Wall
- m. B2010-11-13 Section @ Spandrel: CMU Veneer/CMU Cavity Wall: High Windows
- n. B2010-11-14 Section @ Spandrel: Brick/CMU Cavity Wall: Relieving Angle
- o. B2010-11-15 Section @ Foundation: Brick CMU Veneer /CMU Backup: w/Basement
- p. B2010-11-16 Section @ Roof: CMU Veneer/CMU Cavity Wall: Curb: Built up Roof @ Wall
- q. B2010-11-17 Part Plan: Brick/CMU Veneer/ CMU Cavity Wall
- r. B2010-11-18 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Typical
- s. B2010-11-19 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Exterior Corner
- u. B2010-11-20 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Interior Column
- v. B2010-11-21 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Typical GWB Enclosure
- w. B2010-11-22 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Exterior Corner: GWB Enclosure
- x. B2010-11-23 Column Plan Detail: Brick or CMU Veneer/ CMU Cavity Wall: Interior Corner: GWB Enclosure
- y. B2010-11-24 Partial Section: Brick or CMU Veneer: Coping Stone Detail
- z. B2010-11-25 Section: Brick Exterior Cavity Wall w/ Metal Stud Backup
- aa. B2010-11-26 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Stud Backup
- bb. B2010-11-27 Section @ Spandrel: Brick/Metal Stud: Masonry Openings 8'-0" or Less
- cc. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
- dd. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
- ee. B2010-11-30 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Backup
- ff. B2010-11-31 Section @ Spandrel: Brick/Metal Stud: Masonry Openings 8'-0" or Less
- gg. B2010-11-32 Section @ Parapet: Brick/Metal Stud Cavity Wall

# Model Schools: Materials and Systems Standards

## **B2010 Exterior Walls**

### **B2010.10 Exterior Wall Veneer**

#### **A. Masonry Materials: General Description/Design Approach**

1. Brick and/or concrete block shall be the typical and predominant material for all exterior cavity walls of the building.
2. Brick / Block Bond Pattern:
  - a. Typical brick / concrete masonry unit bond pattern/coursing shall be running bond.
  - b. Use of other masonry pattern/coursing to enhance building elements as well as the overall building aesthetic is acceptable but is subject to approval by the NJSDA.
  - c. Avoid changing between masonry products with different properties of expansion and contraction within the same vertical plane(s) of the exterior wall whenever possible. Provide proper control joints both horizontally and vertically when this condition is unavoidable. Coordinate locations with parapet and expansion joints and fenestration.
3. Brick and Concrete Masonry Unit type:
  - a. Brick and block types shall be that which is specified by the NJSDA's Standards.
  - b. Color and texture of all masonry products exposed to view is subject to approval by the NJSDA.
  - c. Definition and approval of shapes and sizes to be used: Special sizes and shapes are subject to approval by the NJSDA with the exception of masonry units used as sills or corners and lip bricks or blocks which are required to be utilized. Cutting lip bricks in the field during construction is not permitted.
  - d. Solid units shall be used where unsupported projection of masonry is 1/3" or greater and or the masonry core is visible.

#### **B. Masonry Materials**

1. Brick Veneer
  - a. Type FBX brick has tighter tolerance requirements as compared to the type FBS brick. The specifications shall call for Type FBX brick for the utility brick (or larger sizes) due to the tighter tolerances on the size of the masonry, as the greater variances of the Type FBS are exaggerated with the larger brick. The designer is to carefully research the brick selected with the manufacturer to ensure that the brick selected meets the FBX requirements.

# Model Schools: Materials and Systems Standards

b. Certain bricks have a stone face or rustic appearance, which would fall in the FBA category. If the brick selected to meet a certain aesthetic is Type FBS or FBA, notify the NJSDA and if approved, modify the specification appropriately. Some FBS and FBA brick, depending on their qualities, may be acceptable to the NJSDA.

## 2. Concrete Masonry Units (CMU)

a. Concrete Masonry Units, Unglazed; will be permitted for use as an exterior wythe of masonry only if provided with an integral waterproofing agent.

b. The use of split face CMU, ribbed split-face CMU, or other extremely rough surfaced masonry units is not permitted on any portions of the exterior façade which may be subject to the application of graffiti.

c. On all construction, split faced CMU, ribbed split-face CMU, or other extremely rough surfaced masonry units may be used on addition /renovations and historic buildings to match existing features.

d. The use of split faced CMU, ribbed split-face CMU, or other extremely rough surfaced masonry units and its application is subject to approval by the NJSDA. The proposed type, color, finishes, and application of this material is subject to approval by the NJSDA.

### e. Ground Face Masonry Unit

1). Use of Ground face masonry units for exterior wythe of masonry will be permitted, provided they meet the above criteria 2.b.

### f. Sound Absorbing Masonry Units

1.) The use of sound absorbing masonry units shall be permitted as part of the cavity wall's back up system only when they occur in spaces requiring acoustical dampening such as a gymnasium or music room (Choral or Orchestra/Band, etc.)

### g. Polished Face Masonry Units

1.) Use of polished face masonry units will be permitted as a material for the building base and in small quantities as an accent provided they meet the above criteria in 2.b. The use of this material is subject to approval by the NJSDA.

## 3. Glazed Masonry Units

a. Use of glazed masonry units (brick or CMU) for large expanses or entire planes of a wall is not permitted. The use of glazed masonry units will be permitted as a material in small quantities as an accent. The use of this material is subject to the approval by the NJSDA.

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## 4. Concrete Brick

### a. General Requirements:

1.) Concrete brick, typically made from Portland cement, water, and suitable mineral aggregates with or without the inclusion of other materials is permitted. Materials to be used in the manufacture of brick include Portland cement, limestone, hydraulic cement, pozzolan, blast furnace slag cement, aggregates, and other constituents like air-entraining agents, coloring pigments, integral water repellents, and finely ground silica.

### b. Quality Assurance

1.) The use of concrete brick composed of solid, dry-cast, concrete building brick intended for exterior use in constructing structural masonry and meeting current versions of ASTM C55-23, C1634, and C426 is permitted.

2.) All units shall be sound and free of cracks or other defects that interfere with the proper placement of the units or significantly impair the strength or permanence of the construction.

## C. Other Masonry Materials

1. The following masonry material choices shall only be used in rare instances and utilized in limited quantities. The Design Consultant must present adequate justification for the use of these materials. The use of any of the following materials is subject to approval by the NJSDA.

### a. Calcium Silicate Masonry Unit (CSMU)

1.) Use of calcium silicate masonry units will be permitted as a material for the building base. The use of this material is subject to approval by the NJSDA.

### b. Cast Stone

1.) Cast Stone, as specified in the NJSDA's Standards, can typically be used to accent components and features of the exterior building elevations, in limited use as decorative accents, window sills, window heads, and water table definition.

2.) The use of this material is subject to approval by the NJSDA.

### c. Exterior Cut Stone

1.) Exterior cut stone, as specified in the NJSDA' Standards shall only be used on existing buildings to match features of the building's exterior, such as; coping stones, cornices, bands, fascias, window sills, window heads and water tables.

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2.) Use of exterior cut stone on stand-alone new building projects will not be permitted.

3.) Exception:

a.) Possible use of exterior cut stone on Addition Projects, to match features of the existing building, is subject to approval by the NJSDA.

e. Terra-Cotta

1.) Terra-cotta, as specified in the NJSDA's Standards shall only be used on existing buildings, to match exterior building elements.

2.) In rare instances on an addition project where matching an ornamental cornice feature is required, terra-cotta or another product, such as fiberglass, may be used after consultation with and approval by the NJSDA.

3.) The use of terra-cotta in other forms besides ornamental shapes will not be permitted.

4.) Terra-cotta is not as abuse resistant as "cast stone" and its use as such should be limited to areas that are more than 10' above the adjacent grade level.

5.) Special sizes and shapes may require custom anchors and/or attachment details.

**D. Other Exterior Wythe Materials**

1. The following other exterior wythe wall material choices shall only be used in rare instances and utilized in limited quantities. The Design Consultant must present adequate justification for the use of these materials. The use of any of the following materials is subject to approval by the NJSDA.

a. Glass Fiber Reinforced Concrete

1.) NJSDA's Standards include Glass Fiber Reinforced Concrete (GFRC), and Polymer-modified Glass Fiber Reinforced Concrete (P-GFRC).

2.) GFRC is typically used as a substitute for terra-cotta or cut stone. It may be used in limited quantities on stand-alone new buildings.

3.) In existing buildings, GFRC is typically used for large overhanging cornices where lighter weight may be an added value and the cornice can be hung from substrate.

4.) In rare instances on an addition project where matching an ornamental cornice feature is required.

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5.) GFRC and P-GFRC may be permitted when used for column enclosures, and base, soffits and fascias may be permitted in limited quantities.

6.) The use of simulated masonry in other forms besides ornamental shapes will be permitted.

### b. Metal Panels

1.) Metal panels will be permitted for use in lieu of an exterior wythe of masonry if utilized in a proper application. Metal panels without back-up walls will not be acceptable. Utilize a rain-screen design approach to the construction documentation details for a metal panel system. Metal panels may not be used in locations where they are subject to damage, problems arising from vandalism, or ground contact.

2.) Use of insulated metal panels as part of the Vertical or horizontal enclosure is subject to approval by the NJSDA. Areas of such insulated metal panel(s) shall be included in the building's fenestration area to avoid the need for project specific Energy Modeling.

3.) A dry seal system is preferred with a rain screen metal panel system. Wet seal systems are typically not associated with pressure equalized and compartmentalized systems as well as with drained systems. Dry seal systems are typically associated with open rain screen or ventilated systems. The high cladding back ventilation rates also provide removal of condensed moisture from interior sources particularly with metal composite panel systems where the vapor barrier characteristics of metal composite panels and wet seals can be problematic.

## B2010.20 Exterior Wall Construction

### A. Wall Construction: General Requirements

1. Composite wall systems shall be cavity walls.

2. Cavities behind veneers shall not extend below grade.

3. Typical exterior masonry wall construction shall be a masonry cavity wall consisting of an exterior wythe of utility size face brick (4" X 4" X 12" ((Thickness X face dimension)) nominal) as a minimum size or concrete masonry units (4" X 8" X 16" ((Thickness X face dimension)) nominal) or larger. The cavity wall system shall also consist of a 8" nominal concrete masonry unit back-up system with a minimum 2" nominal clear air cavity, a minimum of 1 1/2" thick rigid insulation with in a four inch (4") cavity over a spray or roller applied air/vapor barrier applied to the exterior side of the backup block of the cavity wall system. **No additional wiring, conduit, or other communication related items are allowed within the cavity wall.**

4. A back-up wall comprised of properly structurally sized galvanized metal studs, moisture and mold proof, fiberglass coated, gypsum board sheathing including taping and sealing of joints per manufacturers' recommendations, an air / vapor barrier and minimum of 1 1/2" rigid insulation within the four inch (4") cavity and applied to the



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moisture and mold proof, fiberglass coated, gypsum board sheathing may be substituted for a concrete block back up system. The joints and any penetrations through the rigid insulation shall be taped or properly sealed to form a continuous insulating envelope.

5. The Design Consultant may utilize both types of backup systems, an 8" (or larger as required per wall height) nominal concrete masonry unit back-up system and the system described in #4 above of properly sized light gauge galvanized metal studs, etc. within the contract documents of a single school facilities project. The Design Consultant shall select the proper back up system appropriate for the functional use of the space(s) the wall falls within.

6. Do not specify paper faced sheathing products on exterior or interior walls. Specify only mold and moisture resistant, fiberglass faced, wallboard for all sheathing products where a potential of moisture may be present.

7. Interior side of exterior walls facing circulation spaces i.e. corridor, lobby, vestibule, if not block, shall receive double layer of 5/8" moisture and mold resistant gypsum board, the outer layer shall be abuse resistant. Refer also to Section C10 Interior Construction.

8. The Designer is to carefully layout the brick bond patterns during the design to ensure that the patterns of the 4" X 4" X 12" brick or 4" X 8" X 16" CMU or other size selected will be aesthetically acceptable.

9. All NJSDA school facility projects shall have control and / or expansion joints at spacing suitable to accommodate expected movement. Joints for expansion, contraction, shrinkage, and building movement shall be sealed to prevent weather and water from penetrating to the interior of the building. All vertical and horizontal joints and cavities shall be drained to daylight above all horizontal surfaces. Provisions for vertical and horizontal expansion, contraction, and movement in accordance with BIA Technical Notes shall be included. Wherever possible provide control joints in transitions in masonry color.

11. Provide expansion and control joints as a function of length and material property differences.

12. Specify code compliant thermal resistance and continuity of the thermal envelope around all exterior basement foundation walls / vaults / wall / roof assemblies.

13. A graffiti resistant coating is to be used on all exposed exterior masonry surfaces up to 10'-0" high. Refer also to Section B2010.80.O Graffiti Control for additional requirements.

14. Deflection Criteria: Comply with all presiding codes and regulations, ACI 530/ASCE 5/TMS 402, and its accompanying masonry specification, ACI 530.1/ASCE 6/TMS 602 as well as the masonry standard: "*Building Code Requirements for Masonry Structures*" (ACI 530/ASCE 5/TMS 402) and the "*Specification for Masonry Structures*" (ACI 530.1/ASCE 6/TMS 602). Limit deflection criteria as applicable per Brick Industry Association; Technical Notes found at: <http://www.gobrick.com/resources/technical-notes> such as Note 28B December 2005 "Brick Veneer and Steel Stud Walls", and other applicable standards unless the presiding codes are more restrictive.



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## B. Quality Assurance

1. All concrete masonry and brick work shall be performed in accordance with the recommendations, standard details, and technical notes of the National Concrete Masonry Association (NCMA), (<https://www.masonryandhardscapes.org/technical-resources/#concrete-masonry-tech>), International Masonry Institute (IMI) (<http://www.imiweb.org/>), and the Brick Industry Association (BIA), (<https://www.gobrick.com>).
2. Thermal breaks, expansion joints, control joints, horizontal soft joints, galvanic reactions and accumulated moisture require outlets at bottom of the wall. In addition to the above in B.1. use recommendations from: Sheet Metal and Air Conditioning Contractors National Association (SMCNA) (<http://www.smacna.org/>), American Institute of Steel Construction, Steel Construction Manual, (<http://www.aisc.org/>) American Concrete Institute (ACI) (<https://www.concrete.org/topicsinconcrete.aspx>) as applicable.
3. Single source responsibility for decorative masonry Units: On a project, all decorative masonry block units shall be from a single source and by a single manufacturer, for each different product required.
4. At least one mock-up of the exterior wall is required and shall be properly documented in the drawings and specifications.
  - a. The content of the mockup(s) minimally shall display as many typical exterior cavity wall and or special interior wall construction conditions in a single panel not exceeding 6'-0" x 10'-0". Include a window opening when possible, showing the head and sill conditions, leaving an end dam / flashing, lintel, sill, etc. exposed for inspection. Leave small sections of the exterior wall out to facilitate viewing other conditions normally hidden from view, may be inspected, such as wall ties, mortar net, flashing, termination bars, etc. Locate the mock-up location to depict a wide range of typical exterior materials and joint conditions.
  - b. The mock-up must be approved in writing by the Design Consultant before construction can proceed on the masonry work of the exterior envelope and approved by the NJSDA. Define additional in-situ mock-ups for review and approval in the Contract Documents if appropriate or deemed necessary.
  - c. The use of more than one on site mockup must be defensible by the Design Consultant and is subject to approval by the NJSDA.

### B2010.30 Exterior Wall Interior Skin

#### A. General Description/Design Approach

1. If the inside surface and backup system of exterior cavity wall is comprised of primarily 8" nominal concrete masonry units:
  - a. Whenever possible apply the appropriate block filler, primer and paint finish coats.

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- b. The additional application of galvanized furring strips and a layer of primed, painted, mold, moisture, and abuse resistant gypsum board shall be used when required to provide consistent surfaces on all walls within a room or space.
2. If a back-up wall is comprised of properly structurally sized galvanized metal studs:
  - a. The inside surface shall be primed and painted, moisture, mold, and abuse resistant, gypsum board.
3. Refer to Section C20 Interior Finishes for additional information.

## **B2010.50 Parapets**

### **A. General Description/Design Approach**

1. Parapets when required shall serve the purpose of being a “protective guard” at the roof and/or provide the required exterior wall fire-resistive rating.
2. Parapets shall be provided as determined to be required by presiding codes or other justifiable protective purpose.

## **B2010.80 Exterior Wall Supplementary Components**

### **A. Mortar and Grout**

1. Mortar color may either match, complement, or contrast the associated adjacent masonry product selections.
2. No single type of mortar is best suited for all purposes, but there are several rules for selecting mortar type. Generally, do not use a mortar that is stronger in compression than needed by the structural requirements. Always select the mortar weakest in compression provides the best bond strength, and that is consistent with the performance requirements of the project. However, this guideline should be coupled with good engineering judgment; for example, it would be uneconomical and unwise to change mortar types in various parts of a structure.
3. Following are the recommended uses for different types of mortar:
  - a. Type N mortar: A medium-strength mortar suitable for general use in exposed masonry above grade and recommended specifically where high compressive or transverse masonry strengths are not required.
  - b. Type S mortar: A high-strength mortar suitable for general use and specifically for circumstances where high transverse strength of masonry is desired; for reinforced masonry, where mortar bonds the facing and backing; and for areas subject to winds greater than 80 mph (130 kph).
  - c. Type M mortar: A high-strength mortar suitable for general use and recommended specifically for masonry below grade or in contact with earth, such as foundations, retaining walls, or paving.

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d. Type O mortar: A low-strength mortar suitable for use in non-load bearing applications in walls of low axial compressive strength and where masonry is not subject to severe weathering.

#### 4. Quality Assurance

##### a. Mortar

1.) All mortar selection and composition shall comply with presiding codes. Mortar selection shall be advised by the requirements of Building Code Requirements for Masonry Structures (ACI 530/ASCE 5/TMS 402 latest version).

2.) Mortar and grout selection shall also be advised by the Brick Industry Association's "Technical Notes for Brick Construction" and the International Masonry Institutes, "Technical Briefs" as they relate to this issue.

##### b. Grout:

1.) Grout should be mixed thoroughly in a plastic mix suitable for placement without separation of the constituents. Add enough water to achieve a slump of 8 to 11 in. (200 to 275 mm). The compressive strength of the grout should match that of the brick masonry but must have a minimum compressive strength of 2000 psi (13.9 MPa).

2.) Fine grout: Can be used for grouting interior vertical spaces between two wythes of masonry or aligned, unobstructed vertical spaces in hollow masonry units. See the "Grout Spacing Requirements" table for grout space requirements.

3.) Coarse grout: May be used when the grout space exceeds 2 in. (50 mm) in width. If the minimum grout space dimension exceeds 6 in. (150 mm), a larger aggregate size may be specified.

#### B. Insulation

1. Insulation within the cavity wall may be extruded or expanded rigid polystyrene board insulation, rigid cellular polystyrene thermal insulation or foil faced and or glass fiber reinforced rigid cellular polyisocyanurate thermal insulation.

2. The selection of the in cavity insulation material and related thickness must comply with presiding codes.

3. Tape or caulk all joints per manufacturer's recommendations.

4. Batt or spray on foamed insulation in the outer cavity walls shall only be provided if required to meet presiding codes or other NJSDA requirements.

5. Masonry Cell Insulation: Insulation within masonry cells may be granular perlite or molded polystyrene units.

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## 6. Quality Assurance

### a. Warranty:

- 1.) Specify a fifteen year (15) limited thermal warranty for rigid cellular polyisocyanurate.
- 2.) Specify a fifty year (50) limited thermal warranty for expanded rigid polystyrene board.

## C. Air / Vapor Barrier

1. The preferred system for the masonry exterior walls with concrete masonry back up shall be a fluid / spray applied or troweled on air vapor barrier applied from the base flashing to the top of wall or coping and should seal everything including veneer ties. The barrier shall lap and perform in conjunction with or similar to the weep system at the bottom of cavity walls. All applied stainless steel masonry anchors shall be imbedded or mechanically attached to the wall prior to the coating or as per manufacturer's specification and sealed accordingly.

### 2. Air Vapor Barrier Alternatives:

- a. Specify a complete system based upon a two component, synthetic rubber cold vulcanized producing a resilient, fully bonded, monolithic, elastomeric sheet
- b. Specify a complete system based upon a water based asphalt emulsion modified with a blend of synthetic polymers and special additives
- c. Specify a complete system based upon a SBS rubberized asphaltic sheet applied system may be considered. The Design Consultant must demonstrate this selection to be appropriate for its application and budget tolerance. This choice is subject to approval by the NJSDA.

3. The preferred system for the exterior masonry walls with galvanized metal back up and mold and moisture proof fiberglass sheathing shall be a commercial quality wrap made of flash spun bonded polyolefin, non- woven, non- perforated secondary weather resistant barrier. Specify a complete system including, seam tape, fasteners, etc.

**a. Specify a complete system based upon a fluid-applied, monolithic elastomeric membrane continuously over exterior wall sheathing to mitigate air and water migration while permitting the passage of water vapor.**

4. Specify a complete system based upon a SBS rubberized asphaltic sheet applied system may be considered. The Design Consultant must demonstrate this selection to be appropriate for its application and budget tolerant. This choice is subject to approval by the NJSDA.

## 5. Quality Assurance

- a. The air/vapor barrier shall meet the air barrier requirements of ICC-ES AC-38, the ASTM E1677 Standard Specification for a Type I air barrier and passes the

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ASTM E2357 standard test method for determining air leakage of air barrier assemblies. The air/vapor barrier shall also meet the Massachusetts Commercial Energy Code and the presiding NJ Energy Code: ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings.

b. Warranty: Specify a five (5) year manufacturers' standard warranty.

## **D. Flashing**

1. Flashing may be stainless steel, cold rolled copper, copper laminates, EPDM, or self-adhering butyl or cross laminated high density polyethylene sheet.
2. Select flashing materials so that they are compatible with all adjacent materials. Consideration should be given to compatibility with adjacent sealants, delamination due to moisture penetration and movement of the wall system.
3. Asphalt –impregnated building felt and polyethylene sheeting are not permitted.

## **E. End Dams**

1. Use prefabricated flashing pans with pre-formed end dam systems whenever possible.
2. Properly detail and specify all required end dams, door and window heads and sills so that the cavity can breathe.
3. Properly detail conditions of differential expansion and contraction at all relieving angles and lintels.

## **F. Termination Bars**

1. Termination bars shall be stainless steel with stainless steel fasteners.
2. The practice of terminating flashing within the nearest or next highest horizontal mortar joint is acceptable provided the flashing does not compromise the bond strength of the wall

## **G. Ties, Anchors, and Reinforcement**

1. All masonry ties shall be 2 part, and made of hot dipped galvanized steel or stainless steel.
2. Ties which are surface mounted in the cavity wall to a CMU or galvanized, light gauge, metal stud back up system and attached by screws or other fasteners shall always be stainless steel including the respective fasteners. Any ties subject to damage of the hot dipped galvanized coating due to their location, installation procedures, movement of systems, etc. shall be stainless steel.
3. Horizontal joint reinforcement shall be either stainless steel unless there are budgetary restrictions; in those instances, hot dipped galvanized steel ties may be used.
4. Corrugated ties are not permitted for use within and exterior wall or other location where moisture may be present.

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## **H. Lintels**

1. All loose lintels exposed to the exterior elements shall be galvanized steel. Dual lintels back to back on hangers from the structure shall be used when appropriate. All exposed galvanized steel shall be painted with an appropriate paint type for an exterior application.
2. Pre-cast concrete or concrete bond beams filled with grout may be used in the backup system wythe only and shall be designed by the Structural Engineer to include reinforcing steel bars appropriate for the span of the opening are permitted. Inserts to hold the exterior loose lintels shall be cast into the pre-cast concrete.

## **I. Bottom of Cavity Drainage Material**

1. Properly detail all cavity walls to include "mortar net" or "mesh" or a similar product that will catch mortar droppings while keeping the cavity clear to allow water to weep out to the exterior.
2. Mortar mesh shall extend at least two courses higher than the bottom of flashing below. Include 'mortar mesh' in the specifications. The elevation of the top of the mesh in the cavity shall vary to further reduce the probability of the continuous collection of mortar
3. The use of pea gravel to catch mortar droppings is not permitted.

## **J. Weep Vents**

1. Weep joints / vents shall be achieved by omitting mortar in all or part of the vertical head joint and by using plastic (polyester, polypropylene, polyethylene mesh) or metal prefabricated weep vents that are the full vertical height of the adjacent bricks and 90% open, and the full width of the joint.
2. Prefabricated weeps shall be recessed  $\frac{1}{4}$ " from the outside face of the wall and the full depth of the outside wythe of masonry.
3. Specify plastic or metal weeps in brick veneer as well as weeps in brick veneer at relieving angles and bearing of lintels at wall openings.
4. Vent the top of wall cavities with plastic or metal weeps described above when deemed necessary for pressure equalization and moisture differential below parapets, etc.

## **K. Control Joint Gaskets**

1. Shall be pre-formed styrene-butadiene-rubber, and be designed to fit standard sash block and maintain lateral stability in masonry walls.

## **L. Compressible filler**

1. Pre-molded filler strips formulated from neoprene, urethane, or PVC.

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## **M. Bond-Breaker Strips**

1. Asphalt saturated, organic felt strips min. #15 felt. To be included at all interface conditions in which differing masonry materials are matched unless otherwise addressed by other movement isolation methods/materials.

## **N. Masonry Cleaners/ Efflorescence Removal**

1. All efforts to eliminate efflorescence on exterior masonry walls shall be taken. Proper storage of the masonry product(s) (CMU, brick, etc.) must be defined in the contract documents by the Design Consultant including dry and covered storage at the manufacturing plant, distributor's site, on-site storage, while construction is in progress, and on the entire building when applicable, until final occupancy.
2. The development of efflorescence requires the presence of soluble salts and moisture. To prevent or minimize efflorescence, the elimination of either will suffice. Design, detailing, and construction practices that promote resistance to water penetration are the most effective methods of preventing efflorescence. Minimize the selection of brick, mortar, and grout components that contain soluble salts.
3. Soluble salts in soil are dissolved by water that percolates through the ground. Consequently, most ground water contains a high concentration of these salts. When masonry is in contact with the earth, ground water may be absorbed by the masonry and may rise through capillary action several feet above the ground. An accumulation of salts in the masonry are then possible. To eliminate these salts as sources of efflorescence, waterproof the masonry that extends below grade and install flashing a few courses above grade. The waterproofing prevents the masonry from absorbing dissolved salts from the adjacent soil and the flashing acts as a capillary break, preventing any absorbed salts from rising higher in the wall. Another solution is to detail the below grade condition so that masonry does not extend below grade.
4. Efflorescence: If present requires removal. The first step in removal is to identify the type of efflorescence salts present. If water soluble, this type can be removed with water and using a dry, stiff bristle brush and or the application of a mild soap. If the salts are not water soluble, use an acidic cleaners of the standard or appropriate strength specifically developed for this purpose. Follow the manufacturer's recommendations.
5. Require the use of masonry stain removers specifically developed for the surfaces they are cleaning if any type of staining is present. Require final masonry cleaning using specialized masonry cleaners when appropriate.
6. After the final wash down of any wall, no efflorescence will be accepted. The Design Consultant shall require that the contractor and their subcontractor(s) will be responsible for monitoring and removing any efflorescence or staining on any wall for a period of five years from project completion and occupancy. The Design Consultant shall specify that the contractor and their subcontractor(s) shall be responsible for all costs associated with any efflorescence removal during this warranty period.



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## **O. Graffiti Control: Description/Design Approach**

1. A graffiti resistant coating is to be used on all exposed exterior masonry surfaces up to 10'-0" high.
2. For new construction: use clear, matte finish sacrificial coating. As the coating may discolor the basic material, the designer should provide a break in the façade such as a string course to define the area being coated. An alternative approach to the sacrificial coating may include an ASTM C744 compliant brick/block being utilized to meet this standard.
3. For existing buildings, graffiti should be removed and a sacrificial graffiti resistant coating applied. If the graffiti "shadow" cannot be removed without damage to the surface, the masonry walls should be painted, and then the graffiti resistant coating should be applied.
4. Removal of graffiti should always follow coating manufacturers' recommendations, because many anti-graffiti coatings are intended to be used with a particular removal method or cleaning product. As anti-graffiti coatings provide a barrier to paint and other staining, they also provide a barrier to water evaporation through the outer face of the brick, similar to that of glazed brick. Therefore, most of the drying of the brickwork occurs by evaporation through the back face of the brick, into the air space. It is important that when an anti-graffiti coating is used, the cavity behind the brick be vented at top and bottom to help remove the excess moisture in the air space created by this evaporation. For new construction vents at the top of the wall area should be below any relieving angles or other restriction to the vertical flow of air in the cavity.
5. For existing buildings of solid masonry construction and buildings without weep holes, the bottom two brick course should remain unpainted and uncoated to allow the wall to breathe.

## **P. Masonry Repair, Repointing, and Restoration**

1. Applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places and buildings classified by the New Jersey State Historic Preservation Office (SHPO) (<http://www.nj.gov/dep/hpo/>) as New Jersey State or other Federal Landmark status. The following criteria also apply to all other renovations and restorations where brick mortar removal and repointing is required. The applications of these criteria are subject to the approval of all presiding Authorities.
2. Mortar Removal: Existing mortar is to be removed from historic masonry surfaces using hand held non-power tools for all joints or a combination of power tools/handheld-non-power tools for horizontal joints & hand held non-power tools for vertical joints. Perimeters of brick replacement areas are to be cut in a similar manner prior to brick removal to ensure adjacent bricks to remain are not damaged.
3. Repointing will be appropriate provided it occurs only where mortar is missing or deteriorated, and the new mortar matches the original in color, texture, tooling, size and profile of joint. It is most important to ensure that the work does not significantly alter the building's appearance by reversing or otherwise offsetting the visible mortar to brick ratio. This is traditionally addressed by limiting repointing only to areas where needed



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(at grade, downspouts, parapets etc.) However, if total or extensive repointing is required to ensure a watertight envelope, the specifications must ensure the original appearance is maintained, and brick is not damaged unnecessarily.

4. New mortar shall attempt to be similar to existing mortars, however, the following will dictate: The original mortar shall be tested to determine its composition. Historic Mortars are often soft because of their high lime content and lack of Portland cement. New mortar should be soft enough to prevent damage to historic masonry materials. If a mortar analysis is not performed, a Type O Mortar may be used:

- a. 1 part white Portland cement
- b. 2 parts Type S hydrated lime
- c. 7 parts sand with no admixtures

5. When repointing at parapets, at grade, or at other areas exposed to harsh weathering conditions, it may be appropriate to use a more durable new mortar. If a mortar analysis is not performed, the following mortar mix should be used:

- a. 2 parts white Portland cement
- b. 3 parts Type S hydrated lime
- c. 6 parts sand with no admixtures

## 6. Masonry Cleaning and Removal of Existing Coatings

a. The goal of cleaning a historic structure is not to make it look entirely new. Removal of the last 15% of the grime or coatings will also remove some of the masonry material.

b. Harsh chemicals or high pressure washing can damage historic masonry. Cleaning should remove surface dirt using the gentlest methods possible. Work will be appropriate provided only non-ionic neutral pH detergents (not chemicals), non-metallic, natural bristle brushes or scrapers, and water pressure no greater than 150 psi are used. Vortex systems will be approved only for use on limestone. If proposed for use on brick, testing (with before and after microscopic surveys) will be required.

c. Chemical paint removal systems, particularly “peel-away” systems where lead is an issue, are subject to NJ State Standards. Only approved “peel-away” systems may be used, and, only following a procedure recommended by its manufacturer and compliant with the NJDCA State lead paint protocols. Adequate oversight to ensure proper and prompt removal of the blanket is critical to prevent drying of the material which would then necessitate scraping and the potential to damage the brick.

## 7. Masonry Coatings

a. Use of any masonry coating must be addressed by analysis and, if necessary, testing of each specific problem and material prior to application.

b. Moisture trapped under masonry coatings can cause excessive damage in freeze-thaw cycles. These coatings prevent the natural passage of moisture from within the wall and aggravate many existing moisture problem. Acrylic

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sealers, cementitious paints, and other non-breathable coatings shall not be applied to historic masonry surfaces.

c. Although a more sacrificial coating is preferred, a breathable coating may be approved if the proposal is supported by sufficient information concerning the reason for its use and its permeability.

## B2020 Exterior Windows

### A. General Description/Design Approach

1. The arrangement and design of windows (fenestration) shall be in scale and proportion to the building's elevations, massing, volume, and coordinated with all building systems.
2. The windows (fenestration) must be appropriate for the use of the space for which the windows are being provided. Fenestration includes any exterior aluminum framed cladding system such as a window system, aluminum entrance system, storefront system, curtain wall system, or other similar system.
3. The percentage of fenestration and associated ventilation requirements shall meet the requirements of all presiding codes and regulations.
4. Exterior glazing shall be comprised of 1" sealed insulating units, laminated, tempered, etc. and where required comply with presiding codes and other requirements including but not limited to: NJ Division of Community Affairs, Department of Codes and Standards: "Best Practices Standards for Schools Under Construction or Being Planned for Construction".

### B. General Requirements

1. Choice of materials must be guided by building budget and the following requirements:
  - a. The materials to be used in the design and construction of the school's exterior facades shall typically be limited to those materials which are specified in the NJSDA's Standards and the parameters established herein.
2. Outward projecting windows or awnings are not permitted when they are near or encroaching upon any exterior path of travel such as a sidewalk, or located at the perimeter of an outdoor paved space where a person can become injured.
3. Projection of hopper windows beyond the adjacent interior wall surface or the outer most interior facing vertical plane of permanently installed furnishings or equipment shall not be permitted.
4. Steel frames are permitted where required to provide fire ratings.
5. Sill heights: Coordinate with adjacent furniture and equipment heights. Typical sill height is minimum 2'-8" or 3'-4" above the finished floor (AFF) to top of the sill location. Minimum height of sill above finished floor shall coordinate with masonry coursing.

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6. Fixed transom units are permitted at entrances and other limited locations.

7. Insulated metal panels and spandrel glass, gasketed into the fenestration system are permitted in limited conditions. Spandrel panels may be composed of a single layer of the appropriate type of spandrel glass with insulation behind it or composed of an insulating glass unit with a sandwich panel composed of metal studs and mold and moisture resistant gypsum board behind the spandrel glass. Both approaches should allow for the spandrel condition to be weeped and vented. Insulated metal panels and spandrel panels shall be installed by the fenestration manufacturer or by an installer acceptable to the fenestration manufacturer. The use of insulated metal panels within the fenestration shall only be used if the fenestration systems manufacturer's warranty will remain unaffected by their application. The use of insulated metal panels requires justification by the Design Consultant and is subject to approval by the NJSDA.

8. Fixed windows (fenestration) shall permit re-glazing without removal of the window master or vent frame.

## **C. Quality Assurance**

1. The entire fenestration assembly shall comply with all applicable Fenestration & Glazing Industry Alliance (FGIA) (<https://fgiaonline.org/>), Commercial or Heavy Commercial and Architectural Grade rating standards. The entire window (fenestration) assembly shall comply with all applicable sections and requirements of ANSI/WDMA/CSA 101/I.S.2/A440-08 (or current) "Voluntary Specifications for Aluminum, Vinyl (PVC), Wood Windows, and Glass Doors.

2. Source Limitations: Obtain aluminum windows through one source from a single manufacturer. Use an installer approved by the aluminum window, storefront or curtain wall manufacturer for installation of the window (fenestration) units required.

3. The Design Consultant and their Sub-Consultants shall design and specify performance criteria which meet or exceed the presiding codes for all systems described herein to prevent system failure. This shall include but not be limited to the following:

- a. Deflection of framing members
- b. Structural performance testing to comply with all codes including but not limited to wind loads, uniform loading, and seismic when applicable
- c. Wind-borne debris impact resistance
- d. Air infiltration
- e. Water Resistance including penetration under static pressure
- f. Water Resistance including penetration under dynamic pressure
- g. Thermal resistance and movements
- h. Condensation resistance
- i. Thermal conductance

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- j. Sound transmission
  - k. Strength of structural sealants including their joints
4. The minimum STC value for all aluminum framed exterior fenestration shall be STC 35 when tested for laboratory sound transmission loss according to ASTM E90 and as determined by ASTM E413.
5. All exterior and interior coatings applied to aluminum extrusions, plates, and sheets shall be factory applied by the fenestration manufacturer.
6. All integral window, curtain wall, or storefront system components such as window frames and vents requiring factory assembly shall be assembled by the window (fenestration) manufacturer.

## **E. Related Standardized Details**

1. Refer to the following details for additional information:
- a. B2010-11-01 Section: Brick Exterior Cavity Wall w/ CMU Backup
  - b. B2010-11-02 Section @ Foundation: Brick Exterior Cavity Wall w/ CMU Backup
  - c. B2010-11-03 Section @ Spandrel: Brick/CMU: Masonry Openings 8'-0" or Less
  - d. B2010-11-04 Section @ Parapet: Brick/CMU Cavity Wall
  - e. B2010-11-05 Section @ Spandrel: Brick/CMU Cavity Wall: High Windows
  - f. B2010-11-09 Section: CMU Exterior Cavity Wall w/ CMU Backup
  - g. B2010-11-10 Section @ Foundation: CMU Exterior Cavity Wall w/ CMU Backup
  - h. B2010-11-11 Section @ Spandrel: CMU Veneer /CMU: Masonry Openings 8'-0" or Less
  - i. B2010-11-12 Section @ Parapet: CMU Veneer/CMU Cavity Wall
  - j. B2010-11-13 Section @ Spandrel: CMU Veneer/CMU Cavity Wall: High Windows
  - k. B2010-11-17 Part Plan: Brick/CMU Veneer/ CMU Cavity Wall
  - l. B2010-11-25 Section: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - m. B2010-11-26 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - n. B2010-11-27 Section @ Spandrel: Brick/Metal Stud: Masonry Openings 8'-0" or Less
  - o. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
  - p. B2010-11-29 Section: CMU Exterior Cavity Wall w/ Metal Stud Backup
  - q. B2010-11-30 Section @ Foundation: Brick Exterior Cavity Wall w/ Metal Backup
  - r. B2010-11-31 Section @ Spandrel: Brick/Metal Stud: Masonry Openings 8'-0" or Less
  - s. B2010-11-32 Section @ Parapet: Brick/Metal Stud Cavity Wall

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## **B2020 Exterior Windows**

### **B2020.10 Exterior Operating Windows & B2020.20 Exterior Fixed Windows**

#### **A. General Requirements**

1. All window (fenestration) openings shall be coordinated with masonry unit sizes and design to align with masonry coursing, patterns, control joints, and other features, and to eliminate unnecessary cutting of masonry units.
2. For the specific window type chosen; specify window stops that limit openings to 4". All windows shall be provided with window stops limit the window openings so that the stops prevent students from falling out of the school facilities windows. Removal of stops shall require the use of special tools.
3. Intermediate mullions may be provided for aesthetic reasons, to divide panels into sections so as to not exceed size limitations of the glazing type used, to include operable panels for natural ventilation, and mullions shall be provided where essential to align with existing conditions. If provided, mullions shall be permanently installed and shall be of the same material as the window frame.

#### **B. Window Types: Materials**

1. Windows for new buildings shall typically be aluminum frame, integrally concealed, low-conductance structural thermally broken, hopper/awning (projecting inward / outward respectively), casement windows, and / or fixed windows.
2. Commercial-grade, aluminum windows, with an integrally concealed, low-conductance structural thermal break(s), with fixed and / or operable sash, with minimum 1" thick insulating glass are permitted when code compliant.
3. Heavy duty commercial-grade aluminum windows, with an integrally concealed, low-conductance structural thermal break(s), with fixed and /or operable sash are permitted, when their use is justifiable by the Design Consultant.
4. Use of windows other than those listed above for new buildings or additions shall be approved by the NJSDA
5. Exterior sills shall be either extruded aluminum, fabricated, and provided by the window manufacturer or cast stone.
6. Extruded aluminum shall be 6063-T6 alloy and tempered.
7. All window units shall be factory glazed by the manufacturer.

#### **C. Window Size**

1. View window: Sill height to top of window stool or sill: Provide a minimum 2'-8" or 3'-4" above finished floor (AFF) to top of sill height. A sill height of 2'-8" AFF to top of sill height is preferred, particularly for exterior walls with a concrete masonry unit back up system to align with block coursing. The window head shall be located at a minimum of

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8'-0" AFF. Comply with presiding codes and regulations with regard to daylight and ventilation requirements.

2. Day-lighting window: Provide a day-lighting window from the head of the view window (7'-4") to the ceiling (Optional). The intermediate window head may be lower than 7'-4" to accommodate the addition of a day-lighting window.

### D. Quality Assurance

#### 1. Weather Stripping and Sealing

a. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

b. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.

c. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440-08 (or current version).

d. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702-23 (or current version).

1.) Weather Seals: Provide weather stripping with integral barrier fin or fins of semi rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

e. Replaceable Weather Seals: Comply with AAMA 701/702.

f. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement

#### 2. Fasteners

a. All fasteners shall be either aluminum, nonmagnetic stainless steel, epoxy adhesive coated, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

b. All fasteners must be concealed except where unavoidable for application of hardware.

c. For application of hardware, where required, use non-magnetic stainless steel Phillips machine screws.

#### 3. Anchors, Clips, and Accessories

a. All anchors, clips, and accessories shall be aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe

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service conditions; provide sufficient strength to withstand design pressure indicated. All anchors, clips, shall be anchored to the back-up wall system when possible.

### 4. Manufacturer's Warranties: Aluminum Windows

a. Aluminum Windows: Manufacturer's Standard Form Warranty in which the manufacturer agrees to repair or replace aluminum windows and screens that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

- 1.) Failure to meet performance criteria
- 2.) Structural Failures including excessive deflection
- 3.) Water leakage and air infiltration
- 4.) Faulty operation of movable sash and or hardware
- 5.) Deterioration of metals, metal finishes, and other materials beyond normal weathering.

b. Warranty Period: Manufacturer's Standard Form Warranty for two year against defects in material or workmanship under normal use from the date of Substantial Completion and remain operable for 10 years.

### E. Replacement Window Installations

1. Window types and conditions listed for new construction shall be used wherever possible. Additions/Renovations may require windows other than those listed above for reasons of aesthetic and or historic compatibility.

2. Where other window types are required to align with existing conditions, written justification and approval by the NJSDA as early as possible during the development of the design of the exterior of the building.

## B2020.30 Exterior Window Wall

### B2020.30.1 Curtain Wall

#### A. General Description/ Design Approach

1. Curtain wall shall generally not be used on the NJSDA's projects. In new construction projects, the use of curtain wall must be justified by the Design Consultant and must be approved by the NJSDA as early as possible during the development of the design of the exterior of the building.

2. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Curtain wall may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior



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curtain wall building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.

3. In instances, on a project that is a renovation and or addition to an existing building which contains curtain wall and matching a feature is required, curtain wall may be used after consultation with and approval of the NJSDA.

## **B2020.30.2 Exterior Aluminum Framed Entrances and Storefront Systems**

### **A. General Description/Design Approach**

1. For new construction, the use and application of exterior aluminum framed entrances and storefront systems are permitted for the school facilities project. Refer to Section B2050 Exterior Doors and B2050.10.1 Glazed Doors and Entrances for information on related exterior door systems.

2. For new construction projects, any additional proposed use of exterior aluminum framed entrances and storefront systems must be justified by the Design Consultant and must be approved by the NJSDA as early as possible during the development of the design of the exterior of the building.

3. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Exterior aluminum framed entrances and storefront systems may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior aluminum framed entrances and storefront system building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.

4. In rare instances, on a project that is an addition to an existing building which contains existing exterior aluminum framed entrances and or a storefront system and matching those features is required, exterior aluminum framed entrances and or a storefront system may be used after consultation with and approval of the NJSDA as early as possible during the development of the design of the exterior of the building.

### **B. Quality Assurance**

1. Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

a. Movements of supporting structure indicated on the drawings and or in the specifications including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

b. Dimensional tolerances of building frame and other adjacent construction.

c. Failure includes the following:

1.) Deflection exceeding specified limits.



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- 2.) Thermal stresses transferring to building structure.
- 3.) Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
- 4.) Glazing-to-glazing contact.
- 5.) Noise or vibration created by wind and by thermal and structural movements.
- 6.) Loosening or weakening of fasteners, attachments, and other components.
- 7.) Finish or sealant failure.
- 8.) Failure of operating units.

## 2. Materials

a. Framing Members: Utilize the manufacturer's standard extruded aluminum framing members structural thermal barrier of thickness required and reinforced as required to support imposed loads based upon presiding codes. Refer to Section B2050.10.1 Glazed Doors and Entrances for additional information.

b. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

- 1.) Sheet and Plate: ASTM B 209
- 2.) Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221M-21
- 3.) Extruded Structural Pipe and Tubes: ASTM B 429.
- 4.) Structural Profiles: ASTM B 308/B 308M.
- 5.) Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

c. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to the recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

- 1.) Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
- 2.) Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
- 3.) Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

d. The aluminum framed entrance or storefront system selected and specified may be either screw spline, shear block or stick built and shall be outside glazed. The glazing system shall be retained with gaskets on four sides.

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**C. Window Size**

1. Refer to Section B2020.10 Exterior WindowsC.1 General Requirements: Sill Heights

**D. Brackets and Reinforcements:**

1. Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

**E. Fasteners and Accessories**

1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
3. Reinforce members as required to receive fastener threads.
4. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

**F. Concrete and Masonry Inserts**

1. Quality Assurance
  - a. Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M

**G. Concealed Flashing**

1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

**H. Framing System Gaskets and Sealants**

1. Manufacturer's standard, recommended by manufacturer for joint type.
  - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

**I. Quality Assurance**

1. Manufacturer's Warranties: Aluminum-Framed Entrances and Storefronts
  - a. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

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1.) Failures include, but are not limited to, the following:

- a.) Structural failures including, but not limited to, excessive deflection.
- b.) Noise or vibration caused by thermal movements.
- c.) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- d.) Adhesive or cohesive sealant failures.
- e.) Water leakage through fixed glazing and framing areas.
- f.) Failure of operating components.

b. Warranty Period: Two years from date of Substantial Completion.

## **B2020.90 Exterior Window Supplementary Components:**

### **A. Exterior Aluminum and Steel Frame Windows, Entrances, and Storefront: Materials**

#### **1. Frame: Aluminum Extrusions**

- a. All exterior aluminum frame fenestration shall be composed of the manufacturer's standard aluminum extrusions with a structural, thermal barrier. A structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions. No thermal short circuits shall occur between the exterior and interior.
- b. Extruded aluminum shall be alloy and tempered by the manufacturer for type of use and finish.
- c. All aluminum frame and vent extrusions shall have a minimum wall thickness of .125" (3 mm).
- d. Depth of all aluminum frames and vents shall not be less than ~~2"~~ 4" (50 mm).
- e. Window materials other than aluminum or steel require written justification and approval by the NJSDA as early as possible during the development of the design of the exterior of the building.

#### **2. Glazing**

- a. Exterior glazing shall be comprised of 1" minimum, sealed insulating units, laminated, tempered, etc. and where required comply with presiding codes and other requirements including but not limited to: NJ Division of Community Affairs Department of Codes and Standards: "Best Practices Standards for Schools Under Construction or Being Planned for Construction".

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- b. Glazing treatments such as tinted, fritted, frosted, sandblasted, opaque and other special surface treated or coated glass require justification by the Design Consultant and are subject to approval by the NJSDA.
- c. Single glazing is not permitted on the building exterior.
- d. Conditions requiring fire rated exterior glazing are to be avoided.
- e. All glazing shall be installed by the exterior aluminum frame windows, entrances, and storefront manufacturer or a manufacturer approved installer.
- f. All units shall be glazed with the manufacturer's standard sealant process provided the glass is held in place by a removable, extruded aluminum, glazing beads. The glazing bead shall be isolated from the glazing material by a gasket.
- g. The use of triple glazing requires justification by the Design Consultant and is subject to approval by the NJSDA.

### h. Quality Assurance

#### 1.) Warranty Requirements: For insulating glass units:

a.) Provide manufacturers standard written warranty against visual obstruction from dust or film formation or moisture collection between internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship excluding that caused by glass breakage or abuse by others.

b.) Warranty Period: Ten (10) Years from the date of Substantial Completion.

2.) Comply with published recommendations of glass manufacturers and the National Glass Association (NGA) GANA Glazing Manual unless more stringent requirements are indicated.

### 3. Window Screens

#### a. Insect Screens

1.) General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on inside or outside of window, depending on configuration. Provide insect screens on all operable sash windows.

#### b. Quality Assurance

1.) Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with Screen Manufacturer's Association 6001-2021 (or current). Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

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2.) Extruded-Aluminum Tubular Framing Sections and Cross Braces:

a.) Not less than 0.050-inch (1.3-mm) wall thickness.

b.) Finish: Match other extruded aluminum members.

3.) Glass-Fiber Mesh Fabric:

a.) 18-by-16 (1.0-by-1.1-mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; in the following color. Comply with ASTM D 3656.

b.) Mesh Color: Charcoal gray.

4.) Screen mounting holes shall be factory drilled

4. Finishes

a. The following are acceptable finishes for exterior aluminum frame windows, entrances, storefront systems and security screens:

1.) Anodic: The aluminum window, entrance, or storefront manufacturer shall factory apply the specified anodic finish to all exposed areas of aluminum windows and components with electrolytically deposited color in accordance with Aluminum Association Designations.

a.) Utilize composite standard Aluminum Association Designations for all anodic finishes.

b.) Colors shall be selected from the manufacturers' full range of standard colors.

2.) Organic: Finish all exposed areas of aluminum windows, entrance, or storefront components with a two (2) or three (3) coat high performance fluoropolymer coatings including an appropriate durable, compatible primer.

3.) Baked Enamel: Provide a factory spray applied thermosetting, modified acrylic enamel primer/topcoat system complying with AAMA 2603 to all exposed areas of aluminum windows and components.

4.) Acrylic Polyurethane: Finish all exposed areas of steel windows and components with a factory applied, cathodic, epoxy primer and a spray coat of oven baked acrylic polyurethane as a finish coat. An intermediate powder coat or urethane polyester and or clear finish coat may be added in locations subject to adverse environmental conditions.

5.) De-burring, cleaning, pre-treatment, and priming of metal surfaces are required as applicable but are not described in detail herein. Follow manufacturer's recommendations.

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b. Colors shall be selected from the manufacturers' full range of standard colors.

c. The use and selection of a custom color(s) or special coating(s) not included in the manufacturers' full range of standard colors is subject to approval by the NJSDA.

d. The types and thickness of coatings shall be selected based upon type of coating selected, location, and prevailing environmental conditions. For example: The exterior coatings of a school facilities project located near the ocean would be exposed to air that has a higher salinity content and sand that is wind driven, thus a thicker anodized coating(s) or protective clear coat shall be specified. Similarly; for organic fluoropolymer coating(s) a protective clear coat and special primer shall be provided in certain locations, environmental conditions or with the selection of certain colors which have a tendency to fade or weather more easily than others.

e. Quality Assurance

1.) Comply with NAAMM's "Metal finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes. Comply as applicable with the following:

a.) For Anodic coatings: Comply with the requirements of anodizing specification, MIL-A-8625, which defines three types of aluminum anodization as applicable. The types and thickness of coatings shall be selected based upon location and environmental

1.) AAMA 2603: "Voluntary Specification Performance Requirements and Testing Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels"

2.) AAMA 2604: "Voluntary Specification Performance Requirements and Testing Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels"

3.) AAMA 2605: "Voluntary Specification Performance Requirements and Testing Procedures for Superior Organic Coatings on Aluminum Extrusions and Panels"

2.) Warranty Requirements: Vary depending upon finish type: Provide the following as a minimum:

a.) Anodic Coating Warranty: Manufacturer's standard written warranty in which manufacturer agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated.

1.) Warranty Period: Twenty (20) years from date of Substantial Completion.



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b.) Organic Fluoropolymer Coating Warranty: Manufacturer's standard written warranty in which manufacturer agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated.

1.)) Exposed Coating: Deterioration includes but is not limited to:

a.)) Color fading in excess of 5 Delta E Hunter units per ASTM D 2244.

b.)) Peeling, checking, or cracking of coating adhesion to metal.

c.)) Chalking in excess of a No. 8 per ASTM D 4214, when tested per Method D 659.

d.)) Corrosion of substrate in excess of a No. 6 on cut edges and a No. 8 on field surfaces, when measured per ASTM D 1654.

2.)) Warranty Period: Twenty (20) years, and twenty five (25) years for coatings meeting current AAMA-2605-22 from date of Substantial Completion.

c.) Baked Enamel Warranty: Manufacturer's standard written limited warranty in which the manufacturer agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated

1.)) Warranty Period: Ten (10) years from Substantial Completion.

d.) Acrylic Polyurethane Warranty: Steel Window Manufacturer's standard written limited warranty in which manufacturer agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated

1.)) Warranty Period: Ten (10) years from Substantial Completion.

## 6. Hardware

a. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907-23 (or current), or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.

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b. Locks, Key, or Special Tool, and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

c. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable window hardware more than 72 inches (1800 mm) above floor.

d. Projecting Windows:

1.) Hinges: Operating hardware shall be concealed stainless steel four or six bar friction hinge with adjustable-slide friction shoe; two per ventilator. Friction hinge shall be of nylon or other nonabrasive, non-staining, noncorrosive, durable material, and adjustable. Provide at least two per ventilator.

2.) Lock: Cam-action, white bronze sweep lock handle with strike (two per ventilator over 42" wide).

3.) Lock: Provide pole-operated automatic white bronze locks on inward acting ventilators, where the distance to the operating hardware exceeds six feet above the floor.

e. For other window types the Design Consultant shall select hardware to meet all above referenced standards, presiding codes and regulations.

## B2050 Exterior Doors and Grilles

### A. General Description/Design Approach

#### 1. Use and Application

a. The exterior entrance doors shall have vision lights as large as possible and that will permit the installation of required exit devices, provided the required level of security, all other performance requirements, and code requirements are met. Side lights and transoms may also be provided when compliant with the same criteria. Exterior exit doors may be solid without glazing but must also be compliant with the same criteria contained herein.

b. The proposed entrance design, including door and frame material, vision panel material and size, and the type of security screen (if any) shall be finalized for the NJSDA's approval must be approved by the NJSDA as early as possible during the design phases but prior to fifty percent (50%) complete construction documents.

2. All door(s) and frame(s) design in new construction, additions, renovations, and emergent projects shall comply with the presiding codes, including but not limited to the New Jersey Energy Subcode, ASHRAE 90.1-2019 (or current) and the NJDOE Title 6A



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Chapter 26-6.3 Educational Facility Standards for special supplementary requirements, and the ICC 117.1 for Accessibility Standards.

3. New Construction and Additions: The Design Consultant shall typically design doors to meet but not be limited to the following general guidelines and criteria:

- a. All doors shall be specified as to locations, door width, door leaf/quantity, and shall meet the presiding code requirements for handicapped accessibility, fire, and life safety egress requirements.
- b. All doors shall meet the required fire rating for opening protection, exit load capacities, and be located in partitions such that they provide safe egress travel distance to an exit and discharge to a right of way.
- c. All doors designed as means of egress shall be designed such that they swing in the required direction of egress to provide safe means of egress without obstruction to stair landing or handicapped refuge, lead directly to an unobstructed right of way, and have a vision panel.
- d. All egress doors with a required vision panel shall have the required type of vision glass, size, and location to provide visual and fire safety for the respective age group of occupants of the school.

4. Existing Construction (Including Repairs, Renovations, Alterations, and Reconstructions): The Design Consultant shall typically design doors in existing construction according to but limited to the following:

- a. If doors and frames are replaced to meet new egress or life safety requirements they shall be installed according to unit of egress widths of 22" and shall meet capacity calculation methods required by the NJUCC Rehabilitation Code.
- b. Comply with the all applicable chapters of the NJUCC Rehabilitation Sub-Code.

### **B. Quality Assurance**

1. The entire fenestration assembly shall comply with all applicable Fenestration & Glazing Industry Alliance (FGIA) (<https://fgiaonline.org/>) Commercial or Heavy Commercial and Architectural Grade rating standards. The entire window (fenestration) assembly shall comply with all applicable sections and requirements of ANSI/AAMA/NWDA 101/I.S.2 (or current) "Voluntary Specifications for Aluminum, Vinyl (PVC), Wood Windows, and Glass Doors.

2. All Doors and Frames in this section, in addition to meeting all presiding codes and regulations, shall meet all standards as established by the following listings unless more restrictive requirements are specified:

- a. Door and Hardware Preparation ANSI/BHMA A156.115 (or current version).
- b. Life Safety Codes NFPA-101 (Latest edition).
- c. Fire Doors and Windows NFPA-80 (Latest edition).

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- d. UL 10B Fire test of Door Assemblies and UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.
  - e. For Steel Doors only: Steel Door Institute ANSI/SDI A250.8 (SDI-100) Recommended Specifications: "Standard Steel Doors and Frames" (Latest edition) ([www.steeldoor.org/](http://www.steeldoor.org/)). Hardware reinforcements are to be in accordance with the minimum standard gages as listed in SDI-100.
  - f. For Steel Doors and Frames only: Steel Doors and frames shall be manufactured to high quality standards in manufacturing facilities with annual certified conformance to ISO9001.
3. The Design Consultant and their Sub-Consultants shall design and specify performance criteria which meet or exceed the presiding codes for all systems described herein to prevent system failure. This shall include but not be limited to the following:
- a. Deflection of framing members.
  - b. Structural test performance including seismic when applicable.
  - c. Wind-Borne debris impact resistance.
  - d. Air infiltration.
  - e. Water resistance.
  - f. Water penetration under static pressure and under dynamic pressure.
  - g. Indoor air quality testing.
  - h. Hurricane test standards as applicable.
  - i. Swinging door cycle test and cycle slam test methods.
  - j. Thermal movements and conductance.
  - k. Condensation resistance.
  - l. Salt Spray, Exterior Doors and Frames.
  - m. Surface Burning Characteristics, including Class A Option On Interior Faces of FRP Exterior Panels.
  - n. Sound transmission.
  - o. Impact strength, tensile strength, and flexural strength.
  - p. Water Absorption.
  - q. Indentation Hardness.

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- r. Abrasion resistance, stain resistance, and chemical resistance.
- s. Testing of door core for compressive strength, compressive modulus, tensile adhesion, and thermal and humid aging.
- t. Strength of structural sealants including their joints.

#### 4. Fire-Rated Door Assemblies:

a. Where fire-rated assemblies are indicated or required, provide assemblies that comply with National Fire Protection Association (NFPA) “Standard for Fire Doors and Windows”, ([www.nfpa.org/](http://www.nfpa.org/)), and have been tested, listed, and labeled in accordance with ASTM E252 “Standard Methods of Fire Tests of Door Assemblies” for each class of opening by UL, FM, or other nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction over this project.

b. All fire-rated assemblies including all doors and frames shall be labeled. The label shall meet the requirements of the specification and all presiding codes and regulations. Identify each door and frame with metal UL, or Warnock Hersey Inc. labels indicating applicable fire class of the unit. Rivet or weld labels on the hinge edge of door and jamb rabbet of frame. The assembly shall include:

- 1.) The door must have an hourly rating tag.
- 2.) The frame may be of the same or different certifying agency as the door but must be consist with the label of the door.
- 3.) Hardware and related components may be of a different manufacture but shall not diminish the door rating.

c. Fire doors or shutters in ‘fire protected openings’ shall be labeled to withstand temperatures to afford service and safe passage consistent with hourly ratings listed below. It is the Design Consultants’ obligation to validate or modify all opening protection requirements listed below based on the requirements of their design and the prevailing presiding codes:

- 1.) Opening protection of 1-1/2 to 3hrs. are required for the following:  
Fire walls or Fire barriers having a fire resistance rating of greater than 1hr. located in fire resistive interior partition assemblies of 1-1/2 to 4hr. rating.
- 2.) Opening protection of 3 /4 to 1hr. is required for the following:  
  
Fire barriers having a required fire resistance rating of 1hr., such as for shafts, exit enclosures, smoke barriers, exit passageway, as well as for other fire barrier assemblies, located in fire resistive interior partition assemblies of 1 hr. rating.
- 3.) Opening protection of 1/3 to 3 /4 hr. are required for the following:

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For Fire partitions for either .5 hr or 1hr for corridor, or other fire partitions area separations walls, including 1hr. smoke barriers located in fire resistive interior partitions of .5 to 1hr. rating.

5. Smoke and draft control doors shall meet testing and be labeled complying with NFPA 105 or UL 1784.

6. Fire door and related fire shutters shall be tested for the passage of flame and smoke consistent with testing requirements of side hinged or pivoted swing doors in accordance with NFPA 252 or UL10C and if the opening protection is a 'fire shutter', it shall be in according to NFPA 252 10B.

7. All components of a "fire door" assembly are interdependent on the use of consistent labeling for products for all components such as for hollow metal frame material, vision panels, and hardware. Any component that reduces the rating will subsequently reduce the rating of the overall assembly.

8. Oversize Assemblies: For assemblies required to be fire-rated and exceeding sizes of tested assemblies, provide certificate or label from an approved independent testing and inspection agency, indicating that assembly conforms to the requirements of design, materials and construction as established by individual listings for tested assemblies.

9. Source Limitations: Obtain each generic type of door, frame, and all other component parts such as tracks, motors, accessories, etc. through one source from a single Manufacturer, whenever possible. obtain aluminum framed entrances; storefront, and curtain wall and their respective doors and frames were permitted, through one source from a single manufacturer. Use an installer acceptable to the door, frame and aluminum entrance and storefront manufacturer for installation of their products.

10. Refer to Section B2020.90 Exterior Windows Supplemental Components: Finishes for additional information on acceptable finishes for Exterior Doors and Frames.

### **B2050.10 Exterior Entrance Doors, Glazed Doors and Frames**

#### **A. General Requirements**

1. Hollow metal frames designed to accept pairs of doors with exit hardware shall have a lockable vertical removable mullion between the doors. Main delivery doors in the loading and 'back of house' shall have no mullion to facilitate moving larger objects and shall have full astragal seals with overlap where necessary.

2. Steel Doors and steel hollow metal frames are to be cleaned, and chemically treated to insure maximum finish paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer. The finish shall meet the requirements for acceptance stated in ANSI A224.1 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces."

3. Vision Panels:

a. Vision panels, if provided, in rated stair exit doors shall comply with all presiding codes and regulations.

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b. No vision panels shall be provided for doors to mechanical and/or storage spaces.

### 4. Electrical Requirements:

a. General: Coordinate electrical requirements including low voltage requirements, for doors and frames such as electrical door power assists for handicapped doors, electrical hold open, closing, electric strikes or similar devices.

b. Doors shall typically be standard size 7 foot (7'-0") or 7 foot two inches (7'-2") high doors in standard 2" increment widths. Make provisions for installation of electrical items arranged so that wiring can be readily removed and replaced.

### c. Doors with Electric Hinges:

1.) General: Furnish conduit raceway to permit wiring from electric door hardware.

2.) Hinge Locations: Provide electric hinge at intermediate or center location. Top or bottom electric hinge locations are not acceptable.

5. Doors shall typically be standard size 7ft or 7 foot 2 inches high doors in standard 2" increment widths. This requirement does not apply to overhead coiling doors.

6. Reinforcement for steel doors shall be as indicated in the specifications and standard details.

7. All exterior doors shall have a minimum Sound Transmission Co-efficient (STC) rating of 30. Mineral wool shall be used in the core of the doors for sound deadening.

8. Insure the exterior slab pavement adjacent to exterior doorways are properly designed to drain away from the door threshold, so as not to heave due to freeze thaw and thus inhibit the operation of out-swing doors.

9. Specify proper in/out-swinging door hardware with code compliant panic hardware that can be exposed to the elements as well as specifying weather seals and ADA accessible thresholds in the design of doors at interior courtyards.

### 10. Types: Materials

a. Glazed entrance doors and entrances with adjacent vision lights shall be constructed of one of the following:

## **B2050.10.1 Exterior Fiberglass Reinforced Polyester (FRP) Glazed Flush Doors**

### **A. General Description/Design Approach**

#### 1. Use and Application

a. Exterior FRP doors may be used as the exterior entrance doors and shall have vision lights as large as possible and that will permit the installation of

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required exit devices, provided the required level of security, all other performance requirements, and code requirements are met. Side lights and transoms may also be provided when compliant with the same criteria.

## **B. Quality Assurance**

1. Material: fiberglass reinforced polyester (FRP) face sheets
2. Door Construction and Thickness: Flush type fiberglass reinforced polyester (FRP) doors, sizes indicated by 1-3/4" thick. Material thickness: Minimum: 0.120-inch thickness with a finish color throughout and an abuse-resistant engineered surface.
3. Reinforcements: Manufacturer's extruded aluminum sub-frame of 6063-T5 alloy, including stiles and rails where feasible; otherwise, provide non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A123-17 (or current version). Provide steel reinforcement for closers. Furnish standard reinforcement for each type of hardware required, 0.125" thickness minimum.
4. Corners: Mitered
5. Provide joinery of 3/8-inch diameter full-width tie rods and reinforcing plates through extruded splines top and bottom to reinforce the door. Standard tubular shaped stiles and rails shall be reinforced to accept hardware as specified.
6. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
7. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
8. Extrude top and bottom rail legs for interlocking continuous weather bar. Provide for weather seals on meeting stiles and weather stripping on bottom of door.
9. Core: Poured-in-place polyurethane foam.
  - a.) Density: Minimum of 5 pounds per cubic foot.
  - b.) R-Value: Minimum of 9.
10. Fasteners: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
  - a.) Compatibility: Compatible with items to be fastened.
  - b.) Exposed Fasteners: Screws with finish matching items to be fastened
11. Cutouts: Manufacture doors with cutouts for required vision lights and louvers. Factory installed vision lights, which shall be mechanically fastened and accessible from inside only by removable aluminum stops.
- 12.) Finish: Finish color is throughout the FRP sheet. Color to be selected by the Design Consultant from a full range of manufacturers' standard colors.

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13.) Glazing: See below.

14. Warranty: Submit warranty signed by manufacturer and Contractor, agreeing to replace assemblies which fail in materials, performance or workmanship within the specified warranty period.

a.) Warranty Period: Ten (10) years from date of Substantial Completion.

## **B2050.10.2 Exterior Glazed Steel Doors**

### **A. General Description/Design Approach**

#### **1. Use and Application**

- a. Exterior glazed steel doors may be used as the exterior entrance doors and shall have vision lights as large as possible and that will permit the installation of required exit devices, provided the required level of security, all other performance requirements, and code requirements are met. Side lights and transoms may also be provided when compliant with the same criteria.

### **B. Quality Assurance**

1. Material: Sheets are to be made of commercial quality hot dipped zinc coated steel that complies with ASTM A924 G90 and ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed or Galvalume) by the Hot-Dip Process.

2. Door Construction and Thickness: Doors: Heavy Duty or Extra Heavy Duty, Flush design doors, seamless construction, hollow construction with mineral wool, fiberglass, urethane, styrene, or other acceptable fill depending upon application, 1-3/4" thick unless specifically noted otherwise. Minimum 14-gauge

3. Doors shall be constructed with smooth, flush surfaces without visible joints or seams on exposed faces and stile edges, except around glass and louver panels. On mortise face of door, vertical joints shall be continuously MIG or ARC welded and ground smooth and coated with zinc-rich primer.

4. Provide reinforcement for surface sheet, edge, hardware, stops, and other provisions, of size and gage.

5. Provide bottom channel and top channel and closure,

6. Hinge Reinforcements: shall be not less than 10 gage 1-1/4" x six inches longer than the hinge. If a continuous hinge the reinforcement shall be the full height of the door. The reinforcement will be drilled and tapped in the field for a Roton type hinge.

7. Lock reinforcements: minimum 16 gage, 0.053" (1.3mm).

8. Closer reinforcements: minimum 14 gage, 0.067" (1.7mm), coordinate length to exceed closer size and industry standards.



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9. Reinforce tops and bottoms of all doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel shall have a steel closure channel welded in place so the web of the channel is flush with the top of the face sheets of the door. Plastic fillers are not acceptable.

### 10. Stile and Rail Doors

a.) Tubular stile and rail construction, 1-3/4" (45 mm) thick and fabricated from not less than 16 gage (1.3 mm) from commercial quality carbon steel, galvanized, galvanealed or galvalumed steel. Provide stiles that extend the full height of the door. Rails are internally welded or permanently mechanically joined to the stiles forming a neat seam on the face. Hot-dip galvanealed steel stiles and rails conforming to ASTM A 653, Class A60, 16 gage: 0.053" (1.3mm); formed to rectangular tube shape.

b.) Provide Hinge Stile and Lock Stile, Top Rail, Intermediate Rail(s), Bottom Rail per manufacturers' standards for the type of doors selected.

11. Glazing: See Supplementary components below.

12. Finish: Factory -applied primed and field painted.

a.) Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

b.) Primer, galvanized surfaces: Zinc oxide primer.

13. Submit warranty signed by manufacturer and Contractor, agreeing to replace acoustic rated assemblies which fail in materials, performance or workmanship within the specified warranty period.

a.) Warranty Period: 1 year from date of Substantial Completion.

### **B2050.10.3 Exterior Glazed Aluminum Doors**

#### **A. General Description/Design Approach**

##### 1. Use and Application

a. Exterior glazed aluminum doors may be used as the exterior entrance doors and shall have vision lights as large as possible and that will permit the installation of required exit devices, provided the required level of security, all other performance requirements, and code requirements are met. Side lights and transoms may also be provided when compliant with the same criteria.

#### **B. Quality Assurance**

1. Aluminum Frames Sidelights and Transoms: Refer to Design Requirements B2020.30 Exterior Window Wall for additional information.



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## Design Requirements

## Exterior Vertical Enclosures – Section B20

2. Material: Extruded tubular aluminum shall be 6063-T6 alloy and tempered framing with integrally concealed, low-conductance structural thermal break(s).
3. Door Construction and Thickness: Wide Stile-and-Rail Type Thermal Aluminum Doors with ~~three sixteenths of an inch (3/16")~~ **0.125"** thick walls and a minimum of 1" sealed insulating glazing units
4. Heavy Duty Doors: Face dimensions, door thickness: minimum two inches (2") thick with wide stiles: five inches (5") nominal width, and a minimum ten inch (~~10"~~**12"**) bottom rail.
5. Frame: Tubular members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods or J-bolts, supplemented by welding.
6. Brackets and Reinforcement: High-Strength aluminum, nonmagnetic stainless steel, or hot-dip galvanized steel, ASTM A123/123M.
7. System design shall be such that raw edges will not be visible at joints.
8. Fasteners: Noncorrosive and compatible with aluminum components, anchors and other components.
  - a.) Reinforcement: Where fasteners anchor into aluminum less than 0.125 inch thick, and otherwise as required by system design and specified performance, reinforce with aluminum or nonmagnetic stainless steel to receive screw threads, or provide noncorrosive pressed-in splined grommet nuts.
  - b.) Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For the application of hardware, use flat-head machine screws that match the finish of member or hardware.
9. Compression Weather stripping: Replaceable, compressible weather stripping gaskets; molded neoprene ASTM D2000 or molded PVC, ASTM D2287-19 (or current version).
10. Sliding Weather stripping: Replaceable weather stripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, AAMA 701/702-11. being fastened.
11. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops; anchor exterior stops for non-removal. Minimum thickness: 0.125 thick
12. Glazing: minimum of 1" sealed insulating glazing units. See below. Muntins are optional, but if added shall not compromise the thermal characteristics of the door.
13. Finish: Anodized or an organic fluoropolymer coating. Doors are capable of having separate interior and exterior finishes and/or colors
14. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems including doors that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

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a.) Failures include, but are not limited to, the following:

- 1.) Structural failures including, but not limited to, excessive deflection.
- 2.) Noise or vibration caused by thermal movements.
- 3.) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- 4.) Adhesive or cohesive sealant failures.
- 5.) Water leakage through fixed glazing and framing
- 6.) Failure of operating components.

b.) Warranty Period: Three (3) years from date of Substantial Completion.

## **B2050.10.4 Revolving Doors**

### **A. General Description/Design Approach**

#### **1. Use and Application**

a. Revolving doors shall generally not be used on the NJSDA's projects. In new construction projects, the use of revolving doors must be justified by the Design Consultant and must be approved by the NJSDA as early in the Design Phase(s) as possible.

b. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Revolving doors may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior revolving door building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.

c. In rare instances, on a project that is a renovation and or addition to an existing building which contains exterior revolving doors and matching a feature is required, exterior revolving doors may be used after consultation with and approval of the NJSDA.

## **B2050.20 Exterior Utility Doors: Solid Doors and Frames**

### **A. General Description/Design Approach**

#### **1. Use and Application**

a. Exterior solid doors and frames may be used but not limited to exterior exit doors, utility / maintenance room doors, storage room doors, etc. and shall be configured to permit the installation of required exit devices, provided the

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required level of security, other performance requirements, and code requirements are met.

2. Refer to applicable requirements in Sections B2050 Exterior Doors and Grilles and B2050.90 Exterior Doors Supplementary Components for additional information.

## **B. Solid Exterior Doors and Frame Types**

1. Materials: The following materials and door types are acceptable for exterior solid doors:

### **B2050.20.1 Exterior Utility Doors: Solid Fiberglass Reinforced Polyester (FRP) Flush Doors**

#### **A. Quality Assurance**

1. Material: fiberglass reinforced polyester (FRP) face sheets

2. Door Construction and Thickness: Flush type fiberglass reinforced polyester (FRP) doors, sizes indicated by 1-3/4" thick. Material thickness: 0.120-inch thickness, finish color throughout and an abuse-resistant engineered surface.

3. Reinforcements: Manufacturer's extruded aluminum sub-frame of 6063-T5 alloy, including stiles and rails where feasible; otherwise, provide non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A123-17. Provide steel reinforcement for closers. Furnish standard reinforcement for each type of hardware required, 0.125" thickness minimum.

4. Corners: Mitered.

5. Provide joinery of 3/8-inch diameter full-width tie rods and reinforcing plates through extruded splines top and bottom to reinforce the door. Standard tubular shaped stiles and rails shall be reinforced to accept hardware as specified.

6. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.

7. Furnish extruded rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.

8. Extrude top and bottom rail legs for interlocking continuous weather bar. Provide for weather-seals on meeting stiles and weather stripping on bottom of door.

9. Core: Poured-in-place polyurethane foam.

a. Density: Minimum of 5 pounds per cubic foot.

b. R-Value: Minimum of 9.

10. Fasteners: Aluminum, 18-8 stainless steel, or other noncorrosive metal.

a. Compatibility: Compatible with items to be fastened.

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b. Exposed Fasteners: Screws with finish matching items to be fastened

11. Finish: Finish color is throughout the FRP sheet. Color to be selected by the Design Consultant from a full range of manufacturers' standard colors.

12. Glazing: See B2050.90 Exterior Door Supplementary Components

13. Warranty: Submit warranty signed by manufacturer and Contractor, agreeing to replace assemblies which fail in materials, performance or workmanship within the specified warranty period.

a. Warranty Period: Ten (10) years from date of Substantial Completion

## **B2050.20.2 Exterior Utility Doors: Solid Steel Doors**

### **A. Quality Assurance**

1. Material: Sheets are to be made of commercial quality hot dipped zinc coated steel that complies with ASTM A924/A924M, G90 and ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed or Galvalume) by the Hot-Dip Process.

2. Door Construction and Thickness: Doors: Heavy Duty or Extra Heavy Duty, Flush design doors, seamless construction, hollow construction with mineral wool, fiberglass, urethane, styrene, or other acceptable fill depending upon application, 1-3/4" thick unless specifically noted otherwise. Minimum 14-gauge

3. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces and stile edges, except around glass and louver panels. On mortise face of door, vertical joints shall be continuously MIG or ARC welded and ground smooth and coated with zinc-rich primer.

4. Provide reinforcement for surface sheet, edge, hardware, stops, and other provisions, of size and gage.

5. Provide bottom channel and top channel and closure,

6. Hinge Reinforcements: shall be not less than 10 gage 1-1/4" X six inches longer than the hinge. If a continuous hinge the reinforcement shall be the full height of the door. The reinforcement will be drilled and tapped in the field for a Roton type hinge.

7. Lock reinforcements: Minimum 16 gage 0.053" (1.3mm).

8. Closer reinforcements: Minimum 14 gage, 0.067" (1.7mm),

9. Reinforce tops and bottoms of all doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel shall have a steel closure channel welded in place so the web of the channel is flush with the top of the face sheets of the door. Plastic fillers are not acceptable.

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10. Finish: Factory-applied primer and field painted.

a.) Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

b.) Primer, galvanized surfaces: Zinc oxide primer.

11. Submit warranty signed by manufacturer and Contractor, agreeing to replace acoustic rated assemblies which fail in materials, performance or workmanship within the specified warranty period.

a.) Warranty Period: 1 year from date of Substantial Completion.

## **B2050.20.3 Exterior Utility Doors: Aluminum or Stainless Steel Clad Doors**

### **A. General Description/Design Approach**

1. Exterior aluminum or stainless steel clad doors shall generally not be used on the NJSDA's projects except as permitted below. In new construction projects, the use of exterior aluminum or stainless steel clad doors must be justified by the Design Consultant and must be approved by the NJSDA as early in the Design Phase(s) as possible.

2. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Exterior aluminum or stainless steel clad doors may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior aluminum or stainless steel clad door building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.

3. In rare instances, on a project that is a renovation and or addition to an existing building which contains exterior aluminum or stainless steel clad doors and matching a feature is required, exterior aluminum or stainless steel clad doors may be used after consultation with and approval of the NJSDA.

## **B2050.30 Exterior Utility Doors: Oversized Doors and Frames**

### **B2050.30.1 Exterior Utility Doors: Overhead Coiling Doors and Frames**

#### **A. General Description/Design Approach**

1. Use and Application

a. Exterior overhead coiling doors and frames may be used but not limited to exterior openings for loading areas, docks, service and maintenance storage rooms or structures, specialty classrooms such as vocational shops as vehicle repair and maintenance classrooms, etc. provided the required level of security, all other performance requirements, and code requirements are met. Glazing may be provided when required based upon the function of the space and the door. Glazing shall be based upon a manufacturer's standard glazing solutions

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but shall be modified to comply with all presiding codes and other programmatic requirements.

## **B. Quality Assurance**

1. All exterior overhead coiling doors shall comply with ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors ([www.ansi.org/](http://www.ansi.org/)).
2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to NJSDA having jurisdiction as suitable for purpose specified.
3. Materials: Exterior overhead coiling doors and frames shall be composed of one of the following:

### **B2050.30.2 Exterior Utility Doors: Steel Slat Rolling and Sectional Overhead Doors**

## **A. Quality Assurance**

1. Materials: Sheets are to be made of commercial quality zinc coated, cold rolled, structural steel that complies with ASTM A 653/A 653M G90-coating designation in Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed or Galvalume) by the Hot-Dip Process.
2. Door Construction and Thickness: zinc coated, cold rolled, structural steel / foam/ zinc coated, cold rolled, structural steel G90, insulated sandwich panel construction.
3. Panel Thickness: Minimum: 1-3/8 inches (35 mm).
4. Interlocking Steel Slats or Sections: Minimum Exterior Skin: 20 gauge (0.036 inch minimum thickness) hot dip galvanized; G90. Insulated, type per manufacturers' standard choices.
5. End Stiles: Minimum: 20 gauge.
6. Insulation: Manufacturers standard CFC-free and HCFC-free polyurethane or rigid cellular polystyrene foam type fully encapsulated insulation. Maximum flame spread and smoke developed indexes of 75 and 450 respectively according to ASTM E84 or presiding codes whichever is more stringent.
7. Thermal Values: Select doors' thermal values in compliance with presiding codes, including the New Jersey Energy Conservation Code
8. Partial Glazing of Steel Panels: Design Consultant to select a code compliant glazing option based upon the manufacturers' standard choices for the door(s) selected and projects' other performance criteria.
9. Track: Provide track as recommended by manufacturer to suit loading required and clearances available. Provide a counterbalance system.

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10. Hardware:

- a. Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
- b. Push Pull Handles: Galvanized Steel lifting handles on each side
- c. Slide Bolt: Engage thru slots in track for locking with a padlock, located on both the left and right jamb sides, operable from coil side.
- d. Locking Device Assembly: Lock, spring loaded dead bolt, operating handle, cam plate and adjustable locking bar to engage thru slots in tracks. Provide lock cylinder coordinated with School District requirements.

11. Chain Lock Keeper: Suitable for a padlock for Emergency operations.

12. Power Operated Door Control: Keyed safety interlock switch to disengage power supply when door is locked.

13. Manual Operation: Chain hoist.

14. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325 requirements for continuous monitoring of safety devices.

- a. Motor shall have factory pre-wired motor controls, starter, gear reduction unit, solenoid-operated brake, clutch, remote control stations, control devices, integral gearing for locking door and accessories. Comply with NFPA 70.

- b. Disconnect Switch: Hand operated for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount to be accessible from floor level. Provide interlock device to automatically prevent motor from operating when emergency operator is engaged.

- c. Door Operator type: Wall hood or bracket mounted unit with electric motor gear head reduction drive, and chain and sprocket secondary drive.

- d. Entrapment Protection: Required for momentary contact, includes radio control operation.

- e. Pneumatic, electric, or photoelectric sensing edge up to 18 feet (5.5 m) wide. Sensing edge shall be constant contact only complying with UL 325. Activation of sensor immediately stops and reverses downward door travel.

- f. Operator Controls:

- 1.) Key operated control stations with open, close, and stop buttons.

15. End locks: Lateral movement of the slats to be contained by code compliant means.



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## 16. Finish Factory-applied primer and finish coats

- a. Primer: Rust-inhibitive enamel or epoxy paint, either air-drying or baking, suitable as a base for specified finish paints.
- b. Primer, galvanized surfaces: Zinc oxide or epoxy primer
- c. Factory applied two coats of baked-on polyester powder coat. Color to be selected by the Design Consultant from a full range of manufacturers' standard colors

## 17. Warranty

- a. Door Sections: Door manufacturer shall warrant the door sections against defects in material and workmanship and deterioration due to rust. Window components are warranted against defects in material and workmanship. Sections are warranted to be free from delamination of the polyurethane insulation and its exterior and interior steel skins.
- b. Hardware & Spring Components: Door manufacturer shall warrant all hardware and spring components against defects in material and workmanship.
- c. Under the terms of this limited warranty, for any door components that are found to be defective upon inspection by authorized door manufacturers' personnel, the door manufacturer will, at its option, repair or replace the defective door components. Labor charges for installations or repairs shall be the responsibility of the consumer and must be performed by a manufacturers' authorized Dealer. This warranty applies only to doors that are professionally installed by a manufacturers' authorized Dealer.
- d. This warranty extends only to the original purchaser. This warranty is not transferable.
- e. This warranty does not apply to any damage or deterioration caused by abuse, applied paint failure or failure to provide reasonable and necessary maintenance.
- f. Warranty Period: One (1) year for all components except sections are warranted against delamination of the polyurethane insulation and its exterior and interior steel skins for ten (10) years.

### **B2050.30.3 Exterior Utility Doors: Steel Sectional Overhead Fire Rated Coiling Doors**

#### **A. Quality Assurance**

- 1. Install Fire Rated doors to comply with NFPA 80.
- 2. Refer to the information above in B2050.30.2 Exterior Steel Slat Rolling and Sectional Overhead Doors for requirements listed: "As above". The following requirements are in addition to those above:
- 3. Fire Resistance Rating: Three-hour rating, tested and listed by Factory Mutual (FM) or Four-hour rating, tested and listed by Underwriters Laboratories (UL)



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4. Door Construction and Thickness: As above
5. Panel Thickness: As above
6. Interlocking Steel Slats or Sections: As above
7. Thermal Values: As above
8. Enclosures:
  - a. Hood: Round hood enclosure.
  - b. Head plate Cover: 24 gauge steel finish-painted to match curtain.
  - c. Flame Baffle: Provide flame baffle to comply with listing agency.
9. Release System:
  - a. Descent Control: Rolling fire door operation mechanism shall be disengaged during automatic closing of the door. Descent of door under fire conditions shall be controlled by either a mechanical oscillating governor, viscous governor (weight counterbalance only) or centrifugal governor.
  - b. Release Type: Automatic closing of rolling fire door under fire conditions to be initiated by either: Fusible Links, Thermo-Manual Links, Electro-Thermal Manual Links with Junction Box, Electro-Thermal Manual, Links without Junction Box, Fire Shield (weight counterbalance only). Design Consultant to select a code compliant alternative for the associated application.
  - c. Detection Type: Device used in conjunction with the release type to initiate the automatic closing of rolling fire door. Design Consultant to select either: an ionization smoke detector or photo electronic smoke detector with heat sensor detector.
  - d. Track: Provide track as recommended by manufacturer to suit loading and other requirements for a fire shutter and clearances available. Provide a presiding code compliant counterbalance system based upon manufacturers' standards.
10. Hardware: Design Consultant to select presiding code compliant hardware based upon manufacturers standard options.
11. Chain Lock Keeper: As above
12. Power Operated Door Control: Design Consultant to select presiding code compliant power operated door controller based upon manufacturer's standard options.
13. Manual Operation: Solid or Jackshaft with manual chain hoist
14. Electric Motor Operation: Solid or Jackshaft type basic motor with solid state motor controller or other manufacturers' standard with relay style motor controller.

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## Design Requirements

## Exterior Vertical Enclosures – Section B20

15. End locks: Lateral movement of the slats to be contained by code compliant means.
16. Bottom Bar and Seal: Two roll-formed galvanized steel angles. Structural angle bottom bar to receive one coat of rust-inhibitive primer.
17. Weather-Stripping: Rolling fire door may be provided with guide brush seal if code compliant.
18. Finish Factory-applied primer and finish coats: As above
19. Warranty:
  - a. Door Sections: Door manufacturer shall warrant the door and its component parts against defects in material and workmanship.
  - b. Hardware & Spring Components: Door manufacturer shall warrant all hardware and spring components against defects in material and workmanship.
  - c. Under the terms of this limited warranty, for any door components that are found to be defective upon inspection by authorized door manufacturers' personnel, the door manufacturer will, at its option, repair or replace the defective door components. Labor charges for installations or repairs shall be the responsibility of the consumer and must be performed by a manufacturers' authorized Dealer. This warranty applies only to doors that are professionally installed by a manufacturers' authorized Dealer.
  - d. This warranty does not apply to any damage or deterioration caused by abuse, applied paint failure or failure to provide reasonable and necessary maintenance.

### B2050.30.4 Exterior Utility Doors: Aluminum Sectional Overhead Doors

#### A. General Requirements

1. The use of Aluminum Sectional Overhead Doors may be used on the NJSDA's projects provided comparable both in cost and performance criteria are specified to the products listed above. In new construction projects, the use of exterior aluminum sectional overhead doors must be demonstrated as equal by the Design Consultant and must be approved by the NJSDA as early in the Design Phase(s) as possible.
2. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Exterior aluminum sectional overhead doors may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing exterior aluminum sectional overhead door building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.
3. In rare instances, on a project that is a renovation and or addition to an existing building which contains exterior aluminum sectional overhead doors and matching a

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feature is required, an exterior aluminum sectional overhead door may be used after consultation with and approval of the NJSDA.

## **B2050.90 Exterior Door Supplementary Components**

### **A. Exterior Door Frames: Glazed Sidelights, Borrowed lights, and Transoms: Materials**

1. Exterior Glazed Aluminum Frames Sidelights and Transoms for both Fiberglass Reinforced Polyester and Aluminum Doors: Refer to Design Requirements Section B2020.30 Exterior Window Wall and B2020.90 Exterior Window Supplementary Components for additional information.
2. Materials: Extruded tubular aluminum framing with an integrally concealed, low-conductance structural thermal break(s) when applicable,
3. Frame Construction and Thickness: All aluminum frame and vent extrusions shall have a minimum wall thickness of .125" (3 mm)
4. Aluminum Sills: Thermally broken, 0.125" extruded aluminum sills; finish to match storefront system.
5. Finish to shall match doors.

### **B. Hollow Metal Steel Frames: Materials**

#### **1. Quality Assurance**

- a. Material: Steel, hot dipped zinc coated steel that complies with ASTM designations A924/A924M, G90.Galvanized, Galvalume, or Galvaneal, welded and internally reinforced.
- b. Frame Construction and Thickness: Minimum 12 –gage.
- c. Supports and Anchors: Not less than 16 gauge galvanized sheet metal. Hollow metal frames shall, typically, in new construction have a minimum of three anchors per side of door in masonry openings and shall have slip on drywall type anchors for drywall openings. Floor anchors shall be provided at each jamb.
- d. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A153/A153M, Class C or D as applicable.
- e. Knock down type frames are not acceptable except in renovations, restorations, and emergent projects where welded frames are difficult to install.
- f. All frames are to be assembled so that the face miter seam is "closed and tight". Weld the face seam and the full web of the frame corner or intersection. Grind and dress the weld area smooth. Apply a zinc rich primer over the grinding area, and finish with a matching prime paint.

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g. Hinge Reinforcements: A minimum of 10 gage steel.

h. Finish: Factory-applied primer and field painted.

1.) Primer: Rust-inhibitive enamel or paint, either by air-drying or baking, suitable as a base for specified finish paints.

2.) Primer, galvanized surfaces: Zinc oxide primer.

i. Thresholds: Barrier-free, thermally broken thresholds shall be provided at all exterior doors and shall be detailed to drain water to the exterior of the building.

## **C. Glazing: Exterior Vision Lights, Sidelights, Borrowed Lights, and Transoms**

### **1. Quality Assurance**

a. Exterior glazing shall be comprised of 1" sealed insulating units, laminated, tempered, etc. and where required comply with presiding codes and other requirements including but not limited to: NJ Division of Community Affairs, Department of Codes and Standards: "Best Practices Standards for Schools Under Construction or Being Planned for Construction".

b. Glazing treatments such as low-e, tinted, fritted, coated glass require justification by the Design Consultant and are subject to approval by the NJSDA.

c. Single glazing is not permitted on the building exterior.

d. Conditions requiring fire rated exterior glazing are to be avoided whenever possible.

e. Comply with published recommendations of glass manufacturers and the National Glass Association's GANA Glazing Manual unless more stringent requirements are indicated.

f. All glazing shall be installed by the exterior aluminum frame door, entrance system or storefront manufacturer or a manufacturer approved installer.

g. All units shall be glazed with the manufacturer's standard sealant process provided the glass is held in place by a removable, galvanized steel or extruded aluminum, glazing beads. The glazing bead shall be removable and shall be isolated from the glazing material by a gasket.

h. Glazing Stops and Beads: Whenever possible for ease of glass replacement and security of steel and aluminum doors respectively; provide fixed galvanized steel or aluminum glazing stops on the outside of exterior doors and removable stops of tubular or solid galvanized steel or aluminum beads on the inside of the door. Form corners with butted hairline joints. Coordinate width of rabbet between fixed stop and removable bead and depth of rabbet with type of glass and glazing required. B2050.90 Exterior Door Supplementary Components workmanship excluding that caused by glass breakage or abuse by others.

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i. The use of triple glazing requires justification by the Design Consultant and is subject to approval by the NJSDA.

j. Warranty Requirements: For insulating glass units:

1.) Provide manufacturers standard written warranty against visual obstruction from dust or film formation or moisture collection between internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship excluding that caused by glass breakage or abuse by others.

2.) Warranty Period: Ten (10) Years from the date of Substantial Completion.

k. Vision Panels:

1.) Vision panels, if provided, in rated stair exit doors shall comply with all presiding codes and regulations.

2.) No vision panels shall be provided for doors to mechanical and/or storage spaces.

### **D. Finishes**

1. Refer to Section B2020.90 Exterior Window Supplementary Components: Finishes above for finishes for all Exterior Doors and Frames.

### **E. Hardware**

1. The Design Consultant shall specify and review all hardware to insure that the quality, type of door hinges, bearing weight, and grades of finishes are consistent with the hardware manufacturers' and are compatible with the door manufacturer's specifications and District requirements so that the intended use of the door and hardware are compatible with each other and that neither warranties are violated. The Design Consultant shall consider using a qualified hardware consultant to specify all hardware if in house expertise cannot be provided by the Design Consultant.

2. All egress fire doors shall have panic hardware with positive latching and closing devices for occupancies in excess of 49 occupants and for assembly use.

3. Provide fluid dampers on hardware devices to absorb shock and noise when serving instructional spaces.

4. Specify only the highest quality exit devices for safety, and long term cost savings to school maintenance departments.

5. Smoke or other rated doors in the stage shall have closers that are consistent with ICC A117.1-2017 and the prevailing ADA accessible standards.

6. All door closers where required by code shall be a parallel arm type rated for heavy use, supplied by a single manufacturer, and shall be surface mounted to

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the non-public side of the door. Door hinges shall be fitted with ball bearing type hinges to maintain ease of use by handicapped.

7. The Design Consultant and hardware consultant must be thorough when specifying hardware such as but not limited to: closer travel arm limit stops, coordinators for pairs of doors wall stops and related bumpers to prevent damage by doors against adjoining surfaces in high traffic locations.

8. Do not use cross bar arm type panic devices as they will result in pinching of fingers, instead use a touch pad with 'T' design to not extend full width for safety. All panic hardware shall be dead latching types with roller strikes.

9. Pre-machine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

10. Pre-machine and reinforce insert frame members for hardware in accordance with manufacturer's standards and hardware schedule

11. Provide stainless steel or aluminum continuous "Roton" type hinges on all high traffic exterior doors.

12. Doors to be mortised, reinforced, and function holes provided at the factory in accordance with the hardware schedule and templates by the hardware supplier. Trough bolt holes, attachment holes, or drilling and tapping for surface hardware, to be done by others.

## **F. Window Guards and Security Screens**

1. In school facility locations where compliance with the requirements of Best Practices for Schools Under Construction or Being Planned for Construction is demonstrated to not be adequate to properly secure the school facility the Design Consultant shall provide security screens/window guards on all required accessible building openings. The Design Consultant shall analyze and define the associated threat level and specify a security screen system able to deter the defined threat level.

2. Security screens on main entrance doors are discouraged and may be provided by the NJSDA only if requested in writing by the school district.

3. Specify security screen(s) that install within the window reveal of a window and are designed similar to a "pre-hung" door. The door portion shall have a heavy steel or aluminum frame that holds stainless steel wire cloth or a steel perforated panel/ or mesh and hinges to a subframe. The subframe is to be securely attached into the window reveal and shall include fitting pieces to make the subframe appear to be part of the original window opening.

4. Specify high strength aluminum or steel tubular design elements with welded frame corners.

5. Security screens, when provided, shall be placed on exterior side of glazing and shall be not less than one of the following:

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## Design Requirements

## Exterior Vertical Enclosures – Section B20

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- a. Perforated galvanized 12-gage steel with 48% to 63% open area and a powder coat finish or,
  - b. Stainless steel woven rod and cable or woven wire mesh (cloth) in pattern with 46% to 74% open area. Minimum weight: 1.5 lb. per square foot.
6. Specify heavy duty locks with keyed or special tool operation from the outside, bolts & hinges, single-point emergency release.
7. Security screens and or window guards may be attached to the exterior façade of an existing building if attachment within the existing window opening is not possible.

### **B2070 Exterior Louvers and Vents**

#### **A. General Description/Design Approach**

- 1. Refer to sections above for additional information and requirements
- 2. When necessary, required louvers on the building façade shall be located as inconspicuously as possible on an exterior elevation.
- 3. Where possible, louvers on the building façade may be coordinated and incorporated with the building's window fenestrations.

#### **B. Other Exterior Door, Entrance, and Frame Types**

- 1. Galvanized Steel Louvered Doors: Refer also to Exterior Solid doors above.
  - a. Provide cold rolled galvanized steel louvered doors with fixed blade design.
  - b. Provide mitered and welded corners and Spanner head security fasteners, countersunk to secure louvers.
  - c. Finish: factory-applied baked enamel rust resistant primer finish. Final finish to match the finish of the door the louver is placed in.



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## **Design Requirements**

### **B30: Exterior Horizontal Enclosure**

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## **B30 Exterior Horizontal Enclosures**

### **B3010 Roofing**

#### **A. General Description / Design Approach**

##### **1. General Requirements:**

- a. The selection of a roof system and its component parts; particularly the insulation system, shall meet all the requirements of all current presiding codes including not limited to the New Jersey adopted Energy Subcode. Roof systems shall be designed to resist wind load pressures in accordance with the applicable codes and standards.
- b. Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- c. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- d. ALL MATERIALS AND SYSTEMS INDICATED AS "SUBJECT TO APPROVAL BY THE NJSDA" MUST BE APPROVED BY THE NJSDA AS EARLY AS POSSIBLE DURING THE DESIGN PHASES BUT PRIOR TO FIFTY PERCENT (50%) COMPLETE CONSTRUCTION DOCUMENTS.

##### **2. Emergent, Renovation, Renovation and Addition Projects:**

- a. For complete re-roof projects or projects where a proposed new roof is to be applied to a limited, defined, contained area; whenever possible, follow the recommendations herein for new construction. For projects involving repairs, renovations, and restorations utilize or match the existing system and follow the manufacturers' recommended practices whenever possible.
- b. Roof system shall not be installed over an existing roof, all existing roof materials must be removed to the deck.
- c. The Design Consultant, roofing contractor and manufacturers' representative whom will warranty the roof, shall visit the site after roofing is removed to inspect the existing deck, prior to re-roofing. The roof manufacturer shall make appropriate visits so as to certify that roof warranty capability is maintained.
- d. A pre-roofing meeting is required. The meeting shall include NJSDA, the Design Consultant; General Contractor, Roofing Sub-Contractor, roofing manufacturer, and other installers related to the work.
- e. Daily Re-Roof Construction Scope: During the construction period, each section of a re-roofing project shall be completed each day, including all essential components of the selected roofing system to maintain the integrity of the work. At the completion of each day as described above, all exposed edges of the roofing and the building shall be made watertight. Therefore, the contractor shall tear off and remove only that which can be replaced in a day.

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## f. Verification

- 1.) Inspection: Test cuts should be performed only where there is reason to suspect that less than proper installation procedures have been used or materials have been shorted. Otherwise, use 100% non-destructive tests.
- 2.) Site Visit: The Design Consultant shall visit the site to investigate all existing roof and deck conditions.
- 3.) Investigative Methods: The investigation shall consist of acceptable methods, such as: roof cuts or cores, infrared scans, pullout tests for fasteners, etc. The investigation shall be complete and shall form the basis for the comprehensive scope of work. The Design Consultant shall submit to the NJSDA the intended method and roofing consultant prior to commencement of the work.
  - a.) All existing concrete or LWIC roof decks are to be tested for moisture content using the N.R.C.A Deck Dryness Test to ascertain if they are dry enough to allow a hot mopped application of the base layer of insulation. Given the possibility of excessive moisture which would make this application method unfeasible, the designer is to specify alternative means to mechanically fasten the vented base layer of insulation to the roof deck, in consultation with a structural engineer to verify the structural integrity of the deck.
- 4.) All existing roofs to be repaired or replaced must be tested by a certified testing lab to determine if the material contains asbestos or other hazardous materials.
- 5.) Asbestos: If the asbestos content of material to be removed or otherwise disturbed exceeds the permissible amount, the roof must be removed in accordance with applicable codes.
- 6.) Report: The roof inspection report and a scope of work shall be submitted by the Design Consultant. In the event appreciable time (one year or more) has lapsed from the time of the existing investigation or report to the time of the roof installation, a new report must be provided.

## B. Materials

1. Choice of materials must be guided by building construction budget and the following requirements:
  - a. The materials to be used in the design and construction of the school's roof system(s) shall typically be limited to those materials which are specified in the NJSDA's Standards and the parameters established herein.
2. Roof Covering Reflectance Criteria: Select a roof covering membrane which reduces the heat islands to minimize the impact on microclimates, human, and wildlife habitats. Heat Islands are defined as thermal gradient differences between developed and undeveloped areas.
  - a. The roof system selection shall be accomplished by selecting a roof covering membrane which has a solar reflectance index (SRI) equal to or greater than the values

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below for a minimum of 75% of the roof surface. Roofing materials having a lower SRI value than those listed may be used if the weighted rooftop SRI average meets the following criteria:

- 1.) Area Roof Minimum SRI/Total Roof Area X SRI of Installed Roof/Required SRI greater than or equal to 75%.
- 2.) For low sloped roofs of a slope less than or equal to 2:12 select a roof covering membrane with an SRI of 82.
- 3.) For Steep sloped roofs of a slope greater than or equal to 2:12 select a roof covering membrane with an SRI of 39.

### 3. Roof Pitch & Crickets:

- a. The minimum pitch for any roof system is 1/4" per foot.
- b. The minimum pitch for any roof valley, including the leading edge of crickets, parapets, curbing, or other appurtenances, is one half inch per foot (1/2"/1'-0"). Finish slope of cricket shall not be less than one quarter inch per foot (1/4"/ft.).
- c. Construct crickets behind equipment and other roof penetrations using tapered rigid insulation panels covered by the roof covering membrane(s). The crickets shall be specified and detailed at min. one half inch per foot (1/2"/1'-0") finished slope or 2x the finished slope of the field of the roof area, whichever is greatest.

4. Pitch pockets shall be avoided if possible. Pitch pockets may be provided for roof supported structures such as dunnage for equipment, raised maintenance platforms, etc.

5. Roof mounted mechanical equipment shall have walk pads to and around the units. The Design Consultant and their Sub-Consultants shall, whenever possible, locate all roof-top equipment more than twelve (12'-0") feet from the roof edge. Mechanical equipment, fans, and appliances that require service and are located closer than twelve (12'-0") feet from the roof edge and such edge or open side is located more than thirty inches (30") above the floor or roof below provide OSHA/Code compliant safety guard railing system. Where a minimum 3'-6" high parapet is provided, such guards are not required.

6. Source Limitations: Whenever possible, obtain entire roof or soffit and fascia system and all its' component parts through one source from a single manufacturer.

7. Use an installer acceptable to the roof system(s) or soffit and fascia systems' manufacturer for installation of the entire system specified.

8. The entire roof assembly shall comply with all applicable presiding Codes and Regulations.

### C. Quality Assurance

#### 1. Factory Mutual Research & Factory Mutual Global Listing:

- a. All roofing systems or roof system component parts shall comply with Factory Mutual Research (FMR) standards and be rated by Factory Mutual Global (FMG) to meet or

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exceed the factored uplift pressures outlined in FMG Property Loss Prevention Data Sheet 1-28, and complies with FMG Property Loss Prevention Data Sheet 1-29 for enhancements at the perimeter and corners.

b. At all metal and concrete deck substrates provide roofing system and component materials which have been evaluated by Factory Mutual System for fire spread, wind uplift, and hail damage and are listed in "Factory Mutual Approval Guide" for the applicable Class of construction.

c. Provide roof covering materials bearing FM approval marking on all bundles, packages or containers, indicating that material has been subjected to FM's examination and follow-up inspection service.

2.NRCA: All roofing systems and roof system component parts shall comply with National Roofing Contractors Association (NRCA) Roofing (and Waterproofing) Manual Guidelines.

3. UL listing: Provide built-up roofing system and component materials which have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for the applicable Class rating for external fire exposure. Provide roof covering materials bearing Classification Marking (UL) on all bundles, packages or containers indicating that materials have been produced under UL's Classification and follow-up service.

4. Certificates of Compliance: Provide Certificate of Compliance from an independent laboratory indicating that the asphalt fiber glass shingles made in normal production meet or exceed the requirements of the following:

a. ASTM E 108/UL 790 Class A Fire Resistance.

b. ASTM D D7158 or D3161/UL 997 Wind Speed, Resistance Exposure Categories.

c. ASTM D 3462.

d. Submit certification that roofing systems installed in this Project comply with roofing system manufacturer's specifications and installation instructions.

e. Insulation Acceptance Letter: Submit letter from roofing system manufacturer indicating roofing system manufacturer's approval of proposed insulation for use with roofing system.

5. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for roofing system identical to that used for the school facilities project.

6. Pre-Installation Conference: Schedule a Pre-installation conference in a timely manner prior to the scheduled start of roofing system installation. Conduct Pre-Installation Conference; do not begin roofing system installation prior to this conference.

a. Attendance - Include representatives from at least following organizations:

1.) Prime Construction Contractor and Roofing System Installer

2.) Roofing System Manufacturer

3.) Owner

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- 4.) NJSDA Project Representative
- 5.) Design Consultant
- b. Agenda - Include at least following items on conference agenda:
  - 1.) Review of all systems and materials to be used in roofing system installation.
  - 2.) Review and coordination of all substrate preparation and related construction, including installation of curbs or similar items by other contractors.
  - 3.) Review and modification of Roofing System Installer's proposed sequencing of roofing installation.
7. Protection Requirement: Membrane Protection: In addition to other protection requirements, protection against staining, contamination with other materials, and mechanical damages shall be provided for newly applied roofing and adjacent surfaces throughout this project.
  - a. For SBS Modified Bitumen Membrane System do not apply the cap sheet until after all other work on, around, and above the associated roof area(s) is complete. Protect the roof surface prior to and after application of the cap while construction is occurring in the associated area.
  - b. For EPDM single ply membrane protect the entire roof before and after the membrane is adhered. Protect membrane and flashing materials against coming in contact with coal tar pitch, petroleum, grease, oil, solvents or other waste products. After exposure to pitch of other waste products, remove contaminated membrane and flashing material from Site.
8. The Design Consultant shall specify an appropriate system specific water test to be conducted for all low slope and flat roofs.

## **D. Related Standardized Details**

1. Refer to the following details for additional information:
  - a. B2010-11-01 Section: Brick Exterior Cavity Wall w/ CMU Backup
  - b. B2010-11-04 Section @ Parapet: Brick/CMU Cavity Wall
  - c. B2010-11-08 Section @ Roof: Brick/CMU Cavity Wall: Curb: Built up Roof @ Wall
  - d. B2010-11-09 Section: CMU Exterior Cavity Wall w/ CMU Backup
  - e. B2010-11-12 Section @ Parapet: CMU Veneer/CMU Cavity Wall
  - f. B2010-11-16 Section @ Roof: CMU Veneer/CMU Cavity Wall: Curb: Built up Roof @ Wall
  - g. B2010-11-25 Section: Brick Exterior Cavity Wall w/ Metal Stud Backup
  - h. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
  - i. B2010-11-32 Section @ Parapet: Brick/Metal Stud Cavity Wall
  - j. B2010-11-28 Section @ Parapet: Brick/Metal Stud Cavity Wall
  - k. B3010-11-01 Door Saddle: Building to Roof Detail: SBS Multi-Ply Roof
  - l. B3010-11-02 Bulkhead Door Sill Pan Flashing Detail
  - m. B3010-11-03 Edge Metal Detail: SBS Multi-Ply Roof
  - n. B3010-11-04 Roof Edge with Gutter: SBS Multi-Ply Roof
  - o. B3010-11-05 Parapet Flashing Assembly, Typical: SBS Multi-Ply Roof

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- p. B3010-11-06 Base Flashing @ Wall Expansion Joint : SBS Multi-Ply Roof
- q. B3010-11-07 Expansion joint with Metal Cover: SBS Multi-Ply Roof
- r. B3010-11-08 Expansion joint with Neoprene Cover: SBS Multi-Ply Roof
- s. B3010-11-09 Insulated Pipe Penetration: SBS Multi-Ply Roof
- t. B3010-11-10 Eave Wall Closure: SBS Multi-Ply Roof
- u. B3010-11-11 Coping Saddle @ Wall
- v. B3010-11-12 Coping Termination Typical
- w. B3010-11-13 Coping / Counter flashing Termination
- x. B3010-11-14 Coping Corner @ Wall

## **B3010.1 Roofing**

### **A. General Requirements**

1. Minimum roof covering fire classification for low slope roofs to be based upon the type of construction and the presiding codes.
2. All components of the specified roofing system shall be products of the roofing manufacturer or accepted by the roofing manufacturer as compatible.
3. Unless otherwise approved by the Design Consultant and accepted by the membrane manufacturer, all products (including insulation, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the warranty.
4. Asphalt and composition shingles may be used on School Facilities Projects with sloped roofs. Sheet metal standing seam roofing may be used in limited select locations and in limited quantities based upon application and location on the building. The Design Consultant shall justify the use of sloped roof surfaces on new construction and their use shall be approved by the NJSDA during the early Design Phase of the project.
  - a. The following is applicable to buildings designated as meeting the criteria for listing on the National Register of Historic Places (NRHP) and buildings classified by the New Jersey State Historic Preservation Office (SHPO) as having New Jersey State or other Federal Landmark status. Asphalt and composition shingles roofing may be used on renovations or restorations of historically significant existing buildings to match the replacement of existing asphalt and composition shingles roofing building elements with an acceptable comparable solution. The proposed solution shall be approved by the presiding governmental entities and the NJSDA.
  - b. In rare instances, on a project that is a renovation and or addition to an existing building which contains asphalt and composition shingles roofing and matching a feature is required, asphalt and composition shingles roofing may be used after consultation with and approval of the NJSDA.
  - c. General Sloped Roof Types
    - 1.) Normal sloped shingle roofs are defined as those which are four inches per foot (4" / ft.) or greater in slope.
    - 2.) The use of low sloped shingle roofs, defined as those which have a slope of three to four inches per foot, require the approval of the NJSDA.



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3.) The maximum recommended pitch of any primary roof is 6 in 12, unless greater pitches have been approved by the NJSDA

## **~~B3010.10 Steep Slope Roofing Systems~~**

### **~~B3010.10.1 Shingle Roofing Systems~~**

#### **~~A. Materials~~**

~~1. Shingle Selection: All shingles shall be granule surfaced, asphalt or multi-layered, fiber glass reinforced and organic asphalt shingles.~~

~~2. Color and Finish: Shall be selected from the manufacturers' full range of standard colors and finishes.~~

~~3. Select all system parts such that the manufacturers' warranty remains in force. Utilize manufacturers' standard or recommended hip and ridge shingles, ridge and soffit vents, fascia and soffit systems, as well as other component accessory parts to make up a complete installation.~~

~~4. Underlayment: Utilize two layers when applicable~~

#### ~~a. Ice and Water Protection / Waterproofing Underlayment:~~

~~1.) Provide either a sheet barrier of self-adhering rubberized asphalt membrane shingle underlayment having internal reinforcement, and "split" back plastic release film.~~

~~2.) Install based upon manufacturers recommendations, typically on the entire roof perimeter at a minimum of three (3'-0") feet in from the vertical insulated exterior wall surfaces and a width of three feet (3'-0") on either side of all ridges and valleys.~~

~~3.) Also use an ice and water, self-adhering membrane barrier in 'low-slope' areas (below 4:12, but no less than 2:12); provide material with warranty equal in duration to that of shingles being applied.~~

~~b. Flashing: Refer to B3010.90.2 Roofing Supplementary Components, Flashing and Trim for additional information.~~

~~c. Insulation: Refer to B3010.90.1 Roofing Supplementary Components, Roof Insulation and Fill for additional information.~~

~~d. Sheathing Board: Exterior grade plywood may be used as a substrate to adhere roof shingles to metal deck and other compatible structural roof systems. Use either exterior grade A-C, B-C, or CDX of suitable thickness to attach the shingles and other underlayment systems to the roof structure. Follow manufacturer's recommendations and comply with all presiding codes. Other manufacturer's recommended substrates for shingle systems may be used but are subject to NJSDA approval.~~

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~~e. The Design Consultant shall specify all required adhesives, cleaners, sealants, primers, fasteners, membrane terminations, vapor retarder, sheathing board, cover or recovery board, fiberglass coated sheathing, and accessories etc. to comprise a comprehensive system.~~

## **B. ~~Quality Assurance~~**

~~1. All shingles shall conform with ASTM D 3018 Type I – Self-Sealing; UL Certification of ASTM D 3462, ASTM D 3161/UL997 for code compliant Wind Resistance.~~

~~2. Underlayment:~~

~~a. ASTM D 6757; asphalt-impregnated fiberglass-reinforced organic felt designed for use on roof decks as a water-resistant layer beneath roofing shingles.~~

~~b. Underlayment: ASTM D 4869, asphalt saturated felt.~~

~~c. Underlayment: ASTM D 226, asphalt saturated felt (non-perforated).~~

~~d. Ice and Water Protection / Waterproofing Underlayment:~~

~~1.) Self-adhering rubberized asphalt membrane shingle underlayment complying with ASTM D 1970 or;~~

~~2.) Self-adhering membrane composed of a high strength polyethylene film coated on one side with a layer of butyl rubber adhesive and interwound with a disposable release sheet complying with ASTM E108/UL 790, ASTM D412, ASTM D903, ASTM D1970, and ASTM D3767.~~

~~e. Manufacturer's Warranty~~

~~1.) Special Manufacturer's Warranty: Provide roofing system Manufacturer's special warranty, on manufacturers' standard warranty form, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified~~

~~warranty period. The guarantee shall be a term type, without deductibles or limitations on coverage amount and shall be issued at no additional cost to Owner. Failure includes roof leaks.~~

~~2.) Special warranty shall include includes roofing shingles, underlayment membranes, base flashings, roofing accessories, fasteners and fastening systems, vents, sheet metal flashings and trim, copings, roof edge flashings, soffits and fascias provided by the roof shingle manufacturer, counter flashings and reglets, and roof expansion assemblies specified and all other components of roofing system.~~

~~3.) The manufacturer, at its expense, shall repair or cause to be repaired, the Roofing System described in this warranty to the extent necessary to return the roofing system to a watertight condition.~~

~~4.) Guarantee Re-Issuance: In the event repairs are required due to natural disasters, unauthorized alterations, or other causes specifically~~



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~~excluded in guarantee, roofing system manufacturer will re-inspect roof and re-issue guarantee provided that methods and materials used in repair have received manufacturer's prior approval and repairs are accomplished by approved applicator~~

~~5.) Warranty Period: 50 years limited and or Lifetime limited from date of Substantial Completion. Warranty period may be prorated for lifetime after 50 years~~

~~6.) Warranty Transferability Clause: Make available to Owner shingle manufacturer's standard option for transferring warranty to a new owner.~~

## **B3010.10.2 Sheet Metal Roofing Systems (Under NJSDA Internal Review)**

### **B3010.50 Low Slope Roofing**

#### **B3010.50.1 Styrene-Butadiene-Styrene (SBS) Modified Bitumen Multi-ply Membrane System**

##### **A. Materials**

1. **SBS Modified Bitumen Multi-ply Membrane System** for roofs in new construction and renovation/addition projects, use a hot asphalt-applied, multiplied prefabricated, fiberglass reinforced, homogeneous, SBS copolymer modified bitumen membrane system secured to a prepared substrate. SBS modified bitumen membrane composition roofing system, complete with flashing system. Hot asphalt-applied SBS modified bitumen roofing systems shall include: (Refer also to other related sections below). When system is installed over non-nailable deck or insulation omit rosin paper, if specified and cement with asphalt.

a. Membrane System: A base-ply, interply(s), and granulated capsheet must be incorporated into the system. All plies to be modified bitumen based sheets with polyester or fiberglass (per ASTM 6162 and ADTM 6162M) mat reinforcement.

b. Provide a SBS Modified bitumen, fiberglass or polyester reinforced, asphalt, base ply and interply (s) per manufacturer's recommendations for the system selected.

c. Provide a cap sheet membrane consisting of a prefabricated reinforced polyester or fiberglass scrim, Styrene-Butadiene-Styrene (SBS) copolymer modified asphalt sheet. The cap sheet shall meet ASTM D6162 and ADTM 6162M and have a ceramic or other manufacturer's granular surface meeting the reflectance criteria in B30 Roofing, B.2 Materials.

d. Separation/Protection Sheet: Reinforced rubberized asphalt, minimum thickness 40 mils.

e. Flashing: Refer to B3010.90.2 Roofing Supplementary Components, Flashing and Trim for additional information.

f. Insulation: Refer to B3010.90.1 Roof Insulation and Fill for additional information.

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g. Cover Board – Provide minimum ½” thick fiberglass mat faced (top and bottom), gypsum core cover board. The minimum compressive strength shall be 500 psi.

h. The Design Consultant shall specify all required adhesives, cleaners, sealants, primers, fasteners, membrane terminations, vapor retarder, recovery board, fiberglass coated decking, and accessories etc. to comprise a comprehensive system.

## **B. Quality Assurance**

### **1. Manufacturers' Warranty**

a. Special Manufacturer's Warranty: Submit roofing system Manufacturer's special warranty, on manufacturers' standard warranty form, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. The guarantee shall be a term type, without deductibles or limitations on coverage amount and shall be issued at no additional cost to Owner. Failure includes roof leaks.

b. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners and fastening systems, insulation, cover boards, sheet metal flashings and trim, copings, roof edge flashings, roof edge drainage systems, counter flashings, and reglets, and roof expansion assemblies specified and all other components of roofing system.

c. The manufacturer, at its expense, shall repair or cause to be repaired, the Roofing System described in this warranty to the extent necessary to return the roofing system to a watertight condition.

d. Guarantee Re-Issuance: In the event repairs are required due to natural disasters, unauthorized alterations, or other causes specifically excluded in guarantee, roofing system manufacturer will re-inspect roof and re-issue guarantee provided that methods and materials used in repair have received manufacturer's prior approval and repairs are accomplished by approved applicator

e. Warranty Period: 20 years from date of Substantial Completion.

### **2. Installers' Warranty**

a. Special Project Warranty: Submit roofing Installer's warranty, on standard warranty form, signed by Installer, covering Work of this Section, including all components of roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period.

b. Warranty Period: Two years from date of Substantial Completion.

**B3010.50 Low Slope Roofing**

**B3010.50.2 Single Ply Ethylene Propylene Diene Monomer (EPDM) Membrane System**

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## A. Materials

1. Single Ply EPDM Membrane: Ethylene Propylene Diene Monomer (or Terpolymer which consists of three distinct monomers) For roofs in new construction and renovation/addition projects, use a 90 mil, single ply, fully adhered, EPDM roofing system complete with flashing system. A single ply fully adhered EPDM roofing system shall include: (Refer also to other related sections below)

a. Membrane: Non-Reinforced, 90 mil., White, Fire-retardant, EPDM (Ethylene, Propylene, Diene Monomer or Terpolymer) membrane in the largest sheet possible without factory splices for its application to minimize the number of seams.

b. Application Method: Fully Adhered:

c. Membrane Sealants: Provide sealants, primers, compatible with the roofing membrane and flashing system and recommended by membrane manufacturer.

d. Demonstrated resistance to ultraviolet and ozone exposure

e. Flashing: Refer to B3010.90.2 Roofing Supplementary Components, Flashing and Trim for additional information.

f. Insulation: Refer to B3010.90.1 Roof Insulation and Fill for additional information.

g. Seam Tape/Adhesive: Unless otherwise specifically recommended by membrane manufacturer, secure seams between membrane sheets using seam tape recommended by membrane manufacturer. Obtain Design Consultant's review of proposed seam adhesive prior to incorporation into roofing system.

h. Bonding Adhesive: Where recommended by membrane manufacturer, provide adhesive compatible with membrane and materials to which membrane is to be adhered and recommended by membrane manufacturer.

i. The Design Consultant shall specify all required adhesives, cleaners, sealants, fasteners, membrane terminations, vapor retarder, cover or recovery board, fiberglass coated decking, and accessories etc. to comprise a comprehensive system.

## B. Quality Assurance

1. The membrane Non-Reinforced, 90 mil., White, Fire-retardant, EPDM (Ethylene, Propylene, Diene Monomer or Terpolymer) membrane shall conform to the minimum physical properties of ASTM D4637/D4637M-15(2021)e1 EPDM Type I, with the following physical characteristics:

a. Tensile Strength (ASTM D412)

b. Elongation (ASTM D412)

c. Accelerated Aging (4 weeks exposure at 240 deg. F; ASTM D412 or ASTM D573):

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- 1.) Aged Tensile Strength
  - 2.) Aged Elongation
  - d. Tear Resistance (ASTM D624)
  - e. Low Temperature Brittleness Point (ASTM D746): -45 deg. F or lower
  - f. Accelerated Weathering (ASTM G23, ASTM G26, or ASTM G53 no loss of tensile strength or breaking strength
  - g. Impact Resistance (ASTM D3746, ASTM D4272, CGSB 37-GP-52M or FM 4470) resistant to impact damage
2. Manufacturer's Warranty
- a. Roofing System Manufacturer's Standard warranty for Labor and Materials. Provide a labor and materials guarantee that roofing system will remain in watertight condition and that roofs' covering will remain intact in its' installed location. Include following conditions in guarantee coverage:
    - 1.) Cracking due to membrane expansion or contraction
    - 2.) Deterioration due to exposure to weather
    - 3.) Decomposition of membrane due to ponding water
    - 4.) Separation of factory- and field-fabricated seams and joints
    - 5.) Cracking or deterioration of membrane from water vapor trapped under membrane
    - 6.) Separation of, or decomposition of, membrane flashing
    - 7.) Wind damage sustained up to wind speeds specified in "Wind Uplift" subparagraph of "Performance Requirements" paragraph in "System Description" article above.
  - b. Remedy: In event roofing system fails to perform, roofing systems manufacturer will, at its own expense, make repairs or modifications to roofing system necessary to reinstate water tightness, re-inspect roof, and re-issue guarantee after re-inspection.
  - c. Guarantee Re-Issuance: In the event repairs are required due to natural disasters, unauthorized alterations, or other causes specifically excluded in guarantee, roofing system manufacturer will re-inspect roof and re-issue guarantee provided that methods and materials used in repair have received manufacturer's prior approval and repairs are accomplished by approved applicator.
  - d. Warranty Period: 20 years from date of Substantial Completion.

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## **B3010.90      Roofing Supplementary Components**

### **B3010.90.1      Roof Insulation and Fill**

#### **A.      Materials**

1. Hot asphalt-applied SBS protected membrane modified bitumen roofing systems shall include polyisocyanurate insulation with a minimum R value required to meet the **current** New Jersey Energy Subcode and other presiding code requirements.

a. Roof Insulation used for all projects shall be UL and FM approved.

b. All panels must possess adequate rigidity to span the flute openings of metal roof decks.

c. Where specified or required, insulation shall be installed as a separation layer over the roof deck, the existing substrate and/or to obtain the desired thermal R-value.

d. A maximum panel size of four feet by four feet shall be maintained where insulation is specified to be installed in hot asphalt. Where insulation is to be installed in two layers, joints in the second layer shall not coincide with joints of the first layer. The courses should be staggered to ensure this.

e. Second Layer: (Typically a universally accepted insulation type) such as a panel composed of a non-structural water resistant core material, integrally bonded with fiberglass mats on both sides. Nominal thickness shall be **1/2"** inches. The gypsum sheathing panels shall be approved by Factory Mutual Research.

2. EPDM Single Ply Membrane systems shall include polyisocyanurate roof insulation: Acceptable to roofing system manufacturer, complying with Factory Mutual requirements for FM Approval for Class 1, for use over the projects roof construction, and capable of bridging metal deck flutes, if applicable, without breaking or cracking.

a. Polyisocyanurate Roof Insulation: Rigid, closed-cell, halo-carbon blown polyisocyanurate insulation board integrally faced on both sides with either bituminous-saturated roofing felt, aluminum foil, or glass fiber mat facer (in accordance with roofing system manufacturer's recommendations).

b. Flat insulation: Flat boards; length and width required for installation specified by thickness required to meet minimum R-value specified.

c. Tapered insulation: Boards tapered at one quarter inch per foot (1/4"-1'-0"); or tapered as required to achieve minimum stated slope (1/4" / 1"0")length and width required for installation specified; minimum 1-1/2-inch thickness, unless otherwise indicated on Drawings or required to meet R-value required to comply with the current New Jersey Energy Subcode. Area-weighted average thickness required to provide minimum R-value of not less than twenty four (24) for roofing assembly.

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## Design Requirements

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3. Shingle Roof Systems: The insulation system shall be selected by the Design Consultant based upon the associated roof system assembly and compliance with presiding codes particularly the current New Jersey Energy.

4. The insulation system for a shingle roof shall be separated from the nailable sheathing surface by an air space to allow ventilation and meet code.

### **B. Quality Assurance**

1. All Insulation: Meet or exceed following requirements:

a. Flame spread less than 25 (ASTM E-84)

b. Smoke developed less than 450 (ASTM E-84)

c. Fuel contributed less than 100 (ASTM E-84)

d. Passes tests of FM 4450 and UL 1256 when tested as an assembly.

2. Specify polyisocyanurate insulation meeting ASTM C1289, with at least a minimum R value required to meet the current New Jersey Energy Subcode and other presiding code requirements.

3. Comply with following requirements for both flat and tapered polyisocyanurate types of insulation:

1.) Long Term Thermal Resistance - LTTR (ASTM C1289):

2.) Foam Density: Not less than 1.5 lbs. per cubic foot

3.) Compressive Strength: Nominal 20 psi. For exterior play surfaces: 40 psi or greater based upon applications' loading and presiding codes

4. Roof Insulation used for all projects shall be UL and FM approved.

### **B3010.90.2 Flashings and Trim**

#### **A. General Requirements**

1. Utilize the roofing manufacturers' recommended flashing and trim system(s) for each respective roof system type.

2. The flashing listed below are the recommended flashing for use with the roofing system(s) listed. Other flashing materials may be used such as cold rolled copper, lead coated copper, stainless steel, copper fabric flashing, aluminum, galvanized steel, etc. dependent upon the application. The selection and application of other flashing materials shall not void the manufacturers' roof warranty.

#### **B. Materials**

1. SBS Modified Bitumen Multi-ply Membrane System:

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a. Flashing: Provide two-ply modified bitumen membrane flashing system at all curbs, walls (parapet and rising) consisting of base-ply and granulated cap flashing ply.

b. Flashing Membrane Assembly: The flashing membrane assembly shall consist of a prefabricated, fiberglass scrim-mat reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane. Utilize a granular surfaced flashing sheet to match the cap sheet where applicable.

c. Flashing - Provide reinforced single component liquid flashing system at all pipe, conduit, steel shape, etc. penetrations in lieu of pitch pockets.

d. Trim:

1.) Utilize the manufacturers' standard metal edge, coping systems, and associated fasteners and adhesive if not detailed on the construction drawings and defined by the specifications.

## 2. EPDM Fully Adhered Single-ply Membrane Roof System:

a. Membrane Flashing: EPDM material recommended by membrane manufacturer for flashing applications; thickness as recommended by membrane manufacturer. Conform to profiles indicated at all changes in plane, all roof penetrations, all roof edges, and all roof interruption.

b. Trim:

1.) Utilized the manufacturers' standard metal edge, coping systems, and associated fasteners and adhesive if not detailed on the construction drawings and defined by the specifications

## 3. Shingle Roof System:

a. Trim:

1.) Utilize the manufacturers' standard metal edge, coping systems, and associated fasteners and adhesive if not detailed on the construction drawings and defined by the specifications.

## C. Quality Assurance

1. Except as otherwise shown or specified, comply with applicable recommendations, details, and standards of Copper Development Association (CDA), and Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) "Architectural Sheet Metal Manual".

2. All metal edgings shall be tested and meet ANSI/SPRI ES-1 standards for shop fabricated perimeter edge conditions and comply with presiding codes

3. Shingle Roof System:



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- a. Sheet Flashing: ASTM B 209; 0.025 in (0.63 mm) or 0.032 in (0.8 mm) thick aluminum, mill finish.
- b. Sheet Flashing: ASTM B 370; cold rolled copper; 16 ounces per square foot (0.55 mm); natural finish.

## **B3010.90.3 Roof Eaves and Soffits**

### **A. Materials**

1. The Design Consultant shall select the appropriate eave, soffit, and fascia system including all components to provide a complete, weather resistant water proof assembly. The system selected shall allow for venting from bottom to top of system when applicable and shall require a separate support and attachment system if not provided as an integral part of the manufacturers' eave, soffit, and fascia manufacturers' standard system selected.

2. The eave, soffit, fascia system shall be selected from one of the following system alternatives:

a. A system composed of composite panels made of 0.032" painted aluminum sheet fused to a plywood core and a 0.013" fused aluminum backer sheet attached in a pressure equalized rain screen application. The aluminum faced panels shall be factory fabricated and installed in the field using one of the manufacturers' standard clip and caulk attachment method. Insulation and vapor barrier shall be provided behind the composite panel. The panels shall be supported by a system of light gauge metal framing and a substrate. The soffit system shall include 0.032" aluminum soffit vent panels when applicable.

b. A system composed of composite insulated panels made of 0.032" painted aluminum sheet fused to an expanded polystyrene or polyisocyanurate foam core, an intermediate layer of corrugated polyallomer on both sides of the foam core, and a 0.013" fused aluminum backer sheet attached to a substrate or sub-frame in a pressure equalized rain screen application. The aluminum faced panels shall be factory fabricated and installed in the field using one of the manufacturers' standard attachment methods such as dry seal or route and return. The panels shall be supported by a system of light gauge metal framing and a substrate. This system shall not be used for shingle applications where venting is required.

c. A system composed of prefinished fiber cement solid fascia boards and prefinished, prefabricated ventilated slotted and solid soffit panels. This system shall include insulation to be provided behind the fiber cement board panels. The panels shall be supported by a system of light gauge metal framing.

d. A fascia and soffit system composed of continuous 0.032" aluminum soffit vents and 0.032 thick aluminum fascia panels fused to an insulated core composed of either expanded polystyrene or polyisocyanurate foam core attached to an appropriate substrate material or system utilizing the manufacturers' standard method of attachment.



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## **B. Quality Assurance**

1. All eaves, fascia, soffits, and component parts are to comply with SMACNA "Architectural Sheet Metal Manual" or metal soffit, eave, and fascia panel manufacturer for the respective product or application.
2. Finishes: All finishes are to comply with NAAMM "Metal Finishes Manual for Design of Architectural and Metal Products" for recommendations for applying and designating finishes. Refer to Section B2020.90 Exterior Windows **Supplementary Components A.4 Finishes** for detail on applicable finishes.

## **B3020 Roof Appurtenances**

### **B3020.10 Roof Accessories**

#### **B3020.10.1 Leaf and Snow Guards**

1. Provide leaf guards and or snow and ice guards compatible with the roofing system, including the drainage system per manufacturer's recommendations.
2. For Aluminum and Steel Standing Seam Metal roofs do not specify plastic or other material glue down snow guards. Provide horizontal metal bar type snow guards that attach to the standing seams or a similar system. Specify snow guards in a color to match the roof finish from the manufacturer's selection of standard colors.

## **B3020.70 Rainwater Management**

### **B3020.70.1 Roof Drains / Gutters and Downspouts**

#### **A. General Requirements**

1. New construction, Flat Roofs:
  - a. For new construction, roofs are typically designed for storm water to dissipate within forty-eight hours of rainfall.
  - b. The roof is to be pitched to drain for positive roof drainage, typically one quarter inch (1/4" per 1'-0") per foot minimum finished slope.
  - c. For a typical square or rectangular roof configuration, positive drainage shall be achieved by sloping the structural steel. For other roof configurations, the desired slope can be achieved by the use of tapered rigid insulation panels where it is not appropriate to provide sloped structural steel.
2. Provide exterior roof drains including but not limited to properly sized aluminum gutters, downspouts, leaders, connector boots, conductor heads, and splash pans on roof surfaces. Scuppers when properly detailed are encouraged when a second means of getting water off a roof is required. Interior drains shall be used when the roof type(s) and configuration dictates their use.
3. All roof drainage systems shall be tied directly to the storm system whenever possible.

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4. When internal roof drains are used, use either a combination roof drain comprised of a manufacturer's standard roof drain and an adjacent overflow drain or a manufacturer's standard roof drain and thru wall scuppers. Plumb all lines in compliance with presiding codes.
5. Internal roof drains that are offset from the lowest roof point due to structure shall be set in a minimum 4 foot square sump to ensure the drain is at the lowest point.
6. Utilizing the roof as a retention basin is not recommended and requires approval of the NJSDA.

## **B3040 Traffic Bearing Horizontal Enclosures**

### **A. Description / Design Approach: Other Roofing Systems and Criteria**

1. No Equipment shall sit directly on roofing system. Provide all equipment and piping a minimum of 12" above the roof system.

### **B. Description / Design Approach Roof Equipment Service Access**

#### **1. General Requirements**

- a. The roof top heating and cooling units' (RTU's) serviceable elements and other rooftop equipment that require maintenance must be accessible for maintenance and service via a stair /bulkhead or other direct means to the major equipment at the projects' highest roof and by ladders or doors to other equipment locations.
- b. Safe access and walking surface to maintain and service RTU's shall be detailed and shown on the construction drawings corresponding roof plans.
- c. Rooftop equipment such as cooling towers if on dunnage may require an OSHA code compliant service platform to gain access to service locations. Equipment on dunnage shall only be provided when necessary to properly support the projects' RTU's.

#### **2. Materials**

- a. Access to panels/doors for equipment on dunnage for service shall be provided via a metal platform constructed of aluminum or galvanized steel. This metal platform shall be minimum twenty four inches (24") wide. Length of the platform shall be sufficient to serve one or multiple access panels.
- b. At locations where access panel/door swings into the platform, the width of the platform shall be such that it is at least twenty inches (20") in width beyond the swing of the panel/door.
- c. Surface of the metal platform shall be non-skid with open grates. Platform shall have an OSHA compliant ladder. Platform shall be located at sill level or such that the relative height between the platform and top of access panel/door is no more than seven feet (7'-0").

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d. All platforms to have a 3'-6" high railing system at all open sides. For platforms greater than four inches (4") above adjacent roof, provide toe board along all open sides i.e. sides that are not against the RTU.

e. Where the top of the unit has items that must be serviced, provide an OSHA compliant ladder to access the top of the unit. The ladder and platform structure if required shall be constructed such that it can be removed to facilitate roofing and flashing during roof replacement or any other related work that requires re-roofing.

f. Roof mounted mechanical equipment shall have walk pads to and around the units. The Design Consultant and their consultants shall, whenever possible, locate all roof-top equipment more than twelve (12') feet from the roof edge. Mechanical equipment, fans, and appliances that require service and are located closer than twelve (12') feet from the roof edge and such edge or open side is located more than thirty inches (30") above the floor or roof below provide OSHA/Code compliant safety guard railing system. Where a minimum 3'-6" high parapet is provided, such guards are not required.

g. Mechanical Equipment:

1.) Mechanical equipment should be designed to be set on a full curb.

2.) Provide additional sloped insulation below framework and between equipment support curbs to remove water from below units. Provide taper strip on all sides of all full-curbed equipment to prevent water standing against flashings.

3.) Rooftop equipment shall be designed to resist wind loads.

### **B3040.50      Wear Surfaces**

#### **A.      General Requirements**

1. Walk pads shall be provided on flat roofs at all traffic routes from the points of roof access to all rooftop equipment, fans, and appliances requiring maintenance/service on a routine basis. Walk pads shall be adhered following manufacturers recommendations.

2. Roof-top Play Areas, when provided, shall include both resilient play/sport for fall protection and or hard surfaces over one of the recommended roof systems. The Design Consultant shall also provide presiding code and regulation compliant rooftop enclosures to provide fall protection and contain the sports/play activities where applicable.

#### **B.      Materials**

1. All walkway pads and pavers shall meet the reflectance criteria in B3010 Roofing, B.2 Materials. When using resilient play surfaces to provide fall protection and proper flooring for outside activities and sports; the selection of colors may be impacted in order to comply with the reflectance criteria.

2. Walk pads: Hot asphalt-applied SBS modified bitumen roofing systems shall include walk pads composed of an additional layer of cap sheet / walk pad material. The walk treads shall consist of an asphalt impregnated, puncture resistant polyester fabric core,

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coated with a polymer modified bitumen and topped with a ceramic coated granule wearing surface. Sizes as recommended by the manufacturer standard.

3. Walk pads: EPDM single ply membrane systems shall include: Minimum 30-inch x 30-inch walkway pad as recommended by roofing system manufacturer.

## **C. Roof-top Play Area Description / Design Approach**

1. An accessible outdoor, roof-top play area shall be incorporated in the design of the building when necessary due to on-grade site restrictions or scarcity of on-grade open areas for this purpose. An accessible outdoor, roof-top play area is subject to approval by the NJDOE, Office of Facilities and shall comply with all presiding codes and regulations.

2. Refer also to G2060 Site Development Section G2050 Athletic, Recreational, and Playfield Areas (Play Structures) for additional information.

## **D. Materials**

1. Roofing Systems for Roof-top Play Areas: The Design Consultant shall select the appropriate roof system components and their respective order within the roof assembly to be utilized in conjunction with their design for a rooftop play area and the type of walk or play surface(s) to be provided.

2. When precast concrete pavers and resilient play surfaces such as poured in place rubberized asphalt playground surface or prefabricated resilient playground surfacing such as interlocking or other rubber tiles additional substrates and roofing system component parts shall be detailed and specified by the Design Consultant. This may include but not be limited to the following:

a. To provide support and drainage for the use of precast concrete pavers with adjustable and prefabricated manufacturers' standard support pedestals and or pads, the roofing system selected may require the addition of geotextile fabric drainage medium, one or more layers of rigid insulation, filter fabric, etc. above the roofing membrane.

b. To provide support and drainage for the use of a poured resilient rubberized asphalt floor, the roofing system selected may require the addition of geotextile fabric drainage medium, protection boards, additional layers of impact load resistant rigid insulation, filter fabric, and a poured in place floating concrete slab above the roofing membrane.

c. To provide support and drainage for the use of prefabricated resilient tile, the roof system selected may require the addition of, geotextile fabric drainage medium, drainage board, filter fabric, additional layers of impact load resistant rigid insulation, and a setting bed of compacted stone screening such as limestone, above the roofing membrane.

3. The use of other paver or roof surface types other than those listed herein shall be justified by the Design Consultant and their consultants and is subject to approval by the NJSDA.

4. The following general roof systems are to be used for Roof-top Play areas in conjunction with the respective selected wear surfaces:

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a. **SBS Modified Bitumen Protected Membrane System:** As above in B3010.50.1 Styrene-Butadiene-Styrene (SBS) Modified Bitumen Multi-ply Membrane System and the system requirements below. The Design Consultant is to specify all additional required system components or modifications to the components described above and below as required for the specific surface, play/sport function and application, loading requirements, and to comply with all presiding codes and regulations. Including but not limited to the number of plies, location, density, r-factor, and type of insulation, type of flashing sheet and pedestal type, the inclusion of drainage board and geo-textile drainage fabric, a layer of type of stone screening, etc.

b. **Single Ply EPDM Membrane System:** As above in B3010.50.2 Single Ply Ethylene Propylene Diene Monomer (EPDM) Membrane and the system requirements below. The Design Consultant is to specify all additional required system components or modifications to the components described above and below as required for the specific surface, play/sport function, loading requirements, and to comply with all presiding codes and regulations. Including but not limited to the density and type of insulation, type of flashing sheet and pedestal type.

c. Pavers on adjustable pedestals.

1.) Precast Concrete Pavers:

a.) Nominal size: A minimum of two foot by two foot (2'-0" x 2'-0"), 8500 psi min. compressive strength.

b.) Provide integral pedestal type where recommended by membrane manufacturer. Where integral pedestals are not used, provide plastic paver support pedestals and shims, with protection beneath the pedestal as recommended by the membrane manufacturer.

c.) Air space under pavers shall be at least 0.25", and additional space shall be provided if recommended for ventilation by the insulation manufacturer.

d. Pavers applied on top of an Inverted Roof Membrane Assembly (IRMA) or Protected Membrane Roof (PMR) System

1.) Precast Concrete Pavers: As above

2.) The use of other paver or roof surface types other than those listed herein shall be justified by the Design Consultant and their consultants and is subject to approval by the NJSDA.

e. Resilient Play Surfaces

1.) Poured in place resilient playground surface: Refer to Section G2050 Athletic, Recreational, and Playfield Areas (Play Structures) for additional information.

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2.) Prefabricated resilient playground surfacing (interlocking or other tiles): Refer to Section G2050 Athletic, Recreational, and Playfield Areas (Play Structures) for additional information.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section C: Interiors**

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# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section C10: Interior Construction**

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## C10 Interior Construction:

### C1010.00 Interior Partitions:

#### A. General Description / Design Approach:

1. The following Typical Interior Partition description and design approach are typically used for all new construction and additions. It is the Design Consultant's (DC) contractual obligation to properly define and document all partition types to meet the requirements for separation, privacy, life safety, and the programmatic requirements in the Educational Specification, as well as specific District needs. All partitions, materials, and assemblies shall meet the approval by the NJ School Development Authority (NJSDA) [www.njsda.gov/](http://www.njsda.gov/), the School District, the NJ Administrative Code (NJAC) 6A:26-6.3 Educational Facilities Planning Standards <http://www.state.nj.us/education/facilities/>, the NJ Uniform Construction Code Title 5:23, the current version of the NJ International Building Code and any other relevant Testing Agency or Authorities.
2. Partitions adjacent to or surrounded by existing construction shall meet the requirements of the NJUCC Subchapter 6 Rehabilitation Sub Code and relevant amendments.
3. The Design Consultant shall follow the guidelines below consisting of General Description/Design Approaches, Design Requirements, Material Recommendations, Recommendations in the Table of Assemblies and Materials (TAM) where the DC may choose between using concrete masonry units (CMU) or gypsum board and nonstructural light gauge framing (GB-NSLGF) partitions. The DC shall determine the most cost effective solution and be prepared to defend their choice. If a variation or conflict should exist with the guidelines or choices, they shall follow the recommended procedures for variance in the Introduction and General Requirements of the Material and System Standards.
4. The TAM that follows in subsection C1010.10.5 is based on sound transmission coefficients (STC) rating values of masonry and gypsum board assemblies **specified in the Performance Specifications Section PS1030.00 Project Criteria, or Table PS1030.00-01 Acoustical Performance Criteria.** ~~to the left required between typical rooms in a school found adjacent to the classroom on the far right.~~ The STC ranges ~~to the left~~ incorporate recommended STC values for school design found in ANSI/ASA S12.60 Part 1-2010 Table 4, located at <http://www.acousticalsociety.org/>. ~~The SDA has adopted a position to use and in some instances modifies the STC requirements particularly in the case of masonry values where by a value range is seen as the recommended standard (in parenthesis).~~ The NJSDA ~~will allow a wall STC within the range as it is understood~~ **understands** that the STC is not the only source of criteria by which an interior partition type may be so designed. It is understood that reverberation and sound absorption or reflection may be adjusted by other means that the material composition of a partition such as hung or wall mounted sound soak or reflective panels or the use of clouds, or carpet, that could further control sound performance in a given space. While STC is used as a general tool for organization, the range of possible acoustical performance required of partition types; the TAM is neither meant to be all inclusive of all room types found adjacent to classrooms. It is the responsibility of the DC to validate the TAM with the presiding ANSI/ASA documentation, building codes, and all other acoustical design criteria in choosing the right materials and design of the partition to meet the required acoustical performance criteria of the space.

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## **B. General Requirements:**

1. Self-supporting structural 'Fire Walls', 'Shear', 'Bearing' or other interior walls required for structural purposes, though found within the interior envelope of a school, are not considered typical 'Interior Partitions' and are not described in this section. However, they shall meet the minimum acoustical and finish criteria as part of the enclosure system of a given space as their adjoining typical nonstructural partition counterparts..
2. Code defined 'Fire Barriers', 'Fire Partitions', 'Shaft Enclosures', 'Smoke Barriers', and 'Smoke Partitions' whose definitions are defined in the presiding Code are classified by hourly performance ratings and are considered typical 'Interior Partitions' . They are included in the text and general requirements descriptions below.
3. Height limitations of self-supporting partitions either of concrete masonry units (CMU), non-structural light gauge framing (NSLGF) are described below, however, the DC must validate thicknesses of partitions and recommended service height limitations with their consulting structural engineers, and that which is set by their respective Trade Councils, such as the National Concrete Masonry Association(NCMA) <http://www.ncma.org> for CMU, or by the Steel Stud Manufacturer's Association (SSMA) [www.ssma.com](http://www.ssma.com), and the presiding NJ codes. Materials and elements that constitute a self- supporting interior partition shall:
  - a. Maintain continuity and integrity from floor slab to roof/ceiling deck above and its supporting construction
  - b. Be designed to with stand seismic or other structural forces as required by the presiding Codes.
  - c. Be protected from fire to prevent failure of continuity and integrity of any portion of its construction whether exposed to fire on one or both sides.
4. The DC is responsible for partition assembly designs to typically provide continuity of construction that extends from floor surface to the roof/floor decking above the floor surface unless it is demonstrated why such an assembly may terminate to some other point below the roof/roof deck.
5. The DC is responsible to determine all Head Wall Details and any other Fire Rated Joint Systems that might either penetrate or terminate a fire rated interior partition.
6. The DC is responsible to coordinate all "fire rated" or non- protected penetration requirements in all interior partition assemblies such as but not limited to:
  - a. Architectural openings, such as, doors, glass vision panels, borrow or sidelights and their associated hollow metal frames
  - b. Structural penetrations, such as lateral bracing, co-planar sheer wall bracing, lintels and bond beams over architectural openings, beam or other structural penetrations.

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## **B. General Requirements:**

c. Mechanical, electrical, plumbing or fire protection openings or penetrations such as for ducts or piping risers, or any other adjacencies or hanging equipment that affects the partition design.

7. The DC is responsible to coordinate all lateral bracing and structural enhancements adjacent to or in support of the non-structural partitions to include:

a. Diagonal bracing of the partition to roof/ceiling deck such that bracing will not interfere with adjoining MEP equipment, piping or other appurtenances.

8. Classroom partitions shall be made to allow for flexibility and “Change of Use” wherever possible. It is the NJSDA and School Districts best interest to reduce cost and time of such alterations. See “Change of Use” as defined in the NJ Department of Education definitions section of the N.J.A.C. 6A:26-1.2.

9. Fire rated” specialty glass in partitions such as those used in fire stair enclosures or for atriums shall not be used unless the DC demonstrates the need for such design and shall be reviewed on a case by case basis by the NJSDA and School District.

10. Partitions with borrow or side light glass panels in hollow metal door frames or as stand-alone hollow metal frame elements in partitions shall be limited. The DC shall exercise restraint where quantity and design scope exceeds District preference and NJSDA preference as further described in Section C1030 Interior Doors and C1020 Interior Window.

11. Heavy Duty Service Shops shall typically require CMU partitions and may include, but not be limited to the following types:

a. Carpentry, metal, electric, plumbing, HVAC, automotive, welding, and stagecraft.

12. Light Duty Service Non-structural light gauge steel frame (NSLGF) partitions are permitted as an alternative to CMU in the following shops:

a. Photography, graphics, mechanical drafting, computer-aided design (CAD), home economics, and cosmetology, some robotics and plastics shops depending on the type of fabrication involved.

13. The Design Consultant shall design partitions typically used for Use Occupancy Separation and shall validate the following requirements against the presiding code:

Commonly Used Occupancy Requirements:

- a. Educational Uses (Occupancy E Type) require that all new construction be sprinkled, and that no fire resistive ratings of interior partitions are required between “E” Educational and “A” Assembly.
- b. No fire resistive ratings are required between “E” and “B” use if the business use occupancy does not exceed 10% of the building area.

14. The Design Consultant shall design “Fire Resistive Rated” partitions and identify them in their design documents as “Fire Rated Assemblies” to meet requirements standards set forth in ASTM [www.astm.org](http://www.astm.org) or UL [www.ul.com](http://www.ul.com) tested assemblies: They shall generally fall within the following rating categories, however, the architect shall validate this guidance with the presiding codes.

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Commonly Used “Fire Resistive Ratings” for Interior Partitions in new construction:

**a. Non Rated Fire Resistive Partition Wall Assemblies:** Are typically used for all non-load bearing wall and partition walls that surround all typical interior spaces that are not otherwise described below.

**b. One-Hour Fire Resistive Rated Partition Wall Assemblies:** Are typically used for the following partitions:

- 1.) Walls that separate floor penetrations less than 4 stories to adjoining floor areas (however shall not be rated less than the floor assembly penetrated)
- 2.) Walls surrounding shafts, some Incidental Accessory Occupancies such as fire pump rooms, furnace or boiler rooms, stand by battery or elevator machine rooms, areas of refuge, stage dressing and related appurtenant spaces, and vertical exit enclosures and their connectivity with a horizontal exit passageway to the point of discharge to a public right of way.

**c. Two-Hour Fire Resistive Rated Partition Wall Assemblies:** Are typically used for the partitions for the following:

- 1.) Walls that separate 4 story floor penetrations or higher to adjoining floor areas, (however shall not be rated less than the floor assembly penetrated)
- 2.) Walls surrounding shafts, elevator machine rooms, vertical exit enclosures and their connectivity with a horizontal exit passageway to a point of discharge to a public right of way
- 3.) Walls separating fire areas of buildings that create a horizontal exit, area of refuge or fire rescue area.

**d. Three and Four Hour Fire Resistive Rated Partition Wall Assemblies:** Are typically not used for partitions in NJ schools. However, if the circumstances require this level of fire resistive rated partition assembly, the Design Consultant shall follow the presiding codes.

15. The Design Consultant is responsible for the choice of building construction classification, and related hourly rating of all partition and shall be aware of the indirect impact of those choices in that may affect potential cost increases to other systems that penetrate the selected partition. Two examples are as follows:

- a. There is potential for additional costs of fire protection of structural steel around shafts and vertical floor/ceiling penetrations above what may be intended or required by the classification of the building to the framing system if the DC doesn't adequately protect or separate the framing from fire exposure from the penetration by the partition assembly.
- b. There is the potential for additional indirect costs to mechanical system that may result from the choice by the DC of a non-rated “smoke partition” or 1hr rated partition surrounding a science lab where though it is sprinkled and may meet code with a non-rated “smoke partition”, it may be more cost effective to rate the partition

# Model Schools: Materials and Systems Standards

enclosure because it would lower the cost of the mechanical system by allowing through wall dampers in lieu of hard ducted returns from the space to the AHU.

16. Interior finish treatments on all partition types listed in this section shall refer to Section C20 Interior Finishes and shall be subject to recommendations in the Table of Typical Rooms and Finishes and the Paint Schedule at the end of that section.

## **C1010.10 Interior Fixed Partitions:**

### **C1010.10.1 Concrete Unit Masonry (CMU):**

#### **A. General Description / Design Approach:**

1. Concrete masonry units are the material of choice for partition design throughout all grade levels in K-12 schools for new and existing construction and are generally preferred over other systems because it is durable to high impact loads and abuse, is fire resistant, is acoustically desirable, and reduces long term maintenance and lifecycle costs. However, it is not as flexible as gypsum and steel stud construction is for reconfiguring parts of the building to accommodate a physical change to the facility or for complex integration of technology that may drive the need for flexibility in classroom layout, school configuration, and design. CMU partitions adjacent to or surrounded by existing construction, and CMU in new construction shall meet the characteristics and testing requirements of the presiding Code. In addition; the NCMA, [www.ncma](http://www.ncma) has been used to develop content in this section.

2. CMU's shall typically be ASTM C90-22 (or current version) quality standard with a minimum average net area compressive strength of 1900psi and shall be of a face texture, finish, and pattern, to receive, a painted finish. The weight of the CMU shall typically be in the 105 to 125 pounds per cubic foot density range and shall generally be of nominal 4"-12" thick units with hollow or solid cores.

3. CMU's are the material of choice for use in partition types though not limited to the following:

- a. As back up for exterior walls (see section B2010 on exterior wall construction).
- b. For all typical interior partitions within the shell throughout the floor plans of the buildings.
- c. Partitions for gymnasiums, multipurpose rooms, corridors, toilets, and toilet cores, and egress stair where higher abuse is a concern, particularly for 11 year old youth to 18yr old young adults.
- d. For fire resistant interior partitions exposed to flame on one side or both sides whether a bearing partition or not.

#### **B. General Requirements:**

1. Structural capacity for a CMU partition shall be self- supporting and shall include in its assembly appropriate vertical and horizontal reinforcement with the minimum net average compressive strength to meet the presiding codes.

# Model Schools: Materials and Systems Standards

2. CMU shall be typically attached to a floor or roof deck with appropriate head joints to allow flexure of the floor or roof deck and to provide the required fire rated fire stopping according to UL and ASTM Testing Standards as required by the presiding codes. See drawing C1010-04.
3. CMU, when it is used and exposed to view, shall have their visible surface filled with block filler and painted either with one or two coats depending on its density. CMU walls shall typically have a minimum nominal thickness of six inches; however four inches may be used for chases or in smaller partition enclosures that do not exceed their structural self-supporting capacity or requirements for fire resistive construction.
4. When external CMU corners meet end to end with gypsum board clad partition walls, at hollow metal doors and frames, or at locker unit installation, 1" non 'bullnose' 90 degree CMU's should not be installed on exposed edges .
5. 1" outside radius 'bullnose' CMU shall be used on all outside corners exposed to foot traffic and should include but not be limited to the following locations:
  - a. Column covers, piers, fin walls etc.
  - b. Low walls that are adjacent to a ramp or stair shall have 1" radius, 4" thick, 16" nominal length stretcher wall caps or other similar and suitable eased edge masonry cap.
6. Type S pre-mixed mortar in standard colors shall be used for non- structural or structural purposed and shall conform to ASTM C270-24 and shall meet tests evaluation reports in ASTM C780-23 (or current version) for:
  - a. Aggregate ratio
  - b. Water content
  - c. Air content
  - d. Consistency
  - e. Compressive strength
7. Horizontal joint reinforcement shall be hot dipped galvanized steel ladder type.
8. All exposed joints shall be slightly concave and shall be smoothed to a non- abrasive finish with the proper joint tools to prevent graffiti and abuse.
9. CMU steel reinforced and cast in place or precast lintels shall be used over all CMU partition openings and shall typically be of type, size of reinforcing, and scheduled strength indicated in the structural engineer's intel schedule. Where length exceeds allowable structural loading or fire protection to the reinforcement, the span shall be reduced or shall be protected according to meet the presiding codes.

## **C1010.10.2 Sound Absorbing Concrete Masonry Units (SACMU):**

### **A. General Description / Design Approach:**

1. SACMU's are required typically in a gym, a multipurpose or cafetorium that may be adjacent to rooms requiring a higher STC rating to adjacent quieter classroom, auditorium, or media center spaces. They shall have a double row of cells to accommodate vertical reinforcing separate from the cores used for acoustical absorption or diffusion. Vertical reinforcing rods are not permitted within acoustical cells. SACMU's shall have a minimum thickness of eight inches to accommodate seismic requirements if needed by the presiding code.



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## **B. General Requirements:**

1. SACMU's shall typically provide separate cells within the block for vertical seismic bracing and acoustical treatment.
2. SACMU's shall typically be an ASTM C90-24 and ASTM C129-23 and shall be used in a fixed partition where noise control is required. SACMU are typically concrete masonry units with vertical or flared slots or, metal septa, usually introduced between the outside face and inside core which may be filled with non- combustible fibrous filler for diffusing sound or may be omitted for absorbing sound. Painting of CMU will affect the acoustical properties and may enhance reflective or lower absorptive properties depending on what is recommended by the DC's acoustical evaluation of the particular needs of a space.

When selecting a SACMU; the STC properties are dependent on the following:

- a. Surface texture
  - b. Density of either coarse, medium or fine.
  - c. Block weight, either normal or light weight.
  - d. Number of paint coats and finish applications.
3. Furthermore when specifying the use SACMU sound absorptive location and quantity within a room is critical. It is recommended that the DC review acoustical requirements with their acoustical engineer to determine location, quantity, block weight, density, insert composition or not, surface configuration, and finishes so that acoustical performance meets the requirements of the space..

## **C1010.10.3 Specialized Interior Finished Masonry Units:**

### **A. General Description/Design Approach:**

1. Specialized Interior finished CMU such as glazed masonry faced CMU or structurally glazed facing tile and cove base, ground faced CMU, or other specialized CMU shall be used only when required to match existing partition construction. The use of such specialized CMU is generally not recommended in new construction, however, should any specialized masonry be introduced into the design, the design consultant must demonstrate to the NJSDA that the use of such material is based on the particular needs of the design and that it can be justified on a comparative basis to life cycle vs. first cost, or other similar criteria.

## **C1010.10.4 Gypsum Wall Board and Non-Structural Light Gauge Steel Framing (GB-NSLGF):**

### **A. General Description/Design Approach:**

1. GB-NSLGF may be used in both new and existing construction where ease and speed of erection, integration of utilities, services and technology, acoustical separation, and flexibility to accommodate future "change of use" are of a primary concern.
2. GB-NSLG are competitive solutions when evaluating first costs particularly in multi-story situations where the weight of masonry may drive up the cost of the steel frame beyond three stories, however, they require more maintenance and up keep than CMU and may negatively impact the long term lifecycle costs of a school facility.

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3. The use of GB-NSLGF depends on the level of abuse resistance required of the partition to withstand impact by the student age group occupying the facility and particularly in spaces subject to ball or other high impact loads which may drive up cost beyond its utility where a CMU wall system may be a better choice.
4. Generally, the only spaces and uses permitted by the NJSDA of GB-NSLGF partition assemblies without exceptions across all K- 12 school types are the main administrative offices, guidance and child study team offices, nurse suite, faculty or other similar related spaces. It may be considered for use in teacher or staff supervised instructional or core learning spaces on a case by case basis. Otherwise, partitions generally beyond the administrative core shall typically be constructed with CMU.
5. It is the intention of the NJSDA not to discourage the DC from using GB-NSLGF as it may be equally or better suited than CMU in other parts of the building beyond the administrative and staff related spaces, and it is the responsibility of the DC to demonstrate its suitability to the NJSDA, NJDOE, and District by costs benefit analysis or in other means for a more extended use throughout a facility.

## **C 1010.10.5 Interior Partitions Supplemental Components:**

### **A. Non Structural Light Gauge Steel Framing (NSLGF):**

1. NSLGF members shall consist of steel studs and runners meeting standards set in ASTM C645-18 and shall be whatever sizes are specified for the service load requirements by the DC. NSLGF shall generally comply with ASTM C754-20 and ASTM C840-23 that apply to framing installation and shall be provided with protective coating for interior applications based on ASTM A653/A653M-23, G40 (Z120) hot dipped galvanized zinc coating.
2. NSLGF shall typically extend from floor to underside of deck above, however, may stop above a hung ceiling in office and administrative areas or where flexibility may be a concern. In instances where the partitions stop above the ceiling plane the DC shall assure compliance with all related acoustical requirements. Size and spacing of studs may vary as required for height of partition and may depend on other design considerations. NSLGF shall be typically attached below the floor or roof deck with appropriate head joint to allow flexure of the floor or roof deck and to provide the required fire rated fire stopping according to UL and ASTM Testing Standards as required by the presiding codes. See drawing C1010-10.
3. NSLGF gauge, height limitations, and spacing of studs shall meet structural and seismic loads as determined by the Design Consultants structural analysis. Partition deflection shall be limited to L/240 for painted walls and L/360 for walls with ceramic tile wainscot, designed for a minimum lateral load of 5 psf. Horizontal framing for mold & moisture resistant board soffits or for horizontal fire barriers shall be spaced no more than 12" on center.
4. NSLGF components may be used for shaft walls around elevators, mechanical shafts, return air ducts, and stairwells used in conjunction with 1" gypsum board liner panels shall use C-H, E-Studs, struts, J-runners, H studs of one or two pieces, or C-Runner channels in non- load bearing fire rated assemblies. C-H studs and related components shall be used typically for non-structural shaft wall support enclosures where suited to the requirements of the partition type and enclosure details required by the DC and presiding NJIBC.
5. NSLGF Cold formed metal framing accessories such as 'Furring Channels' shall be, 7/8" or larger 'hat' shaped section of 20, ga. made of corrosion resistive steel. 'Resilient Channels', RC-1



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shall typically be 1-1/2" wide, 20-25, ga. made of corrosion resistive steel used for acoustical assemblies, and "Z-Furring Channels", made in various sizes, shall be of 20 gauge corrosive resistive steel.

## **B. Normal Use Gypsum Board (NUGB):**

1. NUGB panels shall meet ASTM C36 for normal use gypsum board (NUGB) and shall be a non-combustible regular gypsum board core panel typically of 5/8" encased in a bonded smooth finish facing paper and a natural finish on the back side. It shall be typically available in tapered or non-tapered edge treatment shall be used where normal use without exposure to moisture is anticipated. See table of Typical Room and Finishes Section C20 for gypsum board finish systems.

2. NUGB panels shall be also available in with a specially formulated to resist moisture, water and mold (See W/MRGB below) with treated face and natural faced rear and shall have strengthened formulated core and skins for abuse resistance (See ARGB below).

3. NUGB panels shall be used for partitions surrounding smaller spaces within instructional spaces, such as wardrobes and material supply closets in Pre-K to 5 school types, including special education classrooms as an option to CMU.

4. NUGB panels shall be used within the perimeter walls of an administrative areas of all NJSDA schools regardless of age level served may be constructed of NUGB with the light gauge steel stud partition terminating 6" above the ceiling unless the design of the room within the administrative suite requires a full height partition from the floor to ceiling/roof deck due to smoke, fire rating, or other acoustical properties.

## **C. Fire Resistance Rated Gypsum Board (FRGB):**

1. FRGB panels shall meet ASTM C1396/C1396M-24, C1278/C1278M-24, ASTM D3273-21, and E84-24 for fire resistance and shall meet UL and tests and other nationally recognized testing agencies and presiding codes. It shall have shall have a specially formulated gypsum core containing special additives that enhance the integrity of the core under fire exposure and shall be a Type X or C and be typically 5/8" thick with normal use applied smooth paper front and natural finished paper on the back.

2. FRGB panel cores unto themselves will not support combustion or transmit temperatures in excess of 212F degrees until completely calcinated. Use in fire resistive assemblies shall be consistent with the requirements of assemblies listed in UL, ASTM or other testing agencies and shall meet the presiding codes for the hours required of the overall assembly.

3. FRGB panels shall be also available in with a specially formulated core to resist moisture, water and mold (See W/MRGB below) with treated face and natural faced rear and shall have strengthened formulated core and skins for abuse resistance (See ARGB below).

## **D. Abuse Resistant Gypsum Board (ARGB):**

1. ARGB panels shall offer greater indentation and through wall penetration resistance than GWB and be 5/8" thick, with core type, tapered edges, and minimal physical properties as listed below:

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2. ARGB panels shall be manufactured to produce greater resistance to abrasion and indentation ASTM D4977/D4977M-20 and ASTM D5420-21, and tested for penetration due to soft body impact test ASTM E695-22 according to the following criteria:
  - a. ARGB shall meet surface damage and abrasion criteria in (ASTM D4977):30-100cycles .10"-15" inch Indentation
  - b. ARGB shall resist surface penetration according to (ASTM D5420) 5/8" die at 8lb. 9" drop): .15" inch or less.
  - c. ARGB shall meet penetration according to Soft Body (ASTM E695-22) Hard Body (ASTM C1629/C1629M-23) testing according to the following:
    - 1) Soft Body Impact: 90-300 ft-lbs. min. to failure.
    - 2) Hard Body Impact: min. 80-100 ft.lbs. min. to failure .
3. ARGB panels shall be used for partitions in the presence of water or latent moisture shall be enhanced with water and mold resistance and in addition shall be rated for 'fire resistance' where required with a fire-code core.
4. ARGB panels for 'fire resistance' shall meet testing criteria set by the current versions of ASTM C1278/C1278M-24, C1396/C1396M-24 and ASTM D 3273-21, E84-22.
5. ARGB for use in schools shall be further defined by levels of abuse as follows:
  - a. **Light Duty Abuse Resistant Gypsum Board (LARGB)** is an upgrade to GWB with improved resistance to abrasion and indentation due to incidental surface and indentation damage due to soft impact and can be used in higher traffic areas for schools. It shall meet a soft body impact test of 180ft-lbs, and shall be made of a strong face paper and heavy duty backing sheet or a product with an integral fiberglass enhanced mat skin; both types shall be water and mold resistant and available in fire resistant variants.
  - b. **Moderate Duty Abuse Resistant Gypsum Board (MARGB)**  
MARGB shall be resistant to increased level of abrasion and resistance due to denting, breaking, puncturing from pencils or pens, and may be used in higher traffic areas. It shall meet a soft body impact test of 210ft-lbs and be an integral fiber based gypsum cellulose reinforced product, or a product with an integral fiberglass enhanced mat skin; both types shall be water and mold resistant and available in fire resistant variants.
  - c. **Impact Resistant Gypsum Board (IRGB)**  
IRGB shall be resistant to extreme levels of penetration and indentation and damage from hard objects such as thrown balls and shall meet soft body impact test of greater than 300ft-lbs and hard body impact test of 80 or greater and shall be a product with a reinforced integral fiberglass mesh.
- 6 The spacing of studs, use of specialized primer-surfaces, and finish plasters, will affect the total assembly and abuse resistance of ARGB performance. Under supervised public circulation defined in a school as corridors lobbies, vestibules and similar spaces, the partition shall receive double layer wallboard in all partitions with the face layer being of different performance level depending on the performance desired as suggested below.
  - a. For young children to youth; AGWB and may be used in partition construction between classrooms and may use NUGB between classrooms but shall use LGWB on the outer of two layers facing the public circulation spaces. The choice to increase to LAGWB

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between classrooms shall be determined by a number of considerations determined by the District, SDA, guided by recommendation of the DC.

b. For younger teen youth and young adults: LAGWB partition construction shall be used between classrooms but shall use MAGWB on the outer of two layers facing corridors and other traffic or public circulation spaces. The choice to use LAGWB or MAGWB shall be determined by a number of considerations by the District, NJSDA, guided by recommendation of the DC.

7. Wherever administrative and specialized spaces use a multi layered GWB system, the side facing the corridors or public circulation spaces shall use LAGWB or MAGWB and shall be consistent with the choice and recommendations chosen for classroom wall assemblies.

8. Wherever HAGWB is used such as in a gym or multi-purpose room, the District and the NJSDA shall accept its use only after reviewing its performance, lifecycle cost criteria, and recommendations compared by the DC to those of CMU on a case by case basis.

## **E. Fire Resistive Shaft Wall Gypsum Liner Panels (GLP):**

1. GLP used in shaft wall assemblies shall typically be assemblies of 1hr or 2hr rated enclosures depending on the height of the shaft and construction classification of the building. The DC must validate the shaft wall assembly hourly rating requirement selection with the presiding codes and shall construct the shaft wall assembly of the following suggested materials:

a. GLP shall typically be 1" thick, 2ft. wide, ASTM tested type-X, or C fire resistive core panels incased in a moisture/mold resistant multi layered paper.

b. GLP shall be 8ft. to 14ft. long, with V shaped, T&G, or beveled edges.

c. GLP shall comply with ASTM C1396/C1396M-24, and ASTM E119-24 Standard Test Method for Fire Tests of Building Construction Material.

## **F. Water/Mold Resistant Gypsum Board (MWGB):**

1. WMRGB panels shall be constructed of chemically treated multi layered face and paper back that make the panels water resistant in combination with a core that is constructed with a gypsum composite material core that makes the core both water and mold resistant all the way through. Panel shall typically be:

a. WMGB shall typically be 5/8" regular core or 5/8" thick fire-code core (fire resistive)

b. WMGB shall typically meet testing criteria set forth by ASTM C473-19 and ASTM D3273-21 for water absorption as a percentage of weight and for mold which shall test an 8-10 range for mold resistance.

c. WMGB shall typically be used as a base for finishes listed in Interior Finishes Section C20 such as thin-set tile or sanitary wall panels.

2. In order to ensure satisfactory performance of WMGB panels, quality control of the trades must be met such that they are installed correctly as follows:

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- a. The DC shall make sure that their specification includes quality control measures that insure all exposed edges are sealed properly, and all tile finishes and sealants are installed correctly.
- b. In potentially wet areas the floor track and bottom portion of studs shall receive a protective bituminous coating and all attached gypsum board panels shall be mold and water resistant.
- c. The bottom edge of wallboard shall be raised 1/2" above concrete slab in corridors, lobbies, vestibules, and potentially wet areas. Finish bottom edge of wallboard with L-shaped galvanized metal trim. Fill gap with non-shrink material.
- d. WMGB panels that normally are to receive a ceramic tile finish such as at the wet walls of a gang toilet room shall not be installed over a vapor retarder or on a wall acting as a vapor retarder.

3. Where WMGB is not provided with a full tile finish or other similar wall cladding such as above a wainscot; but the space requires a mold and water resistant product; the sheathing shall also meet performance and abuse resistant criteria for the types of students and or adults occupying the spaces such as in gang student toilets, public toilets, or locker rooms above where such finish or cladding ends. However, in spaces occupied by young children or administration and faculty the DC need only provide WMGB to the full height of required wall sheathing including the exposed surface above a wall cladding or wainscot as may be the case.

4. WMGB panels are not intended for wall panel sheathing in areas such as gang showers where a higher degree of constant moisture may be present. In this case, it is suggested to use a 5/8" cementitious fiber mesh reinforces panel backer board.

## **G. Sound Attenuation Blankets (SAB) and Other Acoustical Considerations:**

1. Partitions containing SAB shall be located between all metal stud cavities unless otherwise specified by the Design Consultant in their partition types and generally shall be a 3", 3-1/2", or 5" Type I ASTM C665-23 fiberglass or mineral fiber sound attenuation blanket without facing. Fire resistive rated assemblies shall meet the component requirements of the UL assembly so designated by the DC for the performance and service requirements of the partition.
2. All penetrations in sound rated partitions shall be sealed on their perimeters to meet the STC recommended ratings and attention shall be given to points of 'leakage' between the spaces.
3. Partition walls containing doors between a core learning space and corridors, stairwells, conference, or office space, exclusive of toilets that may have doors that open into the learning space, the STC wall rating is for the wall exclusive of the door.

## **H. Joint Treatment, Finish of Panels, and Accessories:**

1. Joint treatment shall typically consist of gypsum board trim accessories such as but not limited to: metal or metal and paper tape composite corner beads on outside corners, L-C beads at exposed panel edges, and expansion control joints at 30ft on center. Joint treatment material shall be placed according to ASTM C475/C475M(2022) and with manufacturers recommendations using gypsum board compound applied in 5 successive applications consisting of the following:

# Model Schools: Materials and Systems Standards

- a. The prefilling open joints and damaged surfaces with tape setting compound.
- b. The embedding of tape, application of a first coat on joints, and the filling of flanges of trim accessories.
- c. The application of a fill coat to using drying type all- purpose compound.
- d. The application of a finish coat using drying type all- purpose compound.
- e. The application of a final surface finish coat to an ASTM C840 Level 5 finish.

## **C1010.10.5 Table of Assemblies and Materials (TAM):**

1. The TAM shall be used as guidance for the selection of CMU and NSLGF-GWB interior partitions in the rooms and spaces indicated below.
2. The TAM incorporates and considers the following industry standards, guidelines and recommendations as follows:
  - a. The current version of ANSI/ASA Standard S12.60-2010, "Acoustical Performance Criteria, Design Requirements and Guidelines for Schools."  
<http://www.acousticalsociety.org/>
  - ~~b. The NJSDA recommended best practices as modified by the current applicable NJSDA version May 15, 2007 of the 21<sup>st</sup> Century Schools Design Manual: Design, Criteria 1, "Acoustic Comfort". [www.njsda.gov](http://www.njsda.gov).~~
  - c. Industry published data for STC assemblies of gypsum board and steel stud assemblies and from TEK notes by the National Concrete Masonry Association.  
[www.ncma.org](http://www.ncma.org)
  - d. Consideration of abuse and durability requirements set by testing standards for abrasion and indentation resistance, and penetration by hard or soft body impact tests described in board tests or other information found at but not limited to [www.USG.org](http://www.USG.org) or at other product websites..
  - c. Consideration of sizes of light gauge steel studs framing capacities that affect the partition thickness ratios, height, and widths prescribed by structural codes or by the DC structural engineer's recommendations.[www.ssma.com](http://www.ssma.com)
  - d. Consideration of Moisture and Mold growth according to ASTM D3273-21 "Standard Test Method for Resistance to Mold on the surface of Interior Coatings in an Environmental Chamber" [www.astm.org](http://www.astm.org) and information found in but not limited to [www.USG.org](http://www.USG.org) or other product websites.
  - e. Consideration of other acoustical criteria such as prescribed decibel (Db) or minimum Reverberation Time (RT) values that dependent on other room and occupancy acoustical characteristics as listed in the presiding SDA 21<sup>st</sup> Century Design Manual.  
[www.njsda.gov/](http://www.njsda.gov/)
  - f. Consideration of typical programmatic requirements dictated by the DOE Educational Specification or School District Criteria

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3. The TAM is organized according to STC for both CMU and GB-NSLGF partition types and provides guidance in the selection of either type of assembly for the space type listed on the far right when adjacent to an instructional classroom. The STC values listed are generally consistent with STC values of tested gypsum board assembly partition types that are commercially available to the DC at the USG or other manufacturer's websites. CMU STC values are generally consistent with STC values in the TEK 13-1B table 1 STC Ratings for Concrete Masonry Walls.

[www.ncma.com](http://www.ncma.com)

4. The following Related Standardized Partition Details are included by reference in the TAM and can be found at the end of Section C10 Interior Construction.

Drawing Numbers at the end of Section C10 are as follows: (Details are for reference only)

1. C1010-01 Interior CMU Partitions
2. C1010-02 Interior CMU Partitions
3. C1010-03 Interior CMU Partitions
4. C1010-04 Interior CMU Partition Firestopping
5. C1010-05 Interior CMU Control Joints
6. C1010-06 Interior GB-NSLGF Partitions
7. C1010-07 Interior GB-NSLGF Partitions
8. C1010-08 Interior GB-NSLGF Partitions
9. C1010-09 Interior GB-NSLGF Shaft and Chase Walls
10. C1010-10 Interior GB-NSLGF Partition Firestopping

5. See Table of Typical Rooms and Finishes that can be found at the end of Section C20 Interior Finishes for additional information regarding surface treatments of partition types.



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## C1010.10.5. Table of Assemblies and Materials (TAM):

STC Min. Rating or Range (Preferred Rating)	Assembly and Material (CAD Detail Reference)		Suggested Room Types
	Concrete Masonry Units	Gypsum Board	
<del>45</del> <b>35-45</b> <b>Note (a)</b>	6"Hollow units typ. 45-46 with one layer of 5'8" of NUGB, LARGB, or MARGB on 2-1/2" metal studs depending on adjacency 45	6"Hollow units typ. 45-46 with one layer of 5'8" of NUGB, LARGB, or MARGB on 2-1/2" metal studs depending on adjacency 45	Vault, or Records Room, Storage, Emergency Control Center
<del>45</del> <del>(47)</del> <b>35-45</b> <b>Note (a)</b>	6" Hollow units typ., 45-46 8" Hollow units typ., 46-47 (C-1010-03-1) 45-47	3-5/8" min. 22 ga. 16" O.C. Face Layers: 5/8" NUGB ea. side SAB 3" min. (Type C or X 5/8" when req'd.) (C1010-06-1, 1a) 45-49	Main Administrative Offices, Staff Offices, Conference Rooms, Nurse Suite
45-50 <del>(50)</del> <b>Note (a)</b>	6" Hollow units typ., 45-46 6" Solid, grout, sand filled, 48-51 8" Hollow units typ., 46-47 8" Solid, grout, sand filled, 51-55 (C-1010-01-1) 45-55	3-5/8"- 6" min., 20-22 ga., 16" O.C. Face Layers: 5/8" NUGB each side SAB: 3"-5" min (Type C, X 5/8" when req'd.) (C-1010-07-1) 50	Instructional Classrooms, Science Labs, Art Room, Media Center
<del>45-50</del> <del>(50)</del> <b>35-45</b> <b>Note (a)</b>	12" Hollow units typ., 49-50 8" Hollow units typ., 46-47 (C-1010-01-1) 49-50	8" min., 20 ga., 24" OC or 16" O.C. Face Layer: 5/8" LARGB children to youth, MARGB youth to young adults on corridor traffic side, 5/8" NUGB classroom side, SAB 5" min. (Type C, X 5/8" when req'd.) (1010-03-1) 51	Vertical Egress Stairs, Horizontal Exits
<del>45-60</del> <b>50-65</b> <b>Note (a)</b>	8"-12" Solid, grout, sand filled 51-63 range 12" Hollow units typ., 49-50 (50 STC if design consultant can demonstrated that machine noise level is lower otherwise use 60 STC) (C-1010-01-2) 50-60	6" min., 20 ga., 16" O.C. Face Layer: 1 Layer of 5/8" LARGB children to youth, MARGB youth to young adults on corridor traffic side, otherwise concealed or face Layer of 5/8" NUGB, Resil Chan. @24" O.C. SAB 5" min. Type C, X when req'd. (C1010-08-3) 59-60	Elevator Machine & Shaft, Mechanical Equipment Rooms, Maintenance Storage, Pump Rooms.
45-60 <b>Note (a)</b>	8"-12" Solid, grout, sand filled 51-63 range 12" Hollow units typ., 49-50 (50 STC if design consultant can demonstrated that machine noise level is lower otherwise use 60 STC) (C-1010-01-2) 50-60	4" C-H studs 22 ga. 24" O.C. Shaft Liners: 1" GBLP Face Layer: 1 Layer of 5/8" LARGB children to youth, MARGB youth to young adults on corridor traffic side, otherwise concealed and face layer of 5/8" NUGB, SAB 3" min. type C, X when req'd. (C1011-09-1) 51	Mechanical Shafts

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Design Requirements

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## C1010.10.5. Table of Assemblies and Materials (TAM) (con't):

STC Min. Rating Range (Preferred Rating)	Assembly and Material (CAD Detail Reference)		Suggested Room Types
	Concrete Masonry Units	Gypsum Board	
<del>50-60</del> (60) <b>35-45</b> <b>Note (a)</b>	8" Hollow units typ., 46-47 8"-12" Solid, grout, sand filled 51-63 range 12" Hollow units typ., 49-50 (C-1011-01-2) 49-63	8" min., 20 ga., 16" O.C. Face Layers: 5/8" LARGB resist. Gyp.Bd. Vocational Shop side. Concealed Layer and Clsrn. side: 5/8" NUGB Resil Chan. @24" O.C.; SAB 5" min (Type C, X 5/8" when req'd.) (C-1010-07-2) 59-60	Vocational Shops
<del>45-50</del> (50) <b>35</b> <b>Note (a)</b>	6" Hollow Units typ., 45-46 8" Hollow units typ., 46-47 (C-1010-01-1) 45-47	6" min., 20 ga., 16" O.C. Face Layer: 5/8" LARGB children to youth, MARGB youth to young adults on corridor traffic side, 5/8" NUGB, SAB 5" min. (Type C, X when req'd.) (C1010-03-1) 51	Corridors, Lobbies, Vestibules
<del>51-55</del> (53) <b>50</b> <b>Note (a)</b>	8" Solid, sand, grout filled 51-55 range with tile on wet wall Or 8" Hollow unit 46-47 with 4" Hollow unit with tile finish on wet wall min. (See chase wall) (C-1010-03-2,3) 51	3"-5/8 min. 20 ga., 12" O.C. Face Layers: 5/8" WMRGB both sides with 5/8" Cement board & 1/4" ceramic tile over concealed layer @ wet wall Resil. Chan. @24" O.C.SAB 3" min. (Type C, X 5/8 " when req'd.) (C1010-08-1) 53	Gang and Single Stall Toilets, Locker Rooms, Showers
<del>51-55</del> (53) <b>35-45</b> <b>Note (a)</b>	8" Solid, sand, grout filled 51-55 range with tile on wet wall Or chase wall with 8" Hollow units 46-44 with 4"Hollow unit 44-45 with tile finish on wet wall min. (See chase wall) (C-1010-03-2,3) 51-55	6" min., 20 ga., 16" O.C. Face Layers: 5/8" WMRGB both sides with / 5/8" Cement board & 1/4" ceramic tile over concealed layer @ wet wall or w/sanitary wall panels; 5/8" NUGB on classroom side and for exposed and concealed layer, Resil. Chan. @24" O.C. SAB 5" min. (Type C, X 5/8" when req.'d) (C1011-07-3) 59-60	Kitchen and Servery



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Design Requirements

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## C1010.10.5. Table of Assemblies and Materials (TAM) (con't):

STC Min. Rating Range (Preferred Rating)	Assembly and Material (CAD Detail Reference)		Suggested Room Types
	Concrete Masonry Units	Gypsum Board	
<del>51-55</del> (53) <b>65</b> <u>Note (a)</u>	8" Solid, sand, grout filled 51-55 range with tile on wet wall 8" Hollow unit 46-47 with 4" Hollow Units 44-45 and on wet walls min. (C-1010-03-2,3) 51-55	3-5/8", 20 ga., 12" O.C.; Horiz. Braces at 24" O.C. vertically Face layers: 5/8" WMRGB both sides with 1/4" ceramic tile over 5/8" cement board on wet walls or 5/8" NUGB clsm. Side (Type C, x5/8" when req'd.) (C1010-09-2) 60	Plumbing Chase Walls
<del>55 to 60</del> (60) <b>50</b> <u>Note (a)</u>	12" Solid, grout, sand filled 57-63 range 8" Solid, grout, sand filled 51-55 range With 8" SACMU units with 4" Reinf. Cell and 4" CMU backup typ. located 10' above finish floor Acoustical Wall Panels (C-1010-02-2) 55-63	8" min., 20 ga., 16" O.C. Face Layer: 5/8" LARGB Concealed Layer and Clsm. side: 5/8" NUGB each side Resil. Chan. @24" O.C. SAB 5" min; Acoustical Panels, Sanitary Wall Panels for Wainscot in Cafeteria (Type C, X 5/8" when req'd.) (C-1010-07-03) 59-60	Cafeteria
<del>55-60</del> (60) <b>35-45</b> <u>Note (a)</u>	12" hollow units typ., 49-50 8-12" Solid, grout, sand filled 51-63 range 8" SACMU units typically located above wall padding Acoustical Wall Panels, Padding (C-1010-02-2) 49-63	8" min., 20 ga., 16" O.C. Face Layer: 5/8" IRGB Concealed Layer and Clsm. side: 5/8" NUGB Resil. Chan. @24" O.C. SAB 5" min High Density Acoustical Wall Panels, Padding (Type C, X 5/8" when req'd.) (C-1010-07-2) 59-60	Gymnasiums, Multipurpose Rooms
<del>55 to 60</del> (60) <b>45-50</b> <u>Note (a)</u>	12" Solid, grout, sand filled 57-63 range 8" Solid, grout, sand filled 51-55 range Acoustical Wall Panels (C-1010-02-1) 55-63	8" min., 20 ga., 16" O.C. Face Layer: 5/8" NUGB Concealed Layer and Clsm. side: 5/8" NUGB each side Resil. Chan. @24" O.C. SAB 5" min; Acoustical Wall Panels (Type C, X 5/8" when req'd.) (C-1010-07-03) 59-60	Music, and Vocal Room, Auditorium

**Note (a) – STC values listed in the first column indicate values listed in Table PS1030.00-01 of Section Project Criteria in the Performance Specifications. PS 1030.00-01 takes precedence over any contradictions with values listed here.**

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## **C1010.50 Interior Operable Partitions:**

### **A. General Description/Design Approach:**

1. Provide motorized folding partitions for use in large spaces such as gymnasiums and auditoriums only where acoustical separation is absolutely necessary and as required by the District and is approved by NJDOE Educational Specification and the NJSDA otherwise a roll down curtain shall be typically specified. Folding partitions must have doors and hardware to accommodate handicapped accessibility, and use as emergency egress where necessary. Otherwise, it is preferred to use a retractable curtain to divide the gymnasium into two half courts.
2. Manually operated folding panel partitions for partitioning large rooms into smaller spaces such as in classrooms, cafeterias and multipurpose spaces may be used for acoustical separation for solving particular complex programmatic needs however such flexibility or modifications shall require District and NJSDA approval and DC will be required to demonstrate the need for the flexibility of the proposed space. Planning for this flexibility must be demonstrated and generally approved at the time of the District, NJSDA, and NJDOE Educational Specification and Programmatic Model Development.

### **B. General Requirements:**

1. A Sound Transmission Coefficient of 46 is minimum requirement for both partition types (motorized and manual). Both types shall have automatic acoustic seals at the top of panels, between panels and between the panels and the floor. STC may be higher depending on the louder of the two adjacent spaces, (see the STC required in the TAM for adjacent room types to a classroom as a guide).
2. Motorized partitions shall provide the following safety features:
  - a. The electrical device controlling the operation of the partition shall be capable of being reversed at any point in the stack travel cycle.
  - b. Leading edge sensor which will stop the partition if it strikes an object in its path is required.
3. Devices are required to be provided for all electrically operated partitions that will stop the forward or backward horizontal motion of the partition such that when an object passes between the leading panels of such partitions at an adjoining wall, the travel will be stopped in either direction.
4. A safety key switch shall be required to operate the motorized partition: Locate one on each side of the partition, one at the stack end and one opposite the stack end of the partition, both in full view of the partition.
5. A constant contact tamper proof button, activated by a key, shall be required to operate each switch. The switches shall be wired in series. Simultaneous operation of both switches shall be required to operate the partition. Warning signs are required to be posted which designate the safe and proper operation and supervision of the electrical device operating the partition. Signs shall be adjacent to each key activated safety switch and securely fastened to the wall 5'-0" above the finished floor.

# Model Schools: Materials and Systems Standards

**C1020 Interior Windows:**

**C1020.20 Interior Fixed Windows:**

(See Section C1030.90.1 for similar components)

**C1020.90 Interior Window Supplementary Components:**

See Section C1030.90.1 for similar components)

**C1020.90.1 Hollow Metal Frames for Windows, Transoms, Borrow lights and Sidelights):**

**A General Description/Design Approach:**

1. All interior doors to instructional spaces equal to or greater than 300 sf. per the NJDOE requirements shall have ¼" safety glazing for teacher and student security, however, are not required to have sidelights, borrow lights or other more extensive use of glass. If a District demonstrates a need to the NJSDA, for added security or requirement for such, sidelights, transom, or borrow lights, for example for sustainable design credit requirements or for added security, such additional glass areas shall be reviewed on a case by case basis by the NJSDA and shall meet the requirements of the prevailing code.

2. Doors that typically do not require a vision panel are suggested in the table below.

• Auditoriums and Coat Check Room	• Teacher/Staff Preparation Rooms/Offices
• Instructional Classrooms under 300 gsf.	• Principal's Office
• Custodial and Security Rooms	• Conference Rooms
• TV/ AV/MDF Studio or Storage	• Refuse and Compactor Rooms
• Stage Dressing Rooms	• Storage Rooms and Closets
• Sound Control Room	• Toilets, Showers and Locker Rooms
• Janitor's Sink Closet	• Utility, Equipment and Service Rooms
• Medical Examination Rooms	• Vault and Records Rooms

3. Typical glass vision panels installed in metal frames shall be of safety glass with acoustical, fire, smoke or other appropriate glazing seals unless otherwise required by the presiding codes.

4. The DC shall keep the types and quantities of hollow metal frame types window associated to HM frame design with or without transom or sidelights standardized and to a minimum number. Door sidelights windows and transom or borrow lights shall be designed to reflect the type of room, natural light needs for the corridor, and reflect the security interests of the School District .

5. The DC shall design hollow metal (HM) frames with as few intermediate vertical and horizontal muntins as possible or be consistent between types and divisions of sidelight or glass into separate panes or panel divisions. A consideration and use of surface applied glass muntins of steel shall be considered where possible to achieve the same effects as true divided HM framing with individual lights if that may be the case.

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## **B. Fire Resistive Properties:**

1. Fire-protection of door fire vision panels shall be based on testing and design requirements of the presiding code.
2. Fire resistive rating of interior windows as part of door hollow metal frame assemblies such as in, glass borrow lights, side lights, constituting one or more vision panels shall have assemblies complying with NFPA 80 and shall be labeled by a testing and inspection agency acceptable to the authorities having jurisdiction.
3. Both fire rated vision panels in hollow metal frames and in doors shall be afforded the safety of occupants according to hourly ratings and it is the DC obligation to validate or modify all vision panel opening protection requirements based on the requirements of their design and the presiding codes:
4. Glass sidelight, transom panels, or window panels, made of fire rated glass, or that use as part of a limited area sprinkler systems to wash the glass surface, shall be used in limited circumstances where all other design options have been explored by the DC. Such use of fire rated glass or limited area sprinkler systems shall be permitted only after careful consideration on a case by case basis and approved by the NJSDA.

## **C1020.90.2 Window Treatments:**

(See Section E2010 for location of components)

## **C1030 Interior Doors:**

### **A. General Requirements for Existing Construction: (Including Repairs, Renovations, Alterations, and Reconstructions)**

1. The NJ Rehabilitation Subcode NJUCC 5:23 subchapter-6 generally requires that If doors, frames, hardware, or safety glass are repaired or replaced in existing openings, the repair or replacement of constituent components shall not diminish the existing classification, accessibility, or egress capacity below that which exists at the time based on the requirements of the applicable subcode, or whichever is lower. Replacement of some of the components shall not prevent that the selective part or parts of the assembly shall not be replaced to comply with the current codes as an Alteration, Reconstruction, or Renovation.
2. The Design Consultant shall typically design doors in existing construction according to but limited to the following:
  - a. If doors and frames are replaced to meet new egress or life safety requirements they shall be installed according to unit of egress widths ~~of 22"~~ and which shall meet capacity calculation methods required by the NJ Rehabilitation Code.
  - b. All entrances shall comply with the requirements of accessibility standards of the state of NJ Subchapter 7 of the NJ Uniform Construction Code and the presiding ICC A117.1 2017. see <http://www.nj.gov/dca/divisions/codes/index.html>

# Model Schools: Materials and Systems Standards

c. Replacement of existing interior doors shall be made accessible wherever feasible, doors, frame, and hardware that are too difficult to change and make accessible by some limitations of the existing conditions, shall not be required to be changed however components such as hardware shall comply with the barrier free accessibility code to the maximum extent feasible.

## **B. General Requirements for Additions and New Construction:**

1. The DC shall typically design door openings and their appurtenant components the following general guidelines and criteria for new construction and new additions:

a. All doors shall be specified as to locations, door width, door leaf/quantity, and shall meet the presiding code requirements for handicapped accessibility, fire, and life safety egress.

b. All doors shall meet the required fire rating for opening protection, exit load capacities, and be located in partitions such that they provide safe egress travel distance to an exit and discharge to a right of way.

c. All doors designed as means of egress shall be designed such that they swing in the required direction of egress to provide safe means of egress without obstruction to stair landing or handicapped refuge, lead directly to an unobstructed right of way, and have a vision panel.

d. All egress doors with a required vision panel shall have the required type of vision glass, size, and location to provide visual and fire safety for the respective age group of occupants of the school. A vision panel for Pre-K is not the same height for adults and accommodation shall meet the required height for both when both are present for both age groups safety and protection.

## **C General Description/Design Approach:**

1. "The DC shall indicate in the door schedule all door and frame types, interior window types, and all glass to be incorporated into all interior partition assemblies. The schedule shall also include but not be limited indicating glass types including tempered, annealed, fire rated, wire, etc., and the associated drawings shall include elevations of all door and frame types, the dimensional sizes and quantities of all glass door vision panels, hollow metal frame thickness and dimensions that include location and size of all glass panels and doors incorporated into door frames as well as any misc. stand-alone interior window frames and their glass panel types and sizes.

2. Specialized Doors, not typically found in a school, such as recessed fire doors, fusible fire shutters, and specialized fire rated glazing, or door openings requiring water curtain, or other fire protective opening elements or devices as well as specialized acoustical door or related devices, are not considered typical interior doors in this section, however, may be used if the DC demonstrates to the NJSDA the need for such specialized opening protection or devices and is at a cost benefit to the design.

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3. All interior doors within the entire school shall typically be solid core 1-3/4" wood doors and shall meet the fire resistance and safety glazing requirements of the presiding codes unless otherwise indicated below.
4. 'Back of house'" doors and in particular doors in abuse areas such as in kitchen or related spaces (e.g. food storage, can wash, Dieticians office, kitchen help locker rooms, etc.) shall be painted 1-3/4 galvanized metal doors.
5. Mechanical room doors and related storage, electrical closets or other non- instructional spaces along principal corridors shall be solid core 1-3/4" wood doors otherwise shall be 1-3/4" painted galvanized metal doors.
6. Single or multiple privacy doors in series shall be omitted in student restrooms entry areas wherever possible and partitions shall be so designed along the entry path to maintain barrier free accessibility as well as visual and acoustical privacy.
7. Dutch doors maybe used for early childhood Pre-K to K toilet rooms in lieu of vision lights for student security and assistants and shall have hinge covers or continuous hinges and shall have hold open devices for upper section.
8. Acoustical consideration shall be given to all doors; however, specific attention shall be given to specialized hardware sets with enhanced door sound seals for instrumental and choral classrooms, as well as for auditorium and other related performance or rehearsal spaces when adjacent to instructional classrooms.
  - a. A core instructional classroom door assembly shall be 40 STC if a vestibule entry composed of two sets of doors with an STC of 30 or greater is within 30 ft. of the space.
  - b. For interior door assemblies with adjacent windows up to 10 sq. ft. that separate core learning spaces from adjacent corridors, stairways, offices, and conference rooms; the STC given to the door shall achieve a rating of 30 when the door is opened. If the door is separating a music room from corridors or stairways, the STC value shall be 40 STC when separating an adjoining corridor and shall achieve also an STC of 30 when separating a stair if they are either within 30 ft. from the door.
9. Doors to and from vestibules to auditorium shall be typically provided in a series however shall have sound and light isolation hardware when not employed in a series.
10. The DC shall coordinate in the door schedule any electrical devices associated to the door hardware such as but not limited to electrical door power assists or strikes for handicapped doors, electrical hold open, closing, or similar devices for fire protection.
11. All interior doors shall be standard size 7' -2" inch high doors in 2" increment widths. The DC may deviate from this requirement if the District and the DC demonstrates a particular need for deviating from such requirements.

## **D. Fire Resistive Properties:**

1. Fire resistive doors shall be as follows:

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- a. Doors shall be classified as a “non-rated” door or a rated “fire door” or “fire shutter”.
  - b. Doors shall be constructed according to requirements of a “fire protected openings” as defined by in presiding codes.
  - c. Shall comply with NFPA 80 “Basic Fire Doors and Fire Windows”
  - d. Shall meet requirements of the approved testing methods and inspection agencies acceptable to the authorities having jurisdiction.
2. Fire doors or shutters in ‘fire protected openings’ shall be labeled to withstand temperatures to afford service and safe passage consistent with hourly ratings listed below and it is the Design Consultant’s obligation to validate or modify all opening protection requirements listed below based on the requirements of their design and the presiding codes:
  - a. **Opening protection of 1-1/2 to 3hrs. are required for the following:**  
Fire walls or Fire barriers having a fire resistance rating of greater than 1hr. located in fire resistive interior partition assemblies of 1-1/2 to 4hr. rating.
  - b. **Opening protection of 3 /4 to 1hr. is required for the following:**  
Fire barriers having a required fire resistance rating of 1hr., such as for shafts, exit enclosures, smoke barriers, exit passageway, as well as for other fire barrier assemblies, located in fire resistive interior partition assemblies of 1 hr. rating.
  - c. **Opening protection of 1/3 to 3 /4 hr. are required for the following:**  
For Fire partitions for either ½ hr. or 1hr for corridor, or other fire partitions area separations walls, including 1hr. smoke barriers located in fire resistive interior partitions of ½ hr. to 1hr. rating.
3. Fire rated doors shall have an approved label permanently fixed to the door or frame that traces the door back to the manufacturer, trademark, or third party inspection agency.
  - a. The door must have an hourly rating tag.
  - b. The frame may be of the same or different certifying agency as the door but must be consistent with the label of the door.
  - c. Hardware and related components may be of different manufacture but shall not diminish the door rating.
4. Smoke and draft control doors shall meet testing and be labeled complying with NFPA 105 or UL 1784.2.
5. Fire door and related fire shutters shall be tested for the passage of flame and smoke consistent with testing requirements of side hinged or pivoted swing doors in accordance with NFPA 252 or UL10C and if the opening protection is a ‘fire shutter’, it shall be in according to NFPA 252 10B.
6. All components of “fire door” assemblies are interdependent on the use of consistent labeling for products for all components such as for hollow metal frame material, vision panels, and hardware. Any component that reduces the rating will subsequently reduce the rating of the overall assembly.



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## **E. Related Standardized Door Types and Details:**

Refer to the following details for additional information:

1. C1030-02 Door Types
2. C1030-04 Hollow Metal Door Details
3. C1030-05 Wood Door Details

## **C1030.20 Interior Entrance Doors:**

(See Section B2050.10 Exterior Entrance Doors for similar components)

## **C1030.20.1 Interior Wood Doors (WD):**

### **A. General Requirements:**

1. Wood doors shall meet WDMA Quality Standard: I.S.I 'Industry Standard for Wood Flush Doors' of the 'Window and Door Manufacturer's Association (WDMA).
2. Interior wood doors shall comply with 'Architectural Woodwork Standard' AWI Quality Standard, including Section AWI 1300 'Architectural Flush Doors' Doors, of the Architectural Woodworking Institutes' AWI and shall be constructed of structural composite lumber core, 1-3/4" thick 5-ply construction and shall exceed those of WDMA quality standard.
3. All interior wood doors shall be made to the following standards:
  - a. Quality standards of the WDMA I.S.1-A-21.
  - b. Custom Grade with "A" face slip matched plain sliced hardwood face grade veneer,
  - c. 5 ply, stave core, or structural SCL composite lumber with stiles and rails glued to the core.
  - d. Core shall be fire rated where required, horizontal or vertical auxiliary fire latches are not allowed.
  - e. Shall have a factory transparent finish conforming with AWI Finish System TR-4 conversion varnish or TR-6 catalyzed polyurethane
  - f. If the door is required to have a vision window, the frame shall be painted to match the adjoining wood finish.
4. The use of interior wood doors with mineral cores or in any other door types not described above are not permitted.
5. Interior wood door warranty shall be signed by manufacturer, installer, and contractor, for defective material, workmanship, installation, and finishing. Bows or twists shall not be over 1/4" in a 42" x 48" section and core construction shall not show telegraphing of core construction or face veneers exceeding .01 inch in a 3-inch span.



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## **C1030.10.2 Hollow Metal Doors (HM):**

### **A. General Requirements:**

1. Hollow metal doors assemblies shall include all hinged, fixed panel, and frames formed from carbon steel and shall comply with ANSI/SDI A250.8-2023 or current edition.
2. Reinforcing for steel doors shall be as is indicated in the specifications and standard details. Mineral wool shall be used in the core of the doors for sound deadening.
3. All Hollow metal Doors shall be made to the following standards:
  - a. Be heavy duty, 1-3/4" doors, with seamless construction,
    - 1.) Face sheets of cold rolled or hot rolled steel of .042" thickness, level 2
  - b. Be extra heavy duty, 1-3/4" door with seamless construction
    - 1.) Face sheet of cold rolled or hot rolled steel of .053" thickness, level 3
  - c. Shall meet NSI/SDI A250.3-2019 Test Procedure and Acceptance Criteria for Factory applied Finished Painted Steel Surfaces for Steel Doors and Frames
  - d. Where required shall have a vision window with a frame to be with a stile and rail construction painted to match adjoining finish.
  - e. Hollow metal doors shall typically have a closed cell insulated core for acoustical isolation and to minimizes sound travel to corridors from "back of house" spaces.
4. Hollow metal doors and frames shall be made of Metallic Coated Steel Sheet ASTM A653/A653M-23, commercial steel. Type B, with a minimum A40 (ZF180) zinc-iron-alloy (galvannealed or galvalume) coating designation or may be a Electrolytic Zinc-Coated Steel Sheet ASTM A879/A879M, commercial steel Class B coating, mill phosphatized.

## **C1030.40 Interior Coiling Doors and Counter Doors:**

### **A. Description / Design Approach:**

1. Roll down coiling doors, counter doors, and shutters shall be provided with locks and shall not have to move any equipment to reach the unlocking mechanism. The locks shall be on the kitchen side and easily accessible to the NJ Department of Health and any other District designated Kitchen Nutrition or other Agency or related Administrator for periodic inspections.
2. Roll down coiling doors shall be manually operated push up type up to 40 sq. ft, crank type length up to 12 feet. Roll down counter doors or shutters with greater size shall be provided with electrical motors and manual override. If shutter is located in a fire-rated partition, provide fire-rated shutter as required by the prevailing codes.
3. Roll down coiling doors at serving lines are to extend from the ceiling to the tray slide except at the milk dispenser where shutter must extend from ceiling to floor.

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## **C1030.90. Interior Door Supplementary Components:**

### **C1030.90.1 Hollow Metal Frames:**

#### **A. General Description/Design Approach:**

1. The DC shall design HM frames that reflect a modular approach to their design that permits ease of installation within CMU horizontal and vertical modular coursing to minimize field cutting of block.
2. The DC shall use wrap around frames wherever possible except where wall depths preclude their use. The depth and throats of frames shall be consistent with standard ranges of incremental sizes standard to recommended profiles in the (SDI) Steel Door Institute manufacturer's association manufactured standards.
3. If the HM frame package becomes overly complex, the DC must demonstrate to the NJSDA and District why the hollow metal frame types, sizes and quantities described in the drawings are justified. It is the intention to standardize and simplify types and quantities as exemplified in the NJSDA Construction Details Manual wherever possible.

#### **B. General Requirements:**

1. Hollow metal frames assume the rating requirements of fire or smoke door from the door which they are hung and do not require a tag for hourly rating. They shall be fire resistive for flame and sealed for smoke either by fully grouting the assembly when placed against CMU or fully wrapping gypsum board when placed in a NSLGF assembly.
2. Hollow metal frames designed to accept pairs of doors with exit hardware shall have a lockable vertical removable mullion between the doors. Main delivery doors in the loading and 'back of house' shall have no mullion to facilitate moving larger objects and shall have full astragal seals with overlap where necessary.
3. The use of knock-down hollow metal frames are not permitted.
4. Hollow metal frames shall be made to the following standards:
  - a. full size standard profiles with 2" face jamb and head widths (4" may be used at heads), with standard incremental depths to fit CMU and stud sizes.
  - b. Shall have widths that match Door widths standard to the door industry.
  - c. The frames shall be face welded, with all joints smooth ground, and shall be:
    1. .042" thick steel for level 2 type doors,
    2. .053" thick steel for level 3 type doors.
  - d. Shall typically in new construction shall have a minimum of three anchors per side of door in masonry openings'.
  - e. And shall have slip on drywall type anchors for NSLGF openings'.
5. Hollow metal frames shall have a hot dipped factory zinc coating and shall comply with ASTM A924/A924M-22a and ASTM A653/A653M-23 if used in kitchen or other areas where moisture is present.
6. Hollow metal frames shall have removable stops for the ease of broken glass replacement.

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**C. Fire resistive Properties:**

1. Fire resistive hollow metal door framing shall be consistent with the same hourly rating properties of general opening protections as described in the fire resistive properties of Section C1030 Interior Doors section and C1020.90.1 for Hollow Metal Framed Windows above.

**D. Related Standardized Hollow Metal Frame Types and Details:**

1. Refer to the following details for additional information:
  - a. C1030-01 Hollow Metal Frame Elevations
  - b. C1030-03 Hollow Metal Frame Details for CMU Openings
  - c. C1030-04 Hollow Metal Frame Details for GB-NSLGF Openings

**C1030.90.2 Hardware Requirements:**

1. The Design Consultant shall use a Hardware Consultant (HC) to specify and or review all hardware to insure that the quality, type of door hinges, bearing weight, and grades of finishes are consistent with the hardware manufacturers and are compatible with the door manufacturer's specifications so that the intended use of the door and hardware are compatible with each other and that neither warranties are violated.
2. The hardware supplier shall sign and seal all hardware schedules and submissions.
3. The HC shall specify magnetic hold open devices and latching panic hardware for all fire doors in stair towers tied to the building life safety system.
4. The HC shall specify that all egress fire doors shall have panic hardware with positive latching and closing devices for occupancies in excess of 49 occupants and for assembly use.
5. The HC shall specify fluid dampers on hardware devices to absorb shock and noise when serving instructional spaces.
6. The HC shall specify only the highest quality exit devices for safety, and long term cost savings to school maintenance departments.
7. The HC shall specify continuous hinges shall be used for all high volume doors such as for auditorium, gym and cafeteria, or similar multipurpose rooms.
8. The HC shall specify, that only individual keys and grandmaster key operate the principal's office, security office, secured storage records, kitchen, IDF, MDF, or other audio visual record or high security equipment rooms.
9. The HC shall specify smoke or other rated doors in the stage with closers that are consistent with the prevailing ADA accessibility standards.
10. The Design Consultant's hardware specifier shall specify interior door closers where required by code to be a parallel arm type rated for heavy use, supplied by a single manufacturer, and shall be surface mounted with hex nuts mounted to the non-public side of the door. Door hinges shall be fitted with ball bearing type hinges to maintain ease of use by handicapped.

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11. The hardware consultant must be thorough when specifying hardware such as but not limited to: closer travel arm limit stops, coordinators for pairs of doors, wall stops and related bumpers to prevent damage by doors against adjoining surfaces in high traffic locations.

12. The HC shall not specify cross bar arm type panic devices as they will result in pinching of fingers, instead use a touch pad with 'T' design to not extend full width for safety. All panic hardware shall be dead latching types with roller strikes.

## **C1090.90. 3 Window Guards (Interior)**

### **A. Description / Design Approach:**

1. Provide interior wire mesh guards over gymnasium office windows or other windows that must be protected from impact loads. Interior window guards shall be placed within the opening so that there is sufficient clearance to the glass to protect the glass from impact hazard and does not create a hazard by projection of mesh guard on the gym side of the opening.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section C20: Interior Finishes**

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# Model Schools: Materials and Systems Standards

## C20 Interior Finishes

### A. General Description / Design Approach

1. The following interior finish general descriptions, design approach and general requirements described herein are typically required by the NJSDA for new construction and shall meet the requirements of flame spread characteristics and testing requirements of the presiding NJ International Building Code (NJ IBC). New interior finishes adjacent to or surrounded by existing construction shall complement and not necessarily duplicate existing finishes and shall meet the requirements of the NJ Rehabilitation Subcode and relevant amendments.
3. There are general requirements that offer guidance to the DC regarding design practice, and specific concerns regarding material choice that effect performance, and where in some cases relate to particular problems in school design that should be avoided.
4. The interior finishes are divided into categories with descriptions and requirements of individual materials and systems for walls, floor and base, and ceilings to be used in NJSDA projects. Where necessary guidance is given in the form of preferences and performance based information to guide the DC on providing a minimum standard with which to generate school specific finish requirement.
5. At the end of section C2090, the DC has been provided with a Table of Typical Rooms and Finishes (TTRF) preceded by a legend of acronyms used to key the various room finishes and materials recommended for rooms found in NJSDA schools. In some cases there are several choices with which may equally share suitability for a finish in a given room however it is the DC's and the Districts choice based on the age of the student using the space, common district practices, cost basis, warranty, NJSDA preference, or any or all of the above that may dictate the level of performance and service requirement, that influences the ultimate selection of the appropriate material finish for a given space.
6. The DC shall choose interior finish systems and materials that are of high quality, are durable in performance for the intended use, and that balance minimum cost with long term life cycle maintenance and up keep. It is the Design Consultant's responsibility to demonstrate to the NJSDA through a Materials Systems Standards variance request process should finish material deviate from the Materials and Systems Standards
6. It is the DC responsibility to coordinate the guidance of this document with the particular needs of their school and that of the District. The TTRF is not intended to be all inclusive and as new materials and systems emerge in the marketplace and become proven in their performance in school design;
7. The DC has also been provided at the end of section C2090 a Schedule of Typical Paint Types and Substrates that may be referenced in the TTRF generically as a painted finish. It is the Design Consultant's responsibility coordinates the paint schedule and the typical room finish schedule to determine the suggested paint type.

### B. General and Specific Requirements

1. Ceramic tile shall typically be thin set in wet floor areas with drains set a ¼" below finish floor with a two feet by two feet sloped concrete drain pan surrounding the drain. At mud set floor areas, floor areas shall pitch to drains to eliminate standing water. For example where both

# Model Schools: Materials and Systems Standards

conditions may exist in kitchen spaces, wet areas with multiple floor drains shall be mud set while rooms or areas without drains such as dry storage rooms can be thin set.

2. The DC shall limit the use of gypsum board ceilings, soffits, fascias, and similar architectural features in the reflected ceiling designs. Those areas required to be of gypsum board shall be typically painted, and where normal use gypsum board would otherwise be typically used, shall be constructed of mold and moisture resistant gypsum board in moisture prone areas, and be of fiber reinforced abuse resistant gypsum board where subject to impact loads .
3. The DC shall coordinate locations of all wall, floor, and ceiling mounted mechanical, electrical, and plumbing (MEP) and fire protection (FP) devices and shall provide ceiling access to fire stat on kitchen exhaust hood and access panels for filter changes, controls or other above ceiling equipment and devices. Avoid shallow ceilings.
4. The DC shall specify that all wall and floor surfaces be typically be painted and finished or sealed with appropriate primers, paint, and top coating or wear surface finish based on the substrate material and wear characteristics. Block filler shall be used on all concrete block wall surfaces prior to painting.
5. The DC shall specify vinyl composition tile (VCT) products that are thru tile material composition of solid colors and shall be limited to the manufacturer's standard colors and finishes
6. The DC shall avoid complex VCT tile floor pattern design and limit it to no more than what is necessary for way-finding and to help identify constituent parts of the building.
7. The DC shall avoid cutting whole VCT tiles except at the perimeter against walls. There shall be with no custom insets, curves of complexity where non engineered edge to edge cuts may attract dirt and solvents from cleaning and potentially delaminate from the substrate. Any custom work will have to be justified by the DC and District on a case by case basis.
8. The DC shall specify color selections that coordinate with the lighting consultants cavity reflectance values appropriate to the illumination level required in the space and shall be responsible for end result color rendition. Dark or saturated hues shall be avoided and may be used as accents only. Colors shall generally be off white or tints that support the room's natural daylight orientation and compliment artificial light sources be they direct or indirect in their deployment.
9. The DC shall specify ceiling tiles with "hold-down clips" in all non-instructional unsupervised spaces to discourage unwarranted access to concealed space where vandalism criminal use such as in the concealment of weapons, drugs, or stolen property may be of a concern or where an impact load from below maybe an issue such as when balls are tossed in a multipurpose room or where students may jump to hit a ceiling in an under supervised public corridor or locker room.
10. All exposed ceilings open to public view including but not limited to exposed structure, and exposed MEP equipment, shall be painted with a prime and suitable top wear coat and specified accordingly in the Design Consultant's finish schedule and as per NJSDA approval.
11. The DC shall typically limit the use and location of wainscot wall finish materials to what is permitted as an option to typical finishes scheduled in the TTRF. Any specialized use shall require a demonstration to the NJSDA and District where applicable and approved on a cost and performance basis over standard approach to wall finish treatments

# Model Schools: Materials and Systems Standards

12. The DC shall avoid use of floor cover plates for outlets except where absolutely necessary to avoid traffic or hazards of power cord or other equipment cables. Cover plates for expansion joint shall be reduced in lengths, for plumbing cleanouts shall be located in walls, and for specialized floor access shall have seals that can be subject to punishment of cleaning solvents and other agent.

13. The DC shall avoid saddles or floor transitions at thresholds wherever there is high volume traffic or where carts or heavy equipment passes wherever possible.

14. There shall be no exposed concrete floors in any instructional spaces without being surfaced with a suitable wear floor finish and shall minimally be covered with VCT in the absence of any other specified finish except in in vocational shops.

15. The DC specify an independent testing authority to insure that all interior floor surfaces are cured, are within the range of level tolerances, all other surfaces are free from moisture or mold due to exposure during the construction cycle and the room or space has been conditioned to the proper room temperature to install finish product so to insure the validation and service life and warranty of the applied finish material.

## **C2010 Wall Materials and Finishes**

### **A. General Description Design / Design Approach**

1. The following wall finish materials described below by type shall typically be used throughout NJSDA school facilities. The materials described below use acronyms that are used in a master Table of Typical Rooms and Finishes (TTRF) in Section C2090 at the conclusion of Section C20.

2 Description of wall finishes that follow shall be used in conjunction with section C10 Interior construction, C1010 Interior Fixed Partitions, that include materials and descriptions of the supporting elements and wall construction types used to support the wall finishes described below.

a. ALL MATERIALS AND SYSTEMS INDICATED AS “SUBJECT TO APPROVAL BY THE AUTHORITY” MUST BE APPROVED BY THE AUTHORITY PRIOR TO THE FINAL ACCEPTANCE OF DESIGN DEVELOPMENT DOCUMENTS PHASE.

### **B. Related Standardized CAD Wall Details**

1. Refer to the following details for additional information:

- a. C1010-02,07 Acoustical Panel Detail
- b. C1010-03,08 Glazed Tile Wet Wall Wainscot Detail
- c. C1010-07 Sanitary Wall Panel Detail



# Model Schools: Materials and Systems Standards

## C2010.10 Tile Wall Finishes

### 1. Ceramic Tile (Glazed) (CTG)

The use of glazed tile shall typically be limited in use for wet wall surfaces behind plumbing fixtures where surface moisture is present such as in showers, and where maintenance, and chemical cleaning products are constant use. It may be designed as a wainscot or more typically in full height applications. Glazed ceramic tile shall be either a porcelain mosaic of 1/4" or glazed tile of nominal 5/16" thickness with a plain face finish. Accent colors or patterns shall include modest horizontal and vertical accents and color groups when specified shall be common across at least three material product suppliers.

#### Notes:

Generally, thin set method of wall tile installation shall be used in new construction. For existing construction a mortar bed and bond coat over a metal lath may be required depending on the subsurface condition and it may vary in thickness from 3/8" to thicker applications as per guideline used from the American Tile Council's current design handbook.

- a. An applied liquid membrane shall be provided for thin set wall tile installations where constant water is in use such as in gang shower areas ANSI A108.13.
- b. For tile grout subject to chemical exposure to cleaners specify epoxy mortar grout ANSI A108.6.
- c. For cementitious tile Grout subject to normal use ANSI A108.10
- d. Tile wall systems shall be installed according to guidelines and standards set by the prevailing current edition of the Tile Council of North America, Inc. Handbook with compliance to and specific concern for proper joint preparations, membrane separations, building expansion joints as well as related sealant joints and preparations required by other trades.

# Model Schools: Materials and Systems Standards

## C2010.20 Wall Paneling

### 1. Acoustical Wall Panel (AWP)

The use of acoustical wall panels shall be used in rooms where enhanced acoustical performance is desired. Though typically used as individual panels on masonry walls they may on occasion be applied on an entire wall surface when necessary. They are applied at the perimeter of music suites, cafeteria, on walls in auditoriums or multipurpose rooms and gyms to control room acoustics. Location and characteristics of the panels shall be coordinated with the projects acoustician and may be attached by a spline or be back mounted and may vary in their spacing, size, thickness, and density, depending on noise reduction coefficient (NRC) chosen by the acoustician and review by the NJSDA, and School District.

Acoustical wall panels shall be either a Type 1 or a Type 2. The facing materials shall be typically woven or non-woven polyester, or perforated vinyl fabric and shall have a flame spread consistent with the prevailing building codes and applicable testing agency as follows:

Type 1 Shall be a spline mounted edge reinforced abuse resistant panel for resistance to impact loads such as balls being thrown at them with a substrate of perforated water-felted, mineral-fiber board core or cement fiber board of density of not less than 20lbs per cubic foot with a min. NRC of between .60-.70

Type 2 Shall be a back mounted edge reinforced panel mounted to a rigid fiberglass core with edges chemically hardened to prevent warpage or damage of a density of not less than 6-7 lbs per cubic ft with a min. NRC of .80 NRC.

### 2. Wood Paneling and Wood Base Trim (WP),(WB)

Wood veneer paneling and base trim shall be limited to the proscenium and adjoining wall of an auditorium, or multipurpose rooms. It shall typically be a 7 ply glued,  $\frac{3}{4}$ " thick hardwood veneer plywood custom graded paneling, Panels shall be typically specified with a Grade A matching veneer face for transparent finish and a Grade B or better for opaque finish. Base trim shall be min.  $\frac{3}{4}$ " thick 4"-6" of hardwood species. Paneling and base trim shall be fabricated to a custom grade level in accordance with the American Woodworking Institute. Flame spread and wear finishes shall meet the prevailing building codes. Location and use of all of wood paneling and hardwood base trim shall be subject to a design review by the NJSDA and School District.

# Model Schools: Materials and Systems Standards

## **C2010.20 Wall Paneling (cont'd)**

### **3 Sanitary Wall Panels (SWP)**

Sanitary wall panels are primarily used as an abuse resistant finish over a wall partition subject to moisture, impact load, and abuse. It is often used over light gauge steel stud and gypsum board systems or where ball impact, moisture, and chemical cleaning agents would otherwise damage the substrate. It shall typically be a fiberglass reinforced plastic (FRP) sheet with thickness of .090" and be able to resist impact of 7.0 ft-lbs/in. when tested according to ASTM D256-23e1 test method A. It may also be in the form of a thicker 3/8" prelaminated wall panel with a fiberboard core. They shall have trim, moldings, and anchors consistent with the thickness and type of system and shall meet all fire and flame spread tests of the prevailing construction codes.

## **C2010.70 Wall Painting and Coating**

### **1. Paint (P)**

Painted finishes shall include all interior opaque interior surfaces, including exposed mechanical ductwork or other devices. Paints shall typically be a low (Volatile Organic Compound) VOC paint type and shall comply with the paint manufacturer's recommendations for surface preparation, type of material, and type of wear coat characteristics. Paints shall comply with prevailing codes and regulations and shall be used as per location in the Table of Typical Room Finishes and as per section C2090.10 and as listed in the Schedule of Typical Paint Types and Substrates C2090.20

## **C2010.80 Acoustical Wall Treatment**

### **.1. Sprayed on Acoustical Finish (SAF)**

Sprayed on acoustical wall finish shall be consistent with a similar material application for ceiling finish and shall consist of a sprayed on cellulose acoustical finish over an exposed gypsum wall board or CMU wall at the rear of a stage above the cyclorama, at the rear of the auditorium, or on other vertical surfaces required by the design consultants acoustician to attenuate sound. A typical application consists of a NRC for 1" thickness of .90 NRC on solid backing and .80 NRC on ribbed metal deck. A bond strength greater than 100psf per ASTM E736/736M-19(2023), shall be a fire tested consistent with a Class 1 Class A per ASTM E84-24/UL 723 assembly. The application shall be manufacturer certified as per ISO 9001:2015, and shall be Urea-Formaldehyde free. Colors are generally integral with the product.

# Model Schools: Materials and Systems Standards

## C2020 Interior Fabrications

### A. Column Covers (Under Development)

## C2030 Flooring

### A. General Description / Design Approach

1. The following floor finish materials described below by type shall typically be used for floor finishes throughout NJSDA school facilities. The materials described below use acronyms that are used in a master Table of Typical Rooms and Finishes (TTRF) in Section C2090 at the conclusion of Section C20.

2 Description of Floor Finishes that follow shall be used in conjunction with Section B1010.20 Floor Deck, Slabs, and Toppings. This section may include materials and descriptions of floor supporting elements and floor construction types used to support the following finishes described below.

a. ALL MATERIALS AND SYSTEMS INDICATED AS “SUBJECT TO APPROVAL BY THE AUTHORITY” **MUST** BE APPROVED BY THE AUTHORITY PRIOR TO THE FINAL ACCEPTANCE OF THE DESIGN DEVELOPMENT DOCUMENTS PHASE.

### B. Related Standardized CAD Floor Details

1. Refer to the following details for additional information:

- a. C2030-01 Resilient/Metal Edge Strip for Resilient Flooring
- b. C2030-02 Anchored Wood Floors
- c. C2030-03 Floating Wood Floors
- d. C2030-04 Floating Wood Floor (Stage/Platform)

#### 1. Ceramic Tile Unglazed (CTU):

The use of unglazed tile shall typically be used for floor and wall bases where surface moisture is present, and where maintenance, and chemical cleaning products are used. Unglazed ceramic tile shall be a porcelain tile of nominal ¼” thickness with a plain face finish. A slip resistant type shall be used in wet areas or where required for ramps where the wear surface is required to comply with friction coefficients required by the prevailing handicapped codes.

#### **Notes:**

- a. Generally, thin set method of floor tile installation shall be used in new and existing construction. **For wet areas with more than one floor drain provide thickset installation.**

# Model Schools: Materials and Systems Standards

## C2030.20 Ceramic Tile (Unglazed) (cont'd)

### 1. Ceramic Tile Unglazed (CTU) (cont'd)

- b. Thickset method can be specified in existing buildings to match existing or if existing nonstructural fill on top of structural slab can be removed to allow for the mortar bed depth specified. Under no conditions shall the existing structural slab be removed or disturbed
- c. Cold applied liquid waterproof membrane shall be provided for thin set floor tile installations. A sheet waterproof / separator membrane set in thin set shall be used as an alternative solution.
- d. Sheet membrane waterproofing shall be provided in areas that have thick set floor tile.
- e. Tile floor systems shall be installed according to guidelines and standards set by the prevailing current edition of the Tile Council of North America, Inc. Handbook with compliance to and specific concern for proper joint preparations, membrane separations, building expansion joints as well as related sealant joints and cover plates listed in other sections herein.

### 2. Ceramic Tile Unglazed Base (CTUB)

The use of unglazed integral cove base tile shall typically be water tight and impervious to moisture and shall be located surrounding gang showers and behind all wet walls of toilets consistent with the location of plumbing fixtures and where moisture and chemical cleaning products are consistently used. Glazed ceramic tile shall be a porcelain mosaic tile of a minimum of 4" high by a nominal 1/4" thickness with a plain face finish with eased edges to coordinate with inside and outside corners as required to be coordinated with 1" radiused CMU "bullnose" or other partitions that may be unclad with tile but require tile base trim. Radiused horizontal top edges shall be specified where the CTBU is the only vertical application used on the finish surface.

## C2030.25 Quarry Tile

### 3. Quarry Tile (QT)

Quarry tile is one alternative for floor finish in the kitchen, server, pantry and adjoining support rooms of the school as an alternative to Resinous Flooring Type 2. It is a material that is chemical, stain, slip and abuse resistant, long lasting, and has ease of maintenance.

# Model Schools: Materials and Systems Standards

## C2030.25 Quarry Tile (cont'd)

### 3. Quarry Tile (QT)

#### Notes:

- a. Quarry tile in kitchens is to be a mud set application utilizing sheet membrane waterproofing with allowance for proper slope to drains.
- b. Epoxy grout is to be used for quarry tile in kitchens. is non-porous and is resistant to many acids and chemicals found in food products and strong cleaning detergents. It also resists staining and does not promote the growth of bacteria.  
The formulation specified is high temperature resistant and will not soften when exposed to hot liquids or steam.
- c. For other locations, provide thin set application. For areas with drains, provide cold applied liquid waterproof membrane.
- d. See CTU item 2 above for additional notes.

## C2030.30 Specialty Flooring

### 1. Resinous Floor Epoxy (RFE)

A resinous epoxy floor shall typically be a nominal 1/4" thick three part coating system over a concrete floor that consists of a primer/bond coat, a second coat of a two part self-leveling coating with broadcasted quartz chips or sand aggregate and third part wear coat consisting of a clear two part epoxy sealer that creates a standard texture. It is excellent for its durability, is slip resistance, and resistance to stains and chemical cleaners. It shall have a rounded or nubby finish to reduce wear on mops and cleaning instruments.

### 2. Resinous Floor Urethane (RFU)

A resinous urethane floor shall typically be a nominal 1/4" thick two part urethane coating system over a concrete floor consisting of a first part application of a urethane self-leveling urethane formulation with infused broadcasted quartz aggregate and a second part consisting of a finish wear coat of a urethane sealer. It is excellent for durability, is slip resistance, is resistant to grease and moisture, is resistant to chemical cleaners and staining, and has added thermal shock properties for hot fluid spills. Is ideal in food preparation areas. It shall also have a rounded or nubby finish to reduce wear on mops and cleaning instruments.

### 3. Painted Concrete (PC)

Painted concrete is typically used for the concrete floor finish in the seating areas of auditoriums, storage, as well as maintenance rooms. Paints shall be a low VOC water based epoxy system over a latex based compatible primer. (See Schedule of Typical Paint Types and Substrates at the end of section C20.)

# Model Schools: Materials and Systems Standards

## C2030.50 Resilient Flooring

## C2030.51 Vinyl Composition Tile

### 1. Vinyl Composition Tile (VCT)

The use of vinyl composition tile is generally classified as a “resilient flooring” and is the most widely used flooring material throughout the school. It shall be typically a 12” x 12” x 1/8” thick “thru chip” tile meeting ASTM F 1066-23 with a slip resistant granulated surface where need for ramps and on other applications as required by the presiding codes.

#### Notes:

- a. Floating slab construction with a vinyl floor shall be specified for rooms that are located above occupied instructional spaces such as a library or an auditorium in new buildings or additions. (see section B1010.20 for additional details).
- b. See related specification for quality control standards of concrete slab construction, for leveling tolerances and curing of slab prior to application. (See section B1010.20 for additional details).
- c. Color shall be integral through the entire tile.

### 2. Vinyl Base (VB)

The use of vinyl base as with vinyl composition tile is generally classified as “resilient flooring” and is the most widely used wall base material throughout the school. It shall be typically 4” or 6” high x 1/8” thick in roll lengths with preformed outside corners as needed and shall meet ASTM F 1861, Type ~~TV-TS or TP~~, Group I or II, as well as all fire tests require by the prevailing codes.

### 3. Rubber Base (RB)

The use of rubber base is recommended in rooms where higher resistance to abuse and chemical is a concern such as for stair landings, shops, labs, and similar spaces. Rubber may be either a 4” or 6” high with a thickness of 1/8 inch. And shall comply with ASTM F1861-21 (or current), Type TS or TP, Group I or II.

### 4. Vented Rubber Base (VRB)

The use of vented vinyl rubber shall be typically used in conjunction with a resilient wood floor system and shall be a 4” high x 5/16” thick with a 3” long by 3/8” thick toe. The back surfaces shall be grooved with vertical semi-circular vents to ensure proper air circulation under a typical wood floor. In addition it shall meet performance requirements of ASTM F 1861-21, Type TS, Group I (Solid) and outside corners shall be used where required.



# Model Schools: Materials and Systems Standards

## C2030.52 Sheet Resilient Flooring

### 1. Resilient Sheet Floor (RSF) ~~Sheet Resilient Floor~~ (SRF)

Sheet resilient floor often referred to as a sheet seamless vinyl, rubber, urethane, or polyurethane composite floor is ideally used in multipurpose rooms where minimal physical activity may be present as well as in other spaces where a the minimal number of joints is highly desired to resist degradation by maintenance abuse, and to reduce spread of germs and exposure to chemical agents within joints. It shall typically be a single ply fully adhered sheet with a minimum thickness of ~~3/32"~~**0.080"** applied in rolled sections and seamed for a uniform surface over a concrete floor. Quality control of the concrete floor tolerance, moisture content and dryness are a critical part of the warranty and installation of this finish.

## C2030.53 Interlocking Rubber Flooring

### 1. Interlocking Rubber Floor (IRF)

The use of interlocking rubber floor shall be a cushioned removable floor made of an integrally joined tile system. It should be approximately 3/8" thick of recycled rubber, be of a single ply, with a non-laminated construction, and have a slip and stain resistant face. Additionally it should be, durable, non-absorbent, loose laid in a floating system, and be maintenance free, with an anti-microbial treatment to reduce bacterial growth.

## C2030.75 Carpeting

### 1. Carpet (CPT)

The use of carpet in schools shall be used for its durability, acoustical performance and aesthetic qualities. Carpet shall be a static and stain resistant broadloom of a minimum of 22oz., tufted or woven construction or static and stain resistant carpet tile with a minimum of 16oz, multi-level pattern loop construction. ~~with~~ **All carpet to have** a color gray scale rating of 4 or better and shall have a backing with a primary and secondary backing system impervious to water damage so as to provide a barrier to liquid ~~barrier~~ **and All carpet products shall have an be** anti-microbial **and have** ~~treatment with~~ a 20yr. warranty.

## C2030.80 Athletic Flooring C2030.81 Wood Athletic Flooring

### 1. Resilient Wood Floor (RWF)

Resilient Wood Flooring shall be either a "fixed or floating" anchored system consisting of a hardwood floor over multi layers substrate system that includes a synthetic cushion for resiliency and anchors when required. A resilient wood floor is typically provided in areas of physical activity that require an ability to absorb shock and impact weight imposed by the user. Activities include but are not limited to basketball, volleyball, calisthenics, and dance.



# Model Schools: Materials and Systems Standards

## C2030.81 Wood Athletic Flooring (Continued)

### 1. Resilient Wood Floor (RWF)

#### Fixed Systems (Anchored, or High Humidity Uncontrolled Environment)

A fixed wood floor system for new construction shall consist of northern maple strip hardwood flooring 2-1/4" wide by 25/32" continuous tongue and groove flooring attached to a 15/32" plywood subfloor a sleeper system with steel anchorage over 7/16" resilient (recycled) padding for cushioning shock when resiliency is required under an athletic or dance surface. It shall be spaced from the perimeter with a cavity for expansion and have a vented rubber base at its perimeter. It shall typically be a DIN certified system of second and better grade wood for high school gyms only, Third, second and better grades of wood may be used under bleachers, A stage may be use third grade or painted plywood and shall be meet the approval of the NJSDA and School District.

#### Floating Systems (Non-Anchored, Low Humidity Controlled Environment)

A floating wood system may be a low profile type for retrofit or higher profile type for new construction and shall consist of northern maple strip hardwood flooring 2-1/4" wide by 25/32" continuous tongue and groove flooring attached to a non-anchored floating double layer 15/32" (actual) plywood subfloor over a 7/16" resilient (recycled) padding for cushioning shock or over blocking at a (stage) when no resiliency but acoustical cushioning is still required. It shall be spaced from the perimeter for expansion and have a vented rubber base at its perimeter and shall typically be of second, third or better grade wood and shall meet the approval by the NJSDA and School District.

#### Notes:

- a. **A Fixed Wood Floor** shall be specified for gymnasiums that are located on grade or on the lowest floor level of the building or above a cafeteria or non-instructional space on any upper floor level when noise transfer is not an issue and where a controlled humidity environment is available.
- b. **A Floating Wood Floor** shall be specified for gymnasiums, stages and dance rooms that are located above any instructional space, libraries, and auditoriums in new or existing construction to reduce transfer to the structure or in conjunction with a double slab where in such circumstance where such vertical adjacencies cannot be avoided.

# Model Schools: Materials and Systems Standards

## **C2030.821      Resilient Flooring**

### **1. Poured Resilient Floor (PRF)**

Poured resilient floor referred to as a seamless poured urethane or polyurethane composite floor over a base mat of recycled rubber with structural and finish self-leveling layers. PRF shall be utilized as a multipurpose surface subject for light weight physical activity and sanitary applications such as for cafeteriums or gym/cafeteriums and other multipurpose rooms where food cleanup is shared with physical activity use. It is ideal for pre-school to youth. It shall be typically of solid color finish with a wear surface of ¼" over a basement shock layer of thickness of 7mm with thicker and thinner applications available depending on the use and activity.

### **2. Poured Resilient Cushioned Floor (PRCF)**

Poured resilient cushioned floor often referred as a seamless poured, urethane, or polyurethane composite floor over a base mat of recycled rubber cushioning layer with a structural and finish self-leveling layers. It is ideal when used as an effective alternative to cushioned wood flooring with low initial cost of ownership and maintenance as well as where multipurpose use such as sports impact loads of youth to young adult and where floor use is shared with a cafeteria use where food distribution/cleanup may be less of a concern than the impact loading of athletic usage. PRCF is used when more emphasis is placed on enhanced cushioning at a lower initial cost of ownership than a cushioned wood floor system. It shall typically be a DIN certified system, of solid color or of printed wood finish, with a wear layer of 2mm and a base mat shock layer of 7mm with thicker/thinner applications available. A PRCF is a viable option to a wood floor and is subject to NJSDA and District review.

## **C2030.85      Entrance Flooring C2030.85      Rubber Mat**

### **1. Rubber Mat (RM)**

A rubber mat shall be generally classified as a loose laid surface applied recycled rubber matt or a surface adhered recycled rubber product bonded to a rubberized substrate for the purposes of reducing the particulate matter from entering the school. The choice is often based on district preference.

## **C2050      Ceiling Finishes**

### **A.      General Description / Design Approach**

1. The following ceiling finish materials described below by type shall typically be used for ceiling finishes throughout NJSDA school facilities. The materials described below use acronyms that are used in the Table of Typical Rooms and Finishes (TTRF) in Section C2090 at the conclusion of Section C20.

# Model Schools: Materials and Systems Standards

## A. General Description / Design Approach (cont'd)

2. The ceiling heights shall comply with the current version of NJAC Title 6A:26 Educational Facilities Planning Standards and are to be established in conjunction with the Uniform Construction Code of the State of New Jersey Bulletin 00-3. These regulations shall form minimum requirements for the design and construction of NJ Public Schools.
3. Ceiling required fire ratings and separations are to be a UL approved floor/roof assembly consistent with the construction classification of the building and rating requirements for separations. It is the A/E's responsibility to demonstrate that all ceilings and floor finish systems are consistent with those requirements specified by the testing agencies and the applicable sections of the building codes.
4. Description of ceiling finishes that follow shall be used in conjunction with Section B1010.20 Floor Deck, Slabs, and Toppings. This section may include materials and descriptions of ceiling/floor supporting elements for suspended construction used to support the following ceiling finish systems described below.
5. The materials to be used in the design and construction of the school's Interior Ceiling Finishes shall typically be limited to those materials and finishes which are specified in this section of the Authority's Material and System Standards and parameters established herein.
  - a. ALL MATERIALS AND SYSTEMS INDICATED AS "SUBJECT TO APPROVAL BY THE AUTHORITY" MUST BE APPROVED BY THE AUTHORITY PRIOR TO THE FINAL ACCEPTANCE OF DESIGN DEVELOPMENT DOCUMENTS PHASE.

## B. General Requirements of All Ceiling Types

1. Where the NJDOE facilities efficiency standards requires, that in all new, alterations, reconstructions, and/or change of use of Instructional Space, as defined by the NJDOE facilities efficiency standards, shall meet the maximum noise levels, minimum Reverberation Time (RT), and Sound Transmission Coefficients (STC) requirements as described in ANSI / ASA Standard S12.60-2010 (R2015) (or current version), "Acoustical Performance Criteria, Design Requirements and Guidelines for Schools" as modified by the current version of the 21<sup>st</sup> Century Schools Design Manual: Design chapter and Criteria 1, "Acoustic Comfort".
2. Ceilings types in lobbies and corridors where youth and older students are present in High Schools and Middle Schools shall be abuse resistant mineral fiber composite panels (ACT-2). In Early Childhood and K to 5 schools corridors and lobbies ceilings may be designed as general purpose acoustical ceiling (ACT-1) with a higher durability option value as needed for corridors where youth age children might be present.
3. Gyms or multipurpose rooms that may have typically an exposed structure without a ceiling system shall have painted galvanized acoustical deck to acoustically dampen the space. If a ceiling is provided, such as in Pre-K to youth multipurpose rooms, an acoustical tile ceiling (ACT-2) with a minimum of 4 impact clips, or more per tile, shall be specified or as per the quantity recommended by the ceiling system manufacturer.
4. The DC shall design keep the design of soffits and ceilings of gypsum board construction limited where ever possible. Soffits and ceilings of gypsum board construction shall be used

# Model Schools: Materials and Systems Standards

primarily to hide utilities and building system components which would otherwise be exposed to public view and at ceiling height transitions where acoustical tile and grid system might otherwise be unsuitable to resolve geometries.

5. Framing for attachment of the gypsum board shall be on either a light gage framing system, a tee and runner type suspended grid system with accessories, or a “Black Iron” and hat channel suspension system.

6. The use of mold & moisture resistant high impact gypsum board shall typically be used in gang toilets, locker rooms or other spaces where moisture and abuse may be present

7. All systems shall be designed as per service load and code criteria with specific attention given to acceptable loading and seismic restraints as per prevailing codes.

8. If an exposed ceiling is provided, the design consultant shall ensure that duct work, MEP lines and other projecting elements are designed for impact exposure and do not provide areas to trap or damage balls and other equipment (eg. use round metal ducts or inflated fabric ducts). All structure and MEP equipment exposed to public view shall be painted.

## **C. General Requirements for Suspended Ceiling Systems**

1. Typical ceiling shall be 2' x 4' lay-in acoustical tile.

2. School Buildings and additions are to be designed for seismic forces as per NJ presiding codes and as such, suspended ceilings shall meet the manufacturer's certification of compliance for the general design requirements of ASCE 7 Section 13.2.1 and shall be based on analysis, testing, or experience data.

3. Ceilings shall be designed to meet seismic force requirements and design category determined by the project's structural engineers.

4. Sprinkler heads and other penetrations shall have clearances and tolerances around all ceiling penetrations consistent with requirements of seismic zone in the prevailing building code.

## **D. Support of MEP Equipment & Light Fixtures**

1. All mechanical equipment ducts, pipes, etc. regardless of weight, as well as all light fixtures (recessed, surface or pendant) weighing more than 80 lbs:

a. Shall be directly supported by the building structure with support hangers of rigidly attached black iron or a light gauge framing ceiling system so designed to support loads independent of the ceiling suspension system (carrying channels or runners).

2. Recessed, surface, or pendant light fixtures weighing less than 80 lbs:

a. Shall be either be directly suspended by the building structure with enhanced cables or hangers, or indirectly supported by the structure through rigidly attached light gauge framing or rigidly attached black iron ceiling so designed to support loads.

# Model Schools: Materials and Systems Standards

3. In no case shall a fixture may be supported on a ceiling grid of tees, and zee's without meeting criteria of the presiding NJ Building Code.

**E. Anti-Microbial Treatment:**

1. Coating-Based Antimicrobial Treatment:

Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273-21 (or current version).

2. Panel-Based Antimicrobial Treatment:

Provide acoustical panels treated integrally with an antimicrobial treatment in the matrix of the panel formulation that inhibits growth of mold and mildew.

**F. Clearances to MEP and FP Systems and Coordination Access Panels:**

1. Provide adequate clearances to all valves for servicing all above ceiling equipment. Verify accessibility and clearances to all required valves, filters, motors, etc. to allow for all regular maintenance and repair and replacement requirements. Provide properly sized access panels in all areas which do not have suspended acoustical ceiling. Avoid tight equipment clearances or shallow ceiling cavities that are too crammed with systems in ceiling cavities.

**G. Related Standardized CAD Ceiling Details:**

1. Refer to the following details for additional information:

- a. C2050-01 Acoustical Lay-in Tile Suspended Ceiling
- b. C2050-02 Gypsum Board Soffit and Suspended Ceiling
- c. C2050-03 Gypsum Board Pocket and Suspended Ceiling
- d. C2050-04 Gypsum Board Soffit "NO" Suspended Ceiling
- e. C2050-05 Gypsum Board Suspended Ceiling

# Model Schools: Materials and Systems Standards

## 2050.10 Plaster and Gypsum Board Ceiling Finishes

### 1. Gypsum Board (GB)

The DC shall limit the use of gypsum ceiling finishes to interior corridor soffits, rigid ceilings to resist impact loads where a hung ceiling might otherwise not be suitable such as in locker rooms and toilets. Decorative features such as 'Clouds' shall be reviewed on a case by case basis by the NJSDA and District. GB ceilings shall typically be painted and constructed with high impact/mold resistant treated gypsum wall board with a finish based on the schedule of typical paints and substrates at the end of section C2050.90 and as recommended in the TTRF. The cladding of suspended gypsum board may include other custom finishes such as wood or other veneer panels to be subject to reviewed by the NJSDA and District. The GB ceiling may be suspended at option from the floor/roof deck supporting structure with light gauge steel stud assemblies, on a black Iron type, or a grid type runners and tee suspension assembly system. All ceiling types and methods of supports shall be sized to be consistent with the loading and seismic requirements of the prevailing building code.

## 2050.70 Ceiling Painting and Other Coatings

### 1. Galvanized Acoustical Deck (AD)

The DC shall use a galvanized painted acoustical metal deck with air slots and sound absorbing material facing the interior for multipurpose rooms and expansive open ceiling spaces listed in the TTRF and as per the recommendations of the projects acoustician to reduce sound reverberation in the space. This may be used in conjunction with or at option to other acoustical attenuation measures such as acoustical 'clouds' or a partially hung acoustical tile system below a semi exposed ceiling cavity, or when a sprayed acoustical finish in the ceiling cavity may otherwise not be justified. The selection of galvanized acoustical deck shall be primarily based on room type and adjacencies.

### 2.. Exposed Ceiling (Exp.)

Any room listed in the TTRF as 'exposed' may be finished without a hung ceiling and may be exposed to the ceiling cavity above the space which may including but not limited to: ductwork, steel decking and framing of a roof or of a floor deck, plumbing and electrical systems. Any or all elements may be not require a finish other than what is required to meet the protection requirements of the exposed elements by the prevailing codes such as but not limited to intumescent paint or sprayed on fireproofing. However, when exposure is open to view the SDA and District shall decide if a painted finish is desirable such that it hides the exposed systems and that all labels, specialized equipment, acoustical properties, or other characteristics shall be carefully masked prior to painting,

# Model Schools: Materials and Systems Standards

## 1. Acoustical Tile (ACT-1)

### Acoustical Ceiling Tile ACT-1: General Purpose Use

**Size:** 2 x 4 by ¾ inch thick, Square Lay-in

**Material, Texture, Finish:** Wet-Mineral Fiber, Fine Fissured Medium Texture, White Latex.

**Properties:** Humidity Resistant, Anti-sag & Anti-Microbial, Either Durable, or of Higher NRC properties, Low to No VOC.

**Light Reflectance Coefficient:** Not less than 0.85

**Noise Reduction Coefficient:** 0.55-70

**Ceiling Attenuation:** CAC 35-40

## 2. Acoustical Tile (ACT-2)

### Acoustical Ceiling Tile ACT-2: General Impact Resistant

**Size:** 2 x 4 by ¾ inch, Square Lay -in

**Material, Texture, Finish:** Wet Mineral Fiber, Medium Texture, White Latex.

**Properties:** Humidity Resistant, Anti-sag & Anti-Microbial, Impact and Scratch Resistant, Low VOC.

**Light Reflectance Coefficient:** 0.87

**Noise Reduction Coefficient:** 0.50

**Ceiling Attenuation:** CAC 35

## 3. Acoustical Tile (ACT-3):

### Acoustical Ceiling Tile ACT-3: General High Acoustic Value

**Size:** 2 x 4 -1or 1-1/2 inches thick., Square Lay-in Cloud or Soundscape Shapes

**Material, Texture, Finish:** Fiberglass with Acoustically Transparent Membrane, Fine Texture, White

**Properties:** Humidity resistance: Anti-sag-Microbial, Washable, Impact, Scratch & Soil Resistant

**Light Reflectance Coefficient:** 0.90

**Noise reduction Coefficient:** 90.0 to 1.00

**Ceiling Attenuation:** CAC 200-210



# Model Schools: Materials and Systems Standards

## 2050.80 Acoustical Ceiling Treatment

### 4. Acoustical Tile (AcT-4)

#### Acoustical Ceiling Tile ACT- 4: General Wet, Humid and Chemical Use Areas

**Size:** 2 x 4, or 2 x 2 by 5/8, Medium Texture, Square Lay-in,  
**Material, Texture, Finish:** Ceramic/Mineral Fiber Composite,  
Medium Texture, Plastic White Finish

**Properties:** Humidity resistance: Anti-sag & Anti-Microbial,  
Washable, Scrutable, Soil & Chemical Resistant, No VOC

**Light Reflectance Coefficient:** 0.84

**Noise Reduction Coefficient:** NRC 0.55.

**Ceiling Attenuation:** CAC 38-40

### 5. Acoustical Tile (AcT-5)

#### Acoustical Ceiling Tile ACT- 5: Sanitary and Special Acoustical Use

**Size:** 2 x 4 by 5/8 inch thick, Smooth Textured, Non-  
perforated, Square Lay-in Edge

**Material, Texture, Finish:** Wet Mineral Fiber, Smooth Soil  
Resistant Polyester Film, White Finish

**Properties:** Humidity Resistance, Anti-sag & Microbial,  
Washable, Scrutable, Soil Resistant, Low VOC

**Light Reflectance Coefficient:** Not less than 0.83

**Noise Reduction Coefficient:** NRC 0.10

**Ceiling Attenuation:** CAC 40.

## 2050.80 Acoustical Ceiling Coatings

### 1. Acoustical Finish (SAF):

The ceiling finish shall consists of a sprayed on cellulose acoustical finish over an exposed steel deck or structure in a ceiling cavity above the stage and auditorium or on any other horizontal surface where acoustical enhancement is required by the design consultant's acoustician to attenuate sound. A typical application consists of a NRC for 1" thickness of .90 NRC on solid backing and .80 NRC on ribbed metal deck. A bond strength greater than 100psf per ASTM E736/E736M-19(2023) (or current version), shall be a fire tested consistent with a Class 1 Class A per ASTM E84-24/UL 723 assembly. The application shall be manufacturer certified as per ISO 9001:2015, and shall be Urea-Formaldehyde free. Colors are generally integral with the product.



# Model Schools: Materials and Systems Standards

## C2090 Interior Finish Schedule

### C2090.10 Table of Typical Rooms and Finishes (TTRF):

1. The following Legends identify typical materials and finish acronyms used in the preceding sections of C20 that are used to throughout the TTRF as follows:

~~2. Assumes schools interior walls are generally constructed of is Id~~

#### Legend of Floor and Base Materials and Finishes

<b>CPT</b> Carpet	<b>PRCF</b> Poured Resilient Cushioned Floor	<b>RWF</b> Resilient Wood Floor
<b>CTU</b> Ceramic Tile Unglazed	<b>QT</b> Quarry Tile	<b>SC</b> Sealed Concrete
<b>CTBU</b> Ceramic Tile Base Unglazed	<b>RFE</b> Resinous Floor Epoxy	<b>RSF</b> Resilient Sheet Floor <del><b>SRF</b> Sheet Resilient Floor</del>
<b>IRF</b> Interlocking Rubber Flooring	<b>RFU</b> Resinous Floor Urethane	<b>VCT</b> Vinyl Composition Tile
<b>PC</b> Painted Concrete	<b>RM</b> Rubber Mat	<b>VB</b> Vinyl Base
<b>PRF</b> Poured Resilient Floor	<b>RB</b> Rubber Base	<b>VRB</b> Vented Rubber Base

#### Legend of Wall Finishes

<b>AWP</b> Acoustical Wall Panel	<b>SAF</b> Sprayed on Acoustical Finish	<b>WP/WB</b> Wood Panel and Base Trim
<b>CTG</b> Ceramic Tile Glazed	<b>SWP</b> Sanitary Wall Panels	
<b>P</b> Paint	<b>EP</b> Epoxy Painted	

#### Legend of Ceiling Materials and Finishes

<b>ACT -1</b> Acoustical Tile General Purpose Use
<b>ACT- 2</b> Acoustical Tile General Impact Resistant
<b>ACT- 3</b> Acoustical Tile General High Acoustic Value
<b>ACT- 4</b> Acoustical Tile General Wet, Humid
<b>ACT- 5</b> Acoustical Tile Sanitary-Special Purpose Acoustical ( Project Acoustician to validate/specify use)
<b>GB</b> Gypsum Board, Moisture Resistant
<b>SAF</b> Sprayed on Acoustical Finish (Project Acoustician to validate/specify use)
<b>AD</b> Acoustical Deck (Project Acoustician to validate/specify use )
<b>EXP</b> Exposed to Structure and MEP Systems Above

# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Instructional Classrooms						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
General Classrooms Preschool to Early Childhood	VCT	VB	P	---	ACT-1	Includes coat storage areas
Self Contained Bathroom Preschool to Early Childhood	CTU/RFE	CTU/RFE	CTG/P	___+/-4'-6"	ACT-4	CTG on wet wall only
Classroom Storage Room	VCT	VB	P	---	EXP	
General Classrooms Early Childhood High School (Including Self Contained Spec. Ed. Classrooms)	VCT	VB	P	---	ACT-1	
Specialized Rooms						
Cafeteria	VCT	RB	P/AWP	---	ACT-1,3 or & SAF	See Room Ed Spec for use of either ACT-1 or 3 SAF, or AWP
Auditorium	PC/CPT	RB/WB	P/AWP SAF/WP	Wainscot height varies due to slope	ACT-3,5 or SAF & AD	See Room Ed. Specs. for SAF or AWP, WP, Carpet in isles surrounding seating, otherwise painted concrete,
Platform Stages Preschool to High School	VCT/CPT	RB	---	---	EXP/ SAF	See Room Ed. Specs. For specific finishes
General Purpose Stages Elementary School thru High School	RWF	RB	P/ SAF	---	EXP/ SAF	See Room Ed. Specs. for SAF use
Multi-Purpose Room Preschool to Middle School (Mixed functions such as Cafetorium, Gymnasium, Café-Gymnasium (see Ed. Specs.))	VCT/PRF/SRF	RB	P/SWP AWP	+/-4'-6"	ACT- 2,3,5 SAF or AD, EXP	See Room Ed. Specs. For PRF, or SRF AWP or SWP Padding at ends only
Gymnasium Preschool to Elementary School	PRF	RB	P/AWP	Padding	ACT-2 or AD, EXP	See Room Ed. For AWP Specs. Padding at ends only
Gymnasium Middle School to High School (With Multiple Teaching Stations)	RWF/PRCF	VRB	P/AWP	Padding	ACT-2 or AD, EXP	See Room Ed. Specs. For RWF or PRCF

# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Specialized Rooms						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Auxiliary Gymnasium	PRF/PRCF	RB	P/AWP	Padding	ACT-2 or AD,EXP	See Room Ed. Spec.
Wrestling Room	PRF	RB	P	Padding	ACT-2 or AD,EXP	See Room Ed. Spec.
Weight and Fitness Room	IRF	IRB	P	---	ACT-4	
Media Center	CPT	VB	P	---	ACT-1 or, ACT-3	ACT-1 of Higher Acoustic Value
Computer Room	VCT	VB	P	---	ACT-1	
Large Group Instruction	VCT	VB	P	---	ACT-1	
Science Labs or Science Demonstration Labs	VCT/RFU	VB	P/EP	---	ACT-1	See Room Ed. Spec.
Visual Arts Classroom	SRF/SC	VB	P	---	ACT-1or EXP	See Ed Spec., Kiln areas may have SC
Photography Lab	RFE	VB	P	---	ACT-4	
Instrumental Music	CPT/VCT	VB	P/AWP	---	ACT-3 w / ACT-5	See Room Ed. Spec. Acoustical reflectance tiles
Choral Music	CPT	VB	P/AWP	---	ACT-3 w / ACT-5	See Ed. Spec. Acoustical reflectance tiles
Vocal/Instrumental Storage	CPT	VB	P	---	ACT-1	
Music Ensemble Room	CPT	VB	P/AWP	---	ACT-3 w / ACT-5	See Room Ed. Spec. Acoustical reflectance tiles
Music Practice Room	See note	See note	See note	See note	See note	Modular Practice Rooms with integral finishes
Drama Classroom	VCT	VB	P	---	ACT-3	

# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Administrative Staff and Common Support Areas						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Dance Classroom	RWF	RB	P/AWP	---	ACT-3	
Vocational Lab 6-12 (Home Econ, Electronics)	VCT	RB	P/EP	---	ACT-1	
Vocational Shop (Auto Metals, Wood, Materials)	SC	RB	P/EP	---	EXP	
Instructional Greenhouse	QT/SC	QT/SC	P/EP	---	EXP	
TV Recording Studio, Green Room	CPT	VB	P	---	ACT-3	
Resource, SGI, OTPT, Special Ed., Basic Skills Classrooms	VCT	VB	P	---	ACT-1	
ISS Classroom (In School Supervision)	VCT	VB	P	---	ACT-1	
Career Center, Youth Based Services	VCT	VB	P	---	ACT-1	
Student Store, Ticket Office 9-12	VCT	VB	P	---	ACT-1	
Student Offices, Activities Rooms 6-12	VCT	VB	P	---	ACT-1	
Common Circulation Areas						
School Corridors , Main Public Lobby Areas	VCT	VB	P/EP	+/-4'-6"	ACT-1	Act-1 Ceiling of Higher Durability Value,
Vestibules	RM	RB	P/EP	+/-4'-6"	ACT-1	Act-1 Ceiling of Higher Durability Value,
Special Purpose Stairs, Treads and Risers	See note	See note	See note	See note	See note	Design finishes to be reviewed by SDA
Egress Stairs Landings, Treads and Risers	P	RB	P/EP	+/-4'-6"	EXP	EP for CMU,

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# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Administrative Staff and Common Support Areas						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Reception/ Main Waiting Area, Open Office	CPT/VCT	VB	P	---	ACT-1	See Room Ed. Specs.
Principal's, VP Offices	CPT	VB	P	---	ACT-1	
Admin. Secretary, Attendance Offices	CPT	VB	P	---	ACT-1	
Main Conference Room	CPT	VB	P	---	ACT-1	
Teachers Work Room/ Mail Boxes	VCT	VB	P	---	ACT-1	
Teachers Storage Rms.	VCT	VB	P	---	ACT-1	
Teachers/Admin. Toilets	CTU/RFE	CTU/RFE	CTG/EP	+/-4'-6"	ACT-4	See room Ed. Specs CTG on wet wall only
Attendance Office	CPT	VB	P	---	ACT-1	.
Child Study/Guidance Reception Area	CPT	VB	P	---	ACT-1	.
Child Study/ Guidance Staff Offices	CPT	VB	P	---	ACT-1	
Faculty Conference Rooms	CPT	VB	P	---	ACT-1	
Faculty Offices	VCT	VB	P	---	ACT-1	
Faculty Work Room	VCT	VB	P	---	ACT-1	
Faculty Dining Room	VCT	VB	EP/P	---	ACT-1	See room Ed. Specs.
Student Based Youth Services (SBYS) Reception/Offices	VCT	VB	P	---	ACT-1	
Student Assist. Counselor's Office (SAC)	VCT	VB	P	---	ACT-1	
Parent Resource and Community Room	VCT	VB	P	---	ACT-1	Higher Acoustical Value

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Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Administrative Staff and Common Support Areas						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Parent Liaison Office	VCT	VB	P	---	ACT-1	
Parent Toilet	CTU/RFE	CTU/RFE	CTG/EP	+/-4'-6"	ACT-4	CTG on wet wall only
Nurse's Suite (Including Exam, Dispensary, and Cot Areas)	SRF	VB	EP	---	ACT-1	
Nurse's Toilet	CTU/RFE	CTU/RFE	CTG/EP	+/-4'-6"	ACT-4	See Ed. Specs. CTG on wet wall only
Nurse's Storage	VCT	VB	P	---	ACT-1	
Librarian's Office	CPT/VCT	VB	P	---	ACT-1	
Librarian's Workroom	VCT	VB	P	---	ACT-1	
Technology Coordinator Office	VCT	VB	P	---	ACT-1	
Main Data Frame (MDF) Room	VCT	RB	P	---	EXP	
Gym Office	VCT	VB	P	---	ACT-1	
Gym Office Toilets	CTU/RFE	CTU/RFE	CTG/P	+/-4'-6"	ACT-4	CTG on wet wall only
Gymnasium, Equipment/Uniform Storage	PC	RB	P	---	EXP	
Locker Rms., and Visiting Team Rms. 6-12	CT/RFE	RB/RFE	P	---	ACT-4	
Gymnasium Training/ Physical Therapy Room	SRF/RFE	RB/RFE	P	---	ACT-4	
Stage Dressing Room 6-12	VCT	RB	P	---	ACT-1	
Stage Storage Prop Room	SC	RB	P	---	EXP/SAF	
Stage Projection Room	VCT	RB	P	---	ACT-3	

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# Model Schools: Materials and Systems Standards

Design Requirements

Interior Finishes – Section C20

Table of Typical Rooms and Finishes						
Administrative Staff and Common Support Areas						
Room Name	Floor	Base	Wall	Wainscot	Ceiling	Notes
Kitchen, Prep. Areas	QT/RFU	QT/RFU	P/EP	+/-4'-6"	ACT-5	
Kitchen Offices	QT/RFU	QT/RFU	P	---	ACT-5	
Kitchen Storage	QT/RFU	QT/RFU	P/EP	---	EXP	
Maintenance Office	VCT	RB	P	---	ACT-1	
Maintenance Lockers/Lunch Room	VCT	RB	EP	+/-4'-6"	ACT-1	
Storage Rooms	SC	RB	P	---	EXP	
Maintenance Repair Shop Area	SC	RB	EP	---	EXP	
Mechanical Equipment Rooms	SC	RB	EP	---	EXP	
Electrical/Data Closets	VCT	RB	EP	---	EXP	
Male/Female Student Toilets Male/Female Public Toilet Rooms	CTU/RFE	CTU/RF E	EP/CTG	---	ACT-4	CTG on wet wall only
M/F Individual Faculty/ Staff Toilets	CTU/RFE	CTU/RF E	EP/CTG	+/-4'-6"	ACT-4	CTG on wet wall only
Unisex Handicapped Toilets	CTU/RFE	CTU/RF E	EP/CTG	+/-4'-6"	ACT-4	CTG on wet wall only
Custodial Closets	RFU	RB	EP	+/-4'-6"	EXP	
Drinking Fountain Wall or Alcove	VCT	P/CTU	EP/CTG	+/-4'-6"	ACT-1,2	CTG on wet wall only
Security Office, Alcove Area	VCT	VB	P	---	ACT-1	

# Model Schools: Materials and Systems Standards

## C2090.20 Paint Schedule of Typical Paint Types and Substrates:

### A. Schedule:

The following Paint Schedule identifies typical paints used in the interior of NJSDA School Facilities and are categorized by substrate material and type of exposure. It is intended for general use as a performance specification to further clarify and offer guidance to the design consultant as to what type of paint system may be required in a given application when referenced by **(P)** in the TTRF above. For exterior painted finishes or special exterior coatings see Section B20.

- 1) Concrete Surfaces (Semi-Gloss): (Latex)
  1. Primer: Latex Wall Primer, 1.0 – 1.2 mils DFT/coat
  2. Finish Coats: Latex Semi-Gloss Enamel (34-45 units at 60°F.), 2.0-2.4 mils DFT/coat
  3. Surfaces: Concrete walls and concrete locker bases.
- 2) Concrete Surfaces (Gloss): (Water Based Epoxy System)
  1. Primer: Latex Wall primer, 1.0-1.2 mils DFT/coat
  2. Finish Coats: Water Based Catalyzed Epoxy (Gloss) (55-75 units at 60°F.), 2.5-3.0 mils DFT/coat
  3. Surfaces: Floors, stairs, striping on floors
- 3) Concrete Masonry Surfaces (Semi-Gloss): (Water Based Epoxy System)
  1. Primer: Pigmented High Solids/High Build Epoxy Polyamide Filler/Sealer, 30mils DFT/coat
  2. Finish Coats: High Solids, Epoxy Polyamine Coating, Gloss (75-95 units at 60°F.), 4.0-8.0 mils DFT/coat
  3. Surfaces: New masonry walls, graphics (not for use in high humidity areas).
- 4) Concrete Masonry Surfaces (Gloss): (Water Based Epoxy System – High Humidity)
  1. Primer: Pigmented High Solids/High Build Epoxy Polyamide Filler/Sealer, 30mils DFT/coat
  2. Finish Coats: High Solids, Epoxy Polyamine Coating, Gloss (75-95 units at 60°F.), 4.0-8.0 mils DFT/coat
  3. Surfaces: Showers and high humidity areas.
- 5) Metal – Ferrous (Semi-Gloss): (Alkyd Enamel System, Maximum VOC content 450 grams/liter)
  1. Primer: Modified Alkyd Resin Primer, 3 mils DFT/coat
  2. Finish Coats: Alkyd Enamel, Semi-Gloss (40-50 units at 60°F.) 3.0 mils DFT/coat
  3. Surfaces: Hollow metal doors, frames, door mullions, railings, ferrous metal surfaces
- 6) Metal – Ferrous (Gloss): (Acrylic-Latex System)
  1. Primer: 100% Acrylic, Waterborne, Gloss (60-80 units at 60°F)
  2. Finish Coats: 100% Acrylic, Waterborne, Gloss (60-80 units at 60°F.), 3.0 mils DFT/coat
  3. Surfaces: Hollow metal doors, frames, door mullions, railings ferrous metal surfaces
- 7) Metal - Galvanized (Semi-Gloss): (Acrylic Latex System)
  1. Finish Coats: 100% Acrylic, Waterborne, Semi-Gloss (30-40 units at 60°F.), 3.0 mils DFT/coat
  2. Surfaces: Hollow metal doors, frames, door mullions, railings ferrous metal surfaces



# Model Schools: Materials and Systems Standards

- 8) Metal – Galvanized (Gloss) Acrylic Latex System
  1. Finish Coats: 100% Acrylic, Waterborne, Gloss (60-80 units at 60°F.), 3.0 mils DFT/coat
  2. Surfaces: Hollow metal doors, frames, door mullions, railings ferrous metal surfaces
- 9) Wood – Painted (Gloss): (Acrylic Latex System)
  1. Primer: Pigmented Interior Modified Alkyd Primer, 2 mils DFT/coat
  2. Finish Coats: Vinyl Acrylic Gloss Enamel (65-75 units @ 60°F.), 2 mils DFT/coat
  3. Surfaces: Wood trim, etc.
- 10) Wood – Painted (Semi-Gloss): (Acrylic Latex System)
  1. Primer: Pigmented Interior Modified Alkyd Primer, 2 mils DFT/coat
  2. Finish Coats: Modified Acrylic Semi-Gloss Enamel (65-75 units at 60°F.), 2.0 mils DFT/coat
  3. Surfaces: Wood trim, etc.
- 11) Gypsum Board (Egg Shell): (Modified Alkyd System – Low V.O.C)
  1. Primer: Vinyl Acrylic Latex, 1.1 mils DFT/coat
  2. Finish Coats: Modified Alkyd Egg Shell (20-30 units at 60°F.), 2.5-2.8 mils DFT/coat
  3. Surfaces: Gypsum board surfaces, subject to moderate abuse
- 12) Gypsum Board –Painted (Semi-Gloss): Acrylic
  1. Primer: Pigmented Interior Modified Alkyd Primer, 2 mils DFT/coat
  2. Finish Coats: Modified Acrylic Semi-Gloss Enamel (65-75 units at 60°F.), 2.0 mils DFT/coat
  3. Surfaces: Gypsum walls, ceiling, bulkheads, graphics
- 13) Plaster Surfaces (Egg Shell): (Acrylic Latex System)
  1. Primer: Interior Modified Alkyd Primer, 2 mils DFT/coat
  2. Finish Coats: Vinyl Acrylic Egg Shell Enamel (10-20 units at 60°F.), 1.5 mils DFT/coat
  3. Surfaces: Plaster ceilings, bulkheads
- 14) Exposed Structure – Ferrous (Flat) (Waterborne)
  1. Primer:
  2. Finish Coats: Acrylic Waterborne (white) flat (0-10 units at 60°F.), 1 mil DFT/coat
  3. Surfaces: Exposed metal decking, trusses, structural steel, metal joists
- 15) Exposed Structure – Galvanized (Flat) (Waterborne)
  1. Finish Coats: Acrylic Waterborne (white) flat (0-10 units at 60°F.), 1 mil DFT/coat
  2. Surfaces: Exposed metal decking, trusses, structural steel.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section D: Services**

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# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section D20: Plumbing**

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# Model Schools: Materials and Systems Standards

## D20 Plumbing

### D2010 ~~Domestic Water~~ Plumbing Distribution

#### D2010.10 Piping (General)

##### A. Description

1. **Provide code compliant piping distribution systems necessary for building occupancy and use.** Extent of plumbing piping work to be indicated on Drawings and by the requirements of this Section including but is not limited to the following:

- a. **Materials - Piping**
- b. **Materials - Fittings**
- c. **Materials - Piping Nipples** ~~Joints~~
- d. **Materials - Unions**
- e. **Materials Dielectric Fittings/Unions**
- f. **Materials – Gaskets**
- g. **Materials - Cleanouts and Cleaning Screw Plugs**
- ~~d.~~ h. **Materials - Sleeves for Pipes**
- e. ~~Unions~~
- f. ~~Cleanouts and Cleaning Screw Plugs~~
- i. **Materials - Traps**
- ~~g.~~ j. **Materials - Escutcheon Plates**
- h. ~~Traps~~
- i. ~~Drain Bibs~~
- j. ~~Hose Bibs~~
- k. ~~Double Wall Pipe~~

##### B. Codes and Standards

1. Comply with applicable portions of the National Standard Plumbing Code, International Building Code, International Fuel Gas Code, International Mechanical Code and all other Federal, State, County, Municipal, Local Codes and ordinances having jurisdiction over this project. "The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards (<http://www.nj.gov/dca/divisions/codes/index.html>).

2. Standards listed below are referenced in this section.

- a. American Society for Testing and Materials (ASTM).
- b. American Standards Association (ASA).

# Model Schools: Materials and Systems Standards

- c. American National Standards Institute (ANSI).
- d. United States of America Standards Institute (USASI).
- e. Cast Iron Soil Pipe Institute (CISPI).
- f. National Sanitation Foundation (NSF)

## C. Delivery, Storage and Handling

- 1. Pipe materials to be properly protected, and undamaged.
- 2. ~~Specify that a~~ All piping to be shipped to job site with suitable caps, sheet metal covers or plugs. Pipe caps shall not be removed until just before installation
- 3. ~~Require a~~ All pipe and fittings to be examined before installing.

## D2010.11 Products (General)

### A. Materials - Piping

- 1. Piping specifications shall conform and convey the following as ~~applicable~~ **they apply to each plumbing system's Application Section:**
  - a. Hub and Spigot Cast-iron Pipe:
    - 1.) Evenly coated, cylindrical, smooth, and free from all defects, of uniform thickness and shall be of the grade known in commerce as "service weight". Each length of pipe and each fitting shall be plainly marked with the Manufacturer's initials or registered trademark and with the letters "SW" to indicate "Service weight". The marking may be cast, stenciled, or otherwise applied on the pipe so as to be clear and legible at the time of installation. The marking shall be cast on fittings and shall be located away from the spigot end so as not to interfere with proper joining upon installation. Cast iron soil pipe and fittings shall comply with American Society for Testing and Materials (ASTM) A74, latest applicable edition.
    - 2.) Each length of pipe and each fitting shall be plainly marked with the manufacturer's initials or registered trademark. The marking may be cast, stenciled, or otherwise applied on the pipe so as to be clear and legible at the time of installation.
  - b. Steel Pipe:
    - 1.) Black steel pipe and galvanized steel pipe shall be Grade A, seamless, electric resistance welded pipe, or type F furnace butt-welded, and shall be made in accordance with the current Edition of the ASTM A53 Specification. Pipe shall be free from scale, and rust, injurious sand marks, blisters, scale, pits, laminations, imperfect welds, or other defects that might affect its strength, appearance or ability to resist corrosion. The maker's name shall be rolled or stamped in the metal at intervals of each length of pipe 2" and larger, and stamped on a metal tag secured to each bundle of pipe 1-1/2" and smaller.

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2.) Unless otherwise specified or indicated on Drawings, black steel pipe shall be standard weight and galvanized steel pipe shall be Schedule 40 galv. pipe.

c. Brass Pipe:

1.) Seamless drawn red-brass pipe made in accordance with the current edition of ASTM B43, Specification made of an alloy containing not less than eighty five (85%) copper and not more than 0.05% lead, semi-annealed, regular weight. Pipe to be threaded on both ends with National Pipe Thread NPT, (Taper Pipe Threads) conforming to ANSI/ASME B1.20.1. The maker's name shall be stamped at intervals on each length of pipe and the pipe shall be color-coded White in accordance with The Copper and Brass Research Association standards.

d. Copper Tubing Type "K":

1.) Tubing shall be hard drawn seamless tubing manufactured in 20 foot lengths, in accordance with the Copper Development Association and ASTM B88, for below ground use only. Each tube shall be identified by means of color bars, green, running full length of each tube.

e. Copper Tubing Type "L":

1.) Tubing shall be hard drawn seamless tubing manufactured in 20 foot lengths, in accordance with the Copper Development Association and ASTM B88, for above ground use only. Each tube shall be identified by means of color bars, blue, running full length of each tube.

f. Ductile Iron Pipe:

1.) Ductile iron pipe shall have an outer coating of coal tar and shall comply with the requirements of the latest Standard Specifications of ANSI A21.51. Types of pipe shall be as follows:

- a) Push-on Joint Pipe: Pipe shall be for: use on yard drainage when indicated and shall be thickness class 51 for all sizes; use on House Sewers and shall be thickness class 56 for all sizes; use for water service piping, class 52 for three (3) & four (4) inch diameter pipe and class 56 for pipe size greater than four (4) inch. Pipe shall be Bell Joint **with EPDM gaskets.**
- b) **Mechanical Joint Pipe: Pipe shall be used for underground drainage when indicated, with EPDM gaskets, joint retainer glands, steel nuts and bolts.**

2.) Ductile iron pipe shall also comply with the following requirements:

- a.). Marking: the weight and class and other designated markings required by ANSI specifications shall be stenciled at the foundry on all ductile iron pipe, fittings and special markings shall be painted conspicuously in white on the outside of each pipe length, fitting and special casting after the shop coat has hardened.

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b.) Cement Lining: Pipe shall be cement lined, except when used in association with sewer piping, in accordance with ANSI, Standard A21.24, with thickness of lining to be 1/8" minimum. A plus tolerance of 1/8" shall be permitted on all sizes of pipe.

g. PVC Pipe:

1.) Standard weight (SCH 40) PVC pipe, CPVC shall comply with ASTM D-1784, D-1785 and HDPE shall comply with AWWA C906, ASTM F2164, F2620.-

h. Diesel Fuel Pipe:

1.) All above ground pipe, inside the oil storage tank and emergency generator rooms unless otherwise specified, shall be standard, full weight, Schedule 40, black steel pipe, ASTM SA53, Grade B seamless. All other piping to and from boiler room and emergency generator room shall be double wall. Carrier (inner) pipe shall be Schedule 40 ASTM A-53B and the containment pipe jacket shall be 10 gage carbon steel ASTM A139. All double wall piping shall slope back and drain to the generator room floor sump.

2.) Each length of pipe shall be stamped with the trademark of its manufacturer.

3.) The pipe to be installed shall be free of flaws, blisters, cracks and all other imperfections or defects which would impair its quality.

4.) All pipes shall be tested by the manufacturer under standard test pressure.

5.) All pipe threads shall be NPT standard, accurately and cleanly cut and perfect in every respect.

6.) Nipples shall be of the same material and weight as the pipes installed. The use of running nipples will not be permitted.

7.) Pipe sleeves shall be of standards weight, galvanized steel pipe and shall be provided as required.

8.) All fittings and connection shall be screw type except where indicated on the Contract Drawings, or specified herein.

9.) All fittings, unless otherwise specified, shall be galvanized malleable iron, Class 150 with a working pressure of 300 psi, at 150 degrees F.10.) Unions shall have bronze seats and shall be furnished and installed adjacent to, and on the downstream side of each threaded end valve and as directed by the Engineer.

10.) Flanged connections may be used where indicated on the Contract drawings and where necessary with the approval of the Engineer.

11.) Street side fuel oil supply connector: Storage tank fill lines shall terminate in a Spill Container, including a composite top seal; tight fill adapter and locking fill

# Model Schools: Materials and Systems Standards

cap. To prevent damage from frost heave, normal settling, or roadway traffic, the spill compartment shall have a flexible bellows protected by a ribbed gravel shroud. The noncorrosive resin spill compartment shall be readily removable to allow soil testing directly through the spill container without breaking the concrete. The drain valve shall close with tank pressure to help prevent leakage during tank testing or filling.

## B. Materials - Fittings

1. Fittings shall conform to the following;

a. Cast-iron Hub and Spigot Piping:

1.) Fitting shall be service weight pattern, evenly coated, manufactured in accordance with the current ASTM Standard Specifications A74 and shall correspond with the pipe in all particulars.

2.) Material used for Hub and Spigot caulked joints shall be molten lead and packed oakum.

3.) Push-on joint with neoprene gasket.

b. Where screwed pipe is used for storm water or sanitary drainage purposes, fittings and couplings shall be galvanized cast-iron, recessed and threaded drainage fittings conforming to ASTM Specification A 126, Class B, with smooth interior waterway and with threads tapped so as to give a uniform grade to branches of not less than 1/4" to the foot and keep the vertical lines plumb. Fittings for screwed vent piping shall be galvanized cast iron recessed and threaded drainage fittings.

c. Fittings for brass water supply piping shall be cast bronze threaded fittings, Class 125 working steam pressure, conforming to ANSI B16.15. They shall be made of cast bronze containing not less than eighty-five percent (85%) copper and five percent (5%) each of lead, tin and zinc. All connecting threads of pipes and fittings shall be NPT conforming to the requirements of ANSI B2.1. Exposed fittings for fixture connections shall be rough, plain, polished or chromium plated as specified.

d. Fittings for Type "K" copper tubing shall be cast bronze solder joint fittings suitable for soft-soldering and shall be in accordance with ANSI Std. B16.18-1973. Fittings for type copper tubing shall be wrought copper solder joint fittings suitable for soft-soldering and shall be in accordance with ANSI B16.22-latest adopted version Type "L" fittings shall have a minimum working water pressure of 150 PSI Solder shall be lead-free solder as per ASTM B-32.

e. Grooved Joints-Copper Piping: Rolled grooves, EPDM center legged gaskets, Ductile Iron housing, wrought copper or cast bronze fittings, rated for 300 psi working pressure. System shall be designed for rigid installation. Brazed flanges must be used at equipment connections, and for maintenance removal sections. **Submit certified brazing procedures and brazers.**

f. Fittings, joints and accessories for ductile iron pipe shall comply with the requirements of the latest Standard Specifications of ANSI A21.10 and ANSI A21.11. Types of fittings shall be as follows:



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1.) Fittings for mechanical joint pipe shall be mechanically restrained type.

2.) Fittings for push-on joint pipe.

g. Fittings for polypropylene plastic pipe shall be flame retardant schedule 40 polypropylene fittings. Materials shall be in accordance with ASTM D2146 and shall be fire retardant in accordance to ASTM test D635. Fittings shall be legibly marked with molded on letters showing manufacturer's trademark, pipe size of each socket, manufacturer's part number, N.S.F. - CW National Standards Institute listed for chemical waste, and symbol PPFR (polypropylene flame retardant) indicating the material.

## **C. Materials - Pipe Nipples**

1. All pipe nipples shall be of the same materials as the connecting piping.

2. The use of close nipples is prohibited.

## **D. Materials – Unions**

1. Unions 2" and smaller shall be threaded. Unions 2-1/2" and larger shall be flanged

2. Threaded unions on copper or brass pipe shall be brass, ground joint suitable for 300pounds W.S.P.

3. Threaded unions on steel pipe, unless otherwise specified, shall be of malleable iron with bronze ground seats suitable for 300 pounds W.S.P.

4. Flanged unions shall be cast iron for steel pipe, and brass for copper or brass pipe, gasket type suitable for 150 pounds W.S.P.

5. Flanged unions shall be provided with the necessary steel bolts, nuts and gaskets.

6. All unions used on galvanized piping shall be galvanized.

7. All unions used on chromium plated piping shall be chromium plated.

## **E. Materials – Dielectric Fittings/Unions**

1. Unions shall be rated at 250 psi at 180 or 280 F respectively per application and shall meet the requirements of ANSI B16.39. Pipe threads shall be in accordance with ANSI B2.1 and solder ends shall be suitable for brazing. **Submit certified brazing procedures and brazers.**

2. Flange fittings shall have a minimum rating of 175 psi and shall conform to ANSI B16.24 (Bronze), B16.42 (Iron).

## **F. Materials – Gaskets**

1. Gaskets for cold and hot water services shall be full face gaskets. The retaining gasket shall be made of 1175 fabric inserted rubber sheeting and shall be pre-cut at the factory for standard 125 pound cast iron flanges and fittings and for 150 pound raised face steel flanges and fittings.

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## G. Materials - Cleanouts and Cleaning Screw Plugs

1. Cleanouts shall conform to the features of the cleanouts contained in the schedule below. The manufacturer's numbers are for the purpose of type only. The contractor shall submit manufacturer's product technical data for each type required before installation for approval.

a. Gasket seal plugs will not be accepted in place of taper thread plugs.

b. Cleanout plugs shall be bronze and countersunk type with taper screw threads.

c. Cleanouts ~~for within~~ membrane waterproof floors and roof slab shall be furnished with an integrally cast flashing flange with flashing clamp. Cleanouts in unfinished areas shall have cast iron tops and covers; ~~and~~ in finished areas shall have nickel bronze tops and covers.

d. Cleanouts ~~for within~~ cast iron pipe, galvanized steel ~~and or~~ PVC pipe being located in exposed horizontal runs ~~and shall be~~ made accessible.

e. Cleanouts and Cleaning Screw Plugs for Acid Drainage Piping:

1.) Floor cleanouts ~~flush with floor~~ shall be flush with floor and of silicon iron material. All other cleanouts shall be of the same materials and by the same manufacturer as the piping to which they are connected.

f. Wall access covers shall have vandal proof screws.

## H. Materials - Sleeves for Pipes

1. Sleeves and materials for sealing sleeves for gas piping through exterior walls, ~~and~~ floor slabs, and slabs on ~~grade~~ earth shall be as specified and approved by the Gas Utility Company.

2. Sheet metal sleeves shall be 20 gauge Minimum.

3. Pipe sleeves shall be service weight cast iron pipe or schedule 40 galvanized steel pipes or larger weight as applicable.

4. Fire stop penetration materials for sealing sleeves shall be listed by Underwriters Laboratories.

5. Material for sealing spaces between pipe and sleeve through foundation walls below grade shall be Link-Seal Type "C" or approved equal, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve. Links shall be loosely assembled with bolts to form a continuous rubber bolt around the pipe with a pressure plate under each bolt head and nut. Link-Seal pressure plates shall be Type "C" (insulating type) to provide for electrical insulation and cathodic protection.

6. Materials for sealing space between each pipe and sleeve through non-fire rated exterior walls above grade shall be Non-shrinking cement.

7. Waterproof sleeves shall be similar to Link-Seal type wall sleeve or approved equal.

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## I. Materials - Traps:

1. Brass traps shall be heavy pattern cast brass conforming to the National Standard Plumbing Code and in accordance with the current ASTM standard specifications. All cast brass visible traps shall be chrome plated.
2. Cast-iron and silicon iron traps shall be extra heavy pattern, manufactured in accordance with the current ASTM Standard Specifications.
3. Traps associated with drains placed in slab on grade shall be deep seal type with floor cleanout with adjustable housing ferrule and cover. **Provide with trap primer- connection for unoccupied areas.**

## J. Materials - Escutcheon Plates

1. Galvanized cast-iron with set screw.
2. Galvanized cast iron escutcheons with set screw shall be chrome plated for use in finished rooms or spaces.
3. Chrome plated cast brass with brass set screws

## K. Materials - Drain Bibs

1. Drain Bibs shall be 1/2" heavy brass compression faucets with plain end **and recessed lockable wall box.**
2. Drain Bibs in the supply connections under the lavatories and wash sinks shall have lock shields and loose keys. Exposed drain bibs and lock shields shall be chrome plated.

## L. Materials - Hose bibs

1. Hose bibs shall be 3/4" brass with integral vacuum breakers and dual check valve, nickel plated finish, vandal resistant cap, **and recessed lockable wall box.**

## D2010.12 Installation

### A. Piping

1. The run and arrangements of all pipes shall be approximately shown on drawings or specified and as directed during installation, and shall be as straight and direct as possible, forming right angles or parallel lines with building walls and other pipes, and neatly spaced. No piping shall be installed where the headroom will be interfered with unless the conditions are such that it is unavoidable and permission is obtained from the NJSDA. Offsets will be permitted where walls reduce in thickness or beams interfere with direct runs; offsets shall be made at an angle of 45° to the vertical; in no case shall the space between the pipes, partitions, walls, etc., exceed 5". All exposed risers shall be erected plumb, standing free, close to and parallel with walls and other pipes and be uniformly spaced. All horizontal runs of piping hung from structural floor, slab or floor beams shall be erected as closely as possible to bottom of floor slabs, ceilings, or I-beams as the case may be. In no case shall the headroom, beneath the pipe, be less than (7'-0") where the pipe is installed more than (1'-0") from wall, partition, etc., except where piping is required to be installed in Boiler Room and Mechanical spaces above floor. Horizontal piping shall be so graded as to drain to the low points and water lines to drain bibs. All piping installed in floor shall be painted with a heavy coat of asphaltum. All piping shall be installed with ample space for pipe

# Model Schools: Materials and Systems Standards

covering. All exposed plumbing piping in the Kitchen Areas shall be chrome plated brass pipe except for gas line. Provide threaded fittings. Chrome (silver) paints will not be accepted.

2. Roughing construction, underground or concealed in the floor or wall, shall be properly installed, tested and inspected before any of the roughing is covered up. Should any work be covered up before being inspected and tested, it shall be uncovered and recovered at the expense of the installer. Plugged fittings shall be installed when called for. Reducer fittings shall be used in making reductions in sizes of pipes; bushings will not be allowed. Suitable air chambers or Water Hammers Arresters shall be provided as called for in other sections.

3. All lines of piping and branches for fixtures passing through or in connection with waterproofing shall be brought to the proper locations and levels so that fixtures and piping may be installed without disturbing the waterproofing.

4. For work in existing buildings the following additional requirements shall be adhered to:

a. Piping shall run as straight as possible with the fewest number of changes in direction. Provide variations from the layout as shown on the Drawings as existing conditions may require, as approved by the Design Consultant and the NJSDA at no extra cost to the NJSDA. Provide piping without sharp bends, quick changes of sections, pockets or bushings.

b. Specify that the Contractor shall field verify the exact locations of any existing piping systems to remain and coordinate the new piping system layouts as required, at no additional cost to the NJSDA.

c. Design Consultant shall consider the location of all existing infrastructure including equipment, ductwork, piping, electric conduits, structure, etc., in the design of new system layouts. Relocation and rerouting of existing systems to accommodate new shall be noted on design documents.

d. Wherever existing branch piping interferes with installation of new branch piping, the existing branch piping shall be removed and re-routed to accommodate the new work. The rerouted work shall be of all new materials.

e. Specify that all new extensions and relocations of existing piping systems in occupied areas shall be concealed in existing or new walls, floors, ceilings, pipe chases or as otherwise specified.

f. Specify that abandoned piping shall be removed and capped at main. No dead end legs are permitted to remain.

g. Specify that all existing or new hot and cold water branches from mains and risers shall contain isolation valves.

## **B. Piping Joints**

1. Cast Iron Bell and Spigot Type-

a. Joints in cast-iron bell and spigot piping shall be caulked joints made with packed oakum and molten lead, 12 ounces of which must be used for each inch in diameter of

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the pipes at each joint and must be poured in at one time. The lead to be used for this purpose shall be soft "Pig" or "Bar." After cooling and shrinking, the lead shall be thoroughly caulked and the joints made impermeable to gases and liquids, and also be capable of withstanding the tests applied. The face of the lead joints shall finish flush with the face of the hub and be left without putty, paints or cement. Whenever joints are made on the floor or surface they shall be re-caulked after being placed in position.

b. Push-on joint in cast-iron bell and spigot shall be of a molded gasket made of neoprene. As the spigot barrel is forced into the gasket, the gasket is compressed and completely seals the joint both in displacement and compression.

2. The joints of steel and brass piping shall be screwed joints of full length and threads shall be NPT conforming to the requirements of ANSI B 2.1. All pipes shall be screwed close up to their shoulders. The use of lamp wick is prohibited in threaded joints. All burrs shall be removed. Pipe joint cement or Teflon tape shall be used only on male threads.

3. Joints in type "L" copper tubing and type "K" copper tubing shall be soft-soldered joint. All surplus flux shall be wiped off immediately after completion of the soldering. ~~Contractor may use mechanically formed Tee connections in conjunction with copper piping.~~ **Contractor to use pre-formed Tee fittings.** The maximum diameter of branches shall be 2, 1/8". Joint shall be brazed. **Submit certified brazing procedures and brazers.**

4. Joints between galvanized steel and cast iron pipes shall be caulked joints as specified for cast iron piping.

5. Joints for ductile iron mechanical joint pipe shall be made by using ductile iron mechanical joint retainer glands, **tee head nuts and bolts for tightening.**

6. Joints for PVC and cast iron hub and spigot pipes shall be by caulking with lead and oakum or by use of compression gasket.

7. Unions shall be used to connect equipment (pumps, circulators, tanks, meters, etc.) to water lines. The union shall be installed as close to the equipment as practical. Where valves are adjacent to equipment, union shall be on downstream side of valves.

8. Dielectric fittings and unions shall be installed where ferrous piping joins copper tubing or brass piping.

## C. Cleanouts and Cleaning Screw Plugs

1. Specify and or include cleanouts in the following locations: on all traps (except traps integral with floor drains), at the end of and at all points in change of direction of all drain pipes and branch drains, at all offsets, at the ends of all branch soil and waste pipes, and located in runs not more than fifty (50'-0") feet on center, and at all points to make accessible all parts of the drainage system.

2. For underground lines the cleanouts for drains, traps, or branches shall extend up to grade and finish flush with finished level surface or made accessible with brick pits with cast iron frame and covers.

3. Cleanouts in connection with vertical cast iron pipe above the cellar, except the traps and fittings on horizontal branches, shall have tapped tee fittings; same size as pipe, closed with

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bronze screw plugs. All other cleanouts in connection with cast iron pipes, traps and fittings shall have heavy full size cast iron ferrules, same size as pipes or fitting, caulked into hub and closed with bronze screw plug.

4. All cleanouts in connection with galvanized steel pipe, traps and fittings shall consist of drainage fittings closed with bronze screw plugs of heavy pattern. All cleanouts for silicon iron pipe shall be silicon iron, with silicon iron bolted covers, except cleanouts flush with floor.

5. Plugs used for cleanouts shall be same size as the fittings up to and including 4 inches. Sizes above 4" shall be reduced to allow for 4" cleanouts. For house traps 8" and larger plugs allowing for 6" cleanouts shall be used.

6. Cleanouts occurring in membrane waterproof floors shall be provided with a flashing clamp device secured with brass bolts. Cleanouts in unfinished areas shall have brass or bronze tops and cover. Cleanouts in finished areas shall have polished nickel bronze tops and cover. Provide cleanouts with spanner type vandal proof screws.

7. Indicate cleanouts at the base of all soil, waste and storm water leaders, and at all changes in direction on horizontal piping.

8. Specify or otherwise indicate a complete list of the locations of access doors and frames for cleanouts located in or behind walls.

6. Cleanouts on 3" and larger pipes shall be installed so as to allow clearance of at least 18". Cleanouts on pipes less than 3" shall be installed so as to allow at least 12" of clearance.

## **D. Sleeves for Pipes**

1. General: All plumbing pipes passing through floors, roofs, walls, partitions, furring, beams, trenches, and wherever else indicated on drawings shall be shown with sleeves installed. Core drilled holes shall be provided with sleeves. Where plumbing pipes pass through potentially wet floors that do not have membrane waterproofing such as toilet rooms, cafeteria kitchens, serving areas, dish washing room, janitor's sink closet, mechanical equipment rooms, pipe chases and areas that are provided with fire protection sprinkler systems, design to show sleeves of galvanized steel pipe with welded clips or equivalent at bottom ends for securing sleeves to form work and shall project one inch above finished floors, and shall be caulked watertight.

2. Sleeves for gas service piping through exterior walls below grade and floor slabs on earth shall be installed and sealed in accordance with the latest regulations of the Administrative Code of New Jersey. Sleeves for gas piping and gas vents through exterior walls shall be installed and sealed in accordance with the requirements of the serving utility. The space between each pipe and its sleeve through floor slabs on earth and exterior walls above grade for all other piping shall be sealed tightly with picked oakum and molten lead. The lead caulking shall finish flush with the face of the sleeve. The space between each pipe and its sleeve through exterior walls below grade for all other piping shall be sealed tightly with link seals.

3. For interior walls and floors and for pipes through roof, specify that the space between each installed pipe and its sleeve shall be sealed with a three hour rated fire stop penetration material. Fire stop materials shall be installed in accordance with the instructions of the manufacturer.

4. Sheet Metal Sleeves.

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a. Sleeves for pipes passing through floors, partitions, hung or furred ceilings, shall be installed with 1/2" maximum clearance all around pipes. Each sleeve for a pipe passing through an interior floor slab shall be fitted with a 1" flange, or equivalent, at the bottom end for the purpose of securing it to the form work or sheet metal deck. The sleeve shall finish flush with the top of the finished floor. Sleeves for pipes passing through partitions, hung or furred ceilings shall be of one piece construction and shall finish flush with the finished surface.

b. Sleeves installed for pipes passing through vent ducts shall be securely fastened, soldered and made airtight.

## 5. Pipe Sleeve:

a. Specify that the contractor is to install pipe sleeves for all pipes passing through roofs, concrete beams, and brick walls, foundation walls and floor slabs on grade, etc. Sleeves shall be installed with 1/2" maximum clearance all around pipe and shall finish flush with the surfaces penetrated. Pipe sleeves for pipes through roof shall be made of service weight cast iron only.

6. Sleeves through foundation walls below grade shall be provided under General Construction Work.

## E. Traps

1. Install traps full size of the piping to be shown on drawings. All traps, ~~except integral trap with floor drains,~~ shall have bottom cleanout or floor cleanout.

## F. Escutcheon Plates

1. Chrome plated solid cast iron one-piece escutcheon plates with set screw on exposed pipes passing through walls, partitions, floors and ceilings, in finished rooms and spaces.

2. Galvanized solid cast iron one-piece escutcheon plates with set screw on concealed pipes passing through walls, partitions, floors and on exposed piping in unfinished rooms and spaces.

3. Chromium plated cast brass one-piece escutcheon plates with brass set screw on waste and water supply piping at all plumbing fixtures including lavatories, drinking fountains, cabinet sinks, wash sinks, etc.

4. Plates shall fit snugly around the pipes and shall be fastened in place before pipes are insulated or concealed. .

5. Split type escutcheon plates are not acceptable.

## G. Drain Bibs

1. Specify Drain bibs shall be provided in the following locations:

a. At the base of all water risers.

b. At low points of water lines.



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~~c. On the hot supply branch under one fixture in each room; including warming pantry and kitchen area, having a floor drain.~~

dc. Where supply piping to fixture is concealed or only Barrier Free Lavatory or Barrier Free Wash Center is installed, the drain bib shall be wall mounted 18" above the finished floor adjacent to the fixture in each room having a floor drain.

ed. Provide at all other points as indicated on Drawings.

## H. Hose bibs

1. **Provide insulated freezeless wall hydrants with lockable recessed wall box located a maximum of 100 feet apart on each building façade and roof.** Provide ~~adequate~~ hose bibs on the exterior of the building for all required maintenance functions, watering of landscaping, and as specified in the DOE approved Educational Specifications.

## I. ~~Pipe and Fitting Schedule~~

~~1. Domestic Hot & Cold Water (Above Ground Interior):~~

~~a. Type L (blue color bar) copper tubing with wrought copper solder joint fittings suitable for soft soldering; Brass, seamless drawn pipe, regular weight with cast bronze fitting; Groove copper pipe and grooved fittings for 2" and above. Provide copper tubing for short branch connection to plumbing fixtures.~~

~~b. Exposed Piping Serving Laboratory, and Food Service Equipment, Except Piping Installed within Cabinets, and not Exposed to View: Polished, chrome plated brass pipe with cast brass fittings, and threaded joints.~~

~~2. Domestic Water 1 and Non-Potable Water (NW) (Service Underground – Exterior):~~

~~a. 2 1/2" and Less: Type K soft annealed copper tube with cast bronze solder joint fittings; Brass, seamless drawn pipe with threaded fittings.~~

## I. ~~Pipe and Fitting Schedule (Continued)~~

~~b. 3" and Up: Ductile iron (Class 52 for 3" & 4" and Class 56 for 6" & up) and fittings with mechanical or push-on joints.~~

## D2010.40 Domestic Water Piping

### A. General

#### 1. Description

- Design with components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
- Domestic Water Service Piping: 160 psig.
- Domestic Water Distribution Piping: 125 psig.

#### 2. Quality Assurance



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- a. All piping materials shall bear label, stamp, or other markings of specified testing agency.
  - b. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
  - c. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9."
3. ~~Verify that~~**Provide** complete domestic cold and hot water, **gas, sanitary and vent, and storm** piping riser diagrams ~~are provided~~ clearly showing all system components and pipe sizes, including domestic water heaters, **system pumps, plumbing fixtures and equipment.** ~~and~~ Assure ~~they~~ **riser diagrams** indicate water temperatures per National Standard Plumbing Code Section 10.15.2 and Temperature Control Section 10.15.6~~d~~ **and flow capacities (gpm, cfh).**
4. Comply with NSF 61, NSF 61 Annex G and ANSI 372, "Drinking Water System Components-Health Effects" for potable domestic water piping and components.

## B. Products

## C. Piping

### 1. Ductile Iron Piping

- a. Mechanical-Joint, Ductile-Iron Pipe: AWWA C 151, with mechanical-joint, bell- and plain spigot end, unless grooved or flanged ends are indicated.

- 1.) Mechanical-Joint, Ductile-Iron Fittings: AWWA C 110, ductile- or gray-iron, standard pattern; or A WW A C 153, ductile-iron, compact pattern.

- 2.) Glands, Gaskets, and Bolts: A WW A C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

- 3.) Ductile-Iron Piping, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.

- 4.) Ductile-Iron-Piping, Keyed Couplings: A WW A C606 for ductile- iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

- 5.) Push-on-Joint, Ductile-Iron Pipe: AWWA C 151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.1.) Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray- iron, standard pattern; or AWWA C153, ductile-iron, compact pattern.

- a. Gaskets: AWWA C111, rubber.

- 6.) Ductile-Iron, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.

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7.) Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

8.) Ductile-Iron, Flexible Expansion Joints: Compound, ductile-iron fitting with Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.

9.) Ductile-Iron, Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.

10.) Ductile-Iron, Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.

## B.2. Copper Tubing

1-a. Soft Copper Tube: ASTM B 88, Types K, water tube, annealed temper.

a.1) Copper Pressure Fittings: ASME B 16.18, cast-copper-alloy or ASME B 16.22, wrought copper solder-joint fittings. Furnish wrought-copper fittings if indicated.

b.2) Bronze Flanges: ASME B 16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

c.3) Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2-b. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

a.1) Copper Pressure Fittings: ASME B 16.18, cast-copper-alloy or ASME B 16.22, wrought copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

b.2) Bronze Flanges: ASME B 16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

c.3) Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

d.4) Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

e.5) Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

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## D. Valves

1. Specify all valve types. Construction drawings shall indicate all valve types to be used. Where specific valve types are not indicated, the following requirements apply:

- a. Shutoff Duty: Use bronze ball valves for piping NPS 3/2 and smaller. Use cast-iron globe or gate valves with flanged ends for piping NPS 4 and larger.
- b. Throttling Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron globe valves with flanged ends for piping NPS 2-1/2 and larger.
- c. Hot-Water-Piping, Balancing Duty: Memory stop balancing valves.
- d. Drain Duty: Hose-end drain valves.

## E. Piping Applications

- 1. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- 2. Flanges may be used on aboveground piping, unless otherwise indicated.
- 3. Grooved joints may be used on aboveground grooved-end piping.
- 4. Fitting Option: ~~Mechanically formed tee-branch outlets and~~ Brazed joints above ground copper tubing.
- 5. Above ground Domestic Water Piping: Use the following piping materials for each size range:
  - a. NPS 2" and Larger: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.
  - b. Type L (blue color bar) copper tubing with wrought copper solder joint fittings suitable for soft soldering; Brass, seamless drawn pipe, regular weight with cast bronze fitting; Groove copper pipe and grooved fittings for 2" and above. Provide copper tubing for short branch connection to plumbing fixtures.**
  - c. Exposed Piping Serving Laboratory, and Food Service Equipment, Except Piping Installed within Cabinets, and not Exposed to View: Polished, chrome plated brass pipe with cast brass fittings, and threaded joints.**
  - ~~d. Underground Domestic Water Piping~~ NPS-4 1 1/2" and Smaller: Soft copper tube. Type K; copper pressure fittings; and soldered joints.
- 6. **Domestic Incoming Water Service – Underground**
  - a. **2-1/2" and Less: Type K soft annealed copper tube with cast bronze solder joint fittings; Brass, seamless drawn pipe with threaded fittings.**
  - b. **3" and Up: Ductile iron (Class 52 for 3" & 4" and Class 56 for 6" & up) and fittings with mechanical or push-on joints.**

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## **E.F. Piping Installation**

1. Extend domestic water service piping to exterior water distribution piping in sizes and locations to be indicated on drawings.
2. Design underground ductile-iron piping according to AWWA C600, and AWWA M41, and NFPA 24. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall, or floor. Install thrust-block supports at vertical and horizontal offsets.
3. Design underground copper tubing according to Copper Development Association's (CDA) "Copper Tube Handbook."
4. Design cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. ~~Refer to Sleeves for Pipe Section for additional information.~~ **Refer to "Sleeves for Pipes" section for additional information.**
5. Design above ground domestic water piping level, plumb without pitch.
6. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
7. Specify that the following steps are completed before operation:
  - a. Close drain valves and hydrants.
  - b. Open shutoff valves to fully open position.
  - c. Open throttling valves to proper setting.
  - d. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
  - e. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - f. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.
  - g. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
  - h. Check plumbing specialties and verify proper settings, adjustments, and operation.
  - i. Energize pumps and verify **rotation and** proper operation.

## **F.G. Joint Construction**

1. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
2. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

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3. Mechanically Formed Outlets: **Not acceptable. Provide pre-formed elbows and tee fittings.** ~~Form tee in copper tube according to equipment manufacturer's written instructions. Use tool designed for copper tube; drill pilot hole, form collar for outlet dimple tube to form seating stop, and braze branch tube into collar.~~

## **G.H.** Roughing-In For Water Meters

1. Rough-in domestic water piping for water meter installation and install water meters according to utility company's requirements. Water meters will be furnished by Utility.
2. Obtain approval of Utility company for supply usage.

## **H.I.** Valve Installation

1. ~~Design~~ **Provide** sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball valves for piping NPS 2 and smaller. Use globe or gate valves for piping NPS 2-1/2 and larger.
2. ~~Design~~ **Provide** shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use globe or gate valves for piping NPS 2-1/2 inches and larger.
3. ~~Design~~ **Provide** drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
4. ~~Design~~ **Provide** hose-end drain valves at low points in water mains, risers, and branches.
5. ~~Design~~ **Provide** stop-and-waste drain valves where indicated.
6. ~~Design~~ **Provide** calibrated balancing valves in each hot-water circulation return branch, **end of run**, and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

## **I.J.** Hanger and Support Installation

- a. Indicate code compliant hangers and supports of all piping, fittings, and specialties.**

## **J.K.** Connections

- ~~Indicate code compliant hangers and supports of all piping, fittings, and specialties.~~
- ~~a.~~ Design piping adjacent to equipment and machines to allow service and maintenance.
- ~~e.b.~~ Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- ~~d.c.~~ Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:

- 1.) Water Heaters: Cold water supply and hot water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

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2.) Plumbing Fixtures: Cold and hot water supply piping in sizes indicated, but not smaller than required by plumbing code. **Provide copper tubing for short branch connection to plumbing fixtures.**

3.) Equipment: Cold and hot water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

## **K.L. Field Quality Control**

1. Do not enclose, cover, or operate piping systems until they are inspected and approved by authorities having jurisdiction.

2. During installation, it is required that the installer notify Authorities Having Jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of Authorities Having Jurisdiction and engineer.

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b. Final Inspection: Arrange for final inspection by Authorities Having Jurisdiction to observe tests specified below and to ensure compliance with requirements.

c. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

## **L.M. Testing Domestic Water**

1. It is required to test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Specify that the contractor is required to cap and subject piping to static water pressure of 150% of operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow standing for four hours minimum or required by code if more stringent. Leaks and loss in test pressure constitute defects that must be repaired.

4. Specify that the contractor is required to repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

5. Specify that the contractor is required to prepare reports for tests and required corrective action.

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## **M-N. Adjusting**

1. Include balancing valves in hot-water-circulation return piping to provide adequate flow.
2. Include balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
3. Adjust calibrated balancing valves to flows indicated.

## **D2010.50 Cold Water Supply**

### **A. General**

#### 1. Description

- a. Extent of cold water supply Work is to be indicated on the Drawings and by the requirements of this Section.
- b. **Provide independent domestic water service installed in adherence to all Applicable Codes and Standards. Domestic water service shall serve all project potable water and service needs. Fire water service shall be separate from domestic water service.**

### **B. Codes and Standards**

1. Comply with applicable portions of the National Standard Plumbing Code, International Building Code, Mechanical Code and all other Federal, State, County, Municipal, Local Codes and ordinances having jurisdiction over this project. "The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards  
<http://www.nj.gov/dca/divisions/codes/index.html>.

#### 2. Standards listed below are referenced in this section.

- a. American Society for Testing and Materials (ASTM).
- b. American Standards Association (ASA).
- c. American National Standards Institute (ANSI).
- d. United States of America Standards Institute (USASI).
- e. Cast Iron Soil Pipe Institute (CISPI).
- f. The Building Subcode of New Jersey.
- g. International Building Code (current version)

### **C. Products**

#### 1. Materials



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a. The following piping shall be as specified in Section D2010.11, Products (General) Materials, Piping, and shall also comply with the following:

- 1.) Ductile iron mechanical joint pipe shall be used on water service piping. Pipe shall be Class 52 for 3" and 4" pipe sizes and Class 56 for pipe sizes 6" and larger.
- 2.) Type "L" Copper Tubing (Hard Drawn) shall be for use on water distribution piping, excluding short branch supplies to fixtures, above ground.
- 3.) Copper Tubing Type "K" shall be hard drawn for use on water distribution piping below ground only.

## 2. Water Hammer Arresters (Shock Absorbers)

a. Engineered water hammer arresters shall consist of a stainless steel housing, welded metal or elastomer bellows, pneumatic displacement cushion, hydraulic displacement fluid, and threaded plug. Shock Absorbers shall be sized and installed in accordance with Plumbing and Drainage Institute Standard PD1-WH201 and ASSE Standard 1010.

## 3. Water Meters

### a. City Water Supply

- 1.) Compound type water meter supplied by the Water Company and shall comply with all applicable requirements of AWWA Standard C702, latest revision. Meter must be equipped with an approved encoder register.
- 2.) Meter shall have strainer.

## 4. Pressure Gages

- a. Specify and indicate pressure gauges with 4-1/2" diameter dials, 0-100 psi dial range phosphor bronze bourdon tube and black enamel cast aluminum, safety case. Pressure gauges shall have an accuracy of 1/2 of 1% of the scale range.
- b. Require all gauges be equipped with pigtail siphons and shutoff cocks.
- c. Require siphons and cocks to be of same manufacture as gauges.
- d. No permanent gauge shall be used while the installer is making hydrostatic tests on any portion of the piping systems.

## 5. Pressure Reducing Valves

a. Provide flanged pressure reducing valve (screwed ends 2-1/2" and smaller) with equalizing pipe. Pressure reducing valves shall be all bronze up to 2" and shall be iron body over 2". Valves shall be of the size and type suitable for the service and flow conditions.

## 6. Water Gages.



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- a. Provide water gages threaded for 1/2" connections, with four guards, 5/8" diameter glass, with finished brass.

## 7. Vacuum Breakers and Backflow Prevention

- a. Atmospheric Vacuum Breakers to have:

- 1.) Poppets shall be molded plastic (polypropylene) or unicellular hi-car rubber.

- 2) Vacuum Breaker shall be rated to 150 psi working pressure and shall withstand water temperature to 212° F. The uni-cellular hi-car rubber is recommended in 1/2" and 3/4" for low flow applications. The vacuum breaker cannot be subjected to more than 12 hours of constant pressure.

- b. Require Pressure Vacuum Breaker Assemblies shall consist of an approved check valve, vacuum relief, inlet and discharge shutoff and field testing cocks. All nipples and other fittings shall be red brass. Vacuum breakers shall be rated to 150 psi working pressure and shall withstand water temperatures to 170° F. The vacuum relief valve must be of brass construction with a spring loaded diaphragm member to assure positive opening of air inlet when back siphonage occurs. In sizes above 2", two check valves are required.

- c. The Double Check Valve Detector Assembly, 2-1/2" and above, shall consist of two brass internally spring loaded check valves, two brass gate valves and field testing cocks. Double Check Valve Assembly shall be rated to 150 psi working pressure and shall withstand water temperatures to 170° F.

- d. The Double Check Valve Assembly, 2" and below, shall be indicated on drawing. The assembly shall consist of two positive seating check modules with captured springs and rubber seat discs. The check module seats and seat discs shall be replaceable. Service of all internal components shall be through a Single access cover secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves; four top mounted, resilient seated test cocks. The assembly shall meet the requirements of ASSE Std. 1015 and AWWA Std. C510.

- e. Reduced Pressure Backflow Preventer to consist of two separately spring loaded "Y" type check valves, a differential pressure relief valve, two shut-off valves, and test cocks for field testing.

- 1) Backflow Preventer to be tested and certified under A.S.S.E. No.1013, AWWA and USC manual. It shall be rated to 150 psi (minimum) working pressure and 110°F water temperature.

## D. Execution

### 1. Cold Water Service Piping

- a. All operative permanent water service mains provided shall be metered. Temporary service mains shall be metered as required by the Water Company.

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b. If ~~a combination of domestic~~ water service ~~pipng is to be supplied from city water mains, including~~ **and** fire protection water service **are required by the Utility Company**, install meters of the size and type, sized appropriately for ~~both each~~ services and to meet all project **and code** requirements. Fire water service assembly to include code compliant detector check valve / dual back flow preventer.

c. Install meter on a concrete pier, pad or other code compliant manner above the floor.

d. Each incoming service shall be extended inside of the building and shall be fitted with O.S. & Y. valve, check valve, backflow preventer device, strainer, plugged fittings, meter, pressure gages, appurtenances, etc., and shall comply with all Code **requirements**, and local Authority Having Jurisdiction.

## 2. Signs for Fire Services

a. ~~Specify a sign is to be provided~~ **Provide signage** indicating the location of the fire water service control valve on a deck plate or of another acceptable type.

b. ~~Specify a sign is to be provided at~~ **Provide signage for** the main sprinkler control valve ~~inside the building~~ per code and local Authority Having Jurisdiction.

## 3. Cold Water Distribution Piping

a. The cold water distribution mains are to be suspended from the overhead structural floor slab or steel beam and shall be of the sizes and arrangements as detailed on the Drawings. Each system main branch shall be installed with an isolation valve for system segregation during times of maintenance and repair.

b. Provide gate valve, union and 1/2" drain bib for each main branch serving a riser. Branches connected to risers shall be connected in such a manner that the riser is free to expand upward for its entire length.

1.) Install water hammer arresters on all mains, risers and branches to plumbing fixtures utilizing flush valves / flushometers..

## 4. Vacuum Breakers and Backflow Prevention

a. ~~Specify that~~ Vacuum breakers are to be provided at points where air or gases may develop on the interior of water distribution systems through piping or hose connections.

b. ~~Specify that a~~ Potable water supply ~~with~~ backflow preventers are to be provided in accordance with Code and filtration to remove pollutants.

c. Atmospheric Vacuum Breakers may be used as protection against cross connections where the vacuum breaker is not subjected to back pressures due to pumps or gravity and must be installed on the discharge side of the shutoff. They must be installed a minimum of 6" above the highest overflow level. Install with the air inlet in a level position.

d. The Pressure Vacuum Breaker may be installed where it would be subject to continuous pressure but must be installed 12" above the highest outlet it is protecting. It should be located where it would be accessible for periodic testing.

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e. Where a Double Check Valve Assembly is required it must be installed in a horizontal position and must be accessible for periodic testing.

f. Provide Reduced Pressure Backflow Preventers with:

- 1.) Adequate clearance for testing and maintenance.
- 2.) Proper drainage provisions.
- 3.) Protect from freezing.
- 4.) Adequate support.

## 5. Disinfection

a. ~~Require the~~ Installer **shall** be responsible for bacteriological examination, testing, and reporting of ~~and the~~ disinfection of the potable water system.

## D2010.50.1 Hot Water Supply

### A. General

#### 1. Description

a. Hot water system shall be a circulating system.

b. Show extent of hot water supply Work on the Drawings and by the requirements of this Section.

### B. Products

#### 1. Materials

a. The following piping shall be as specified in Section D2010.4011, ~~Plumbing Products (General) Materials – —~~Piping, and shall also comply with the following:

- 1.) Type "L" Copper Tubing (Hard Drawn) shall be for use on water distribution piping above ground, excluding short branch supplies to fixtures.
- 2.) Type "K" Copper Tubing (Hard drawn) shall be for use on water distribution piping underground.

#### 2. Water Hammer Arresters

a. Water hammer arresters shall be as specified in Section D2010.5040 Cold Water Supply.

#### 3. Three-Way Regulating Valves

- a. Three-Way regulating valves shall be installed as noted.
- b. The size of hot and cold inlets and tempered water outlet shall be as indicated on the Drawings.

#### 4. Balancing Valves

a. Specify that the contractor is to provide calibrated balancing valves. Valves to be of bronze construction with glass and carbon filled TFE seat rings and have differential

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pressure read-out ports across valve seat area. Read out ports to be filled with internal EPT insert and check valve. Valves bodies to have 1/4" NPT tapped drain/purge port. Valves to have memory stop feature and calibrated name plate to assure specific valve setting. Valve to be leak-tight at full rated working pressure.

## 5. Thermometers

a. Specify that the contractor is to provide thermometers in proper locations as indicated to record temperatures of the following:

- 1.) Building hot water circulating line
- 2.) Tempered water, temperature downstream of 3-way mixing valve.
- 3.) Hot water storage tank temperature.

b. Thermometers shall be gas actuated dial thermometers having a bulb 6" long with a brass separable socket, 1" NPT filled with a conducting medium. The dial shall be white enameled black figured, approximately 4" in diameter, and graduated 30 to 240° F. The case shall be cast aluminum, with polished chrome ring.

## 6. Vacuum Breakers

a. Refer to Section D2010.50-~~C.7~~ Cold Water Supply. Vacuum breakers shall be suitable for use on ~~150~~212° F hot water.

## C. Execution

### 1. Hot Water Piping

a. Connect to the hot water heater and extend, suspended from the cellar or basement ceiling, brass pipe or type "L" copper tubing hot water mains of the sizes indicated on the Drawings and extend from same the required number of branches and risers to supply all fixtures apparatus, etc. All mains, risers and branches to fixtures shall have water hammer arresters indicated on the Drawings.

b. Indicate gate valves, unions and 1/2" drain bibs on all branches from mains to risers.

c. Branches connected to the hot water and circulation risers shall be connected to the risers in such manners that the risers supported at their base are free to expand upward for their entire length.

d. From a point on the ceiling below the branch to the highest fixture on each riser, extend circulating pipes to the return main, which shall be extended and connected to the piping at water heater to be indicated on the Drawings. At the base of the hot and

circulation pipes and before they connect to return main, indicate gate valves, unions and 1/2" drain bibs.

e. Indicate check valves and balancing valves at the base of circulating line. Adjust balancing valves and regulate same so that a good circulation of hot water is obtained. Hot water system shall provide adequate hot water at the designated temperature to all plumbing fixtures that require hot water. Hot water system to be balanced at maximum velocity between 4 and 5 ft.

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## 2. Three-Way Regulating Valves

a. Specify that the contractor is to provide regulating valve connected to the hot water header at top of the heater and to the cold water header with separate branches of pipe and fittings. install brass and/or bronze "Y" type strainers on the hot and cold water inlet piping to regulator. The hot and cold water branches shall each be shown with gate and check valves, drain faucets and unions.

b. Three-way valve shall be set to deliver water at a temperature of 105° F, unless otherwise noted.

c. Indicate O.S. & Y valves by-pass between hot water header and tempered water header.

## 3. Thermometers

a. Location of thermometers shall be as indicated on the Drawings.

## 4. Vacuum Breakers

a. Indicate vacuum breakers on the Drawings and as required by the National Standard Plumbing Code, International Building Code, Mechanical Code and all other Federal, State, County, Municipal, Local Codes and ordinances having jurisdiction over this project. "The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards (<http://www.nj.gov/dca/divisions/codes/index.html>).

## 5. Balancing Valve

a. Balancing valve shall be indicated on the Drawings.

## D2010.60 Plumbing Fixtures

### A. Description

1. **Project** Specifications and Drawings to include all required plumbing fixtures and trim work.

### B. Indexing Faucet Handles

1. Specify that all faucet handles to be indexed to indicate type of water it will supply. Cold water faucet shall be indexed by a "C", "COLD", or be color coded blue. Hot water faucet shall be indexed by an "H", "HOT", or be color coded red. Tempered water shall be indexed by a "T" or be color coded white.

### C. Fixture Mounting Height Schedule

1. Unless otherwise required, plumbing fixtures shall be mounted in accordance with all applicable codes and shall comply with American Disabilities Act.

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## D2010.61 Products

### A. Fixture supports

#### 1. Water closets

- a. Require water closet chair carrier to have two separate base supports secured to an adjustable face plate.

## D2020.10 Sanitary Sewerage Equipment

1. See section D2020.90 Sanitary Drainage Supplementary Components and G30 Site Utilities for additional information.

## D2020.30 Sanitary Sewerage Piping (General)

### A. Related Documents

1. Drawings and general provisions of the Contract, including General and Supplementary conditions apply to this Section.

### B. Performance Requirements

1. Design components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

- a. Soil, Waste, and Vent Piping: 10-foot head of water.

### C. Quality Assurance

1. Require piping materials to bear label, stamp, or other markings of specified testing agency.

## D2020.40 Sanitary Sewerage Piping (Products)

### A. ~~Piping Materials~~Products

#### 2-1. Materials

- b. ~~Refer to D2010.10 Article~~ The following piping shall be as specified in Section D2010.11 Products (General) Materials – Piping, and shall also comply with the following for applications of pipe, tube, fitting, and joining materials.

#### **B-1)** Cast Iron Soil Piping

- a)** 4-Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.

- i.** a-Gaskets: ASTM C 564, rubber.

- b)** 2-Hub less Pipe and Fittings: ASTM A 888 or CISPI 301

- i.** a-Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.

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- ii. ~~b.~~ Compact, Stainless-Steel Couplings: CISPI310 with ASTM A 167, Type 301, or ASTM A 666, Type 301, stainless-steel corrugated shield; stainless-steel bands; and sleeve.
- iii. ~~c.~~ NPS ~~4-112-1~~  $\frac{1}{2}$ " to NPS 4: 2-l/8-inch- wide shield with 2 bands.
- ~~i.~~ ~~iv.~~ ~~d.~~ NPS 5 and NPS 6: 3-inch- wide shield with 4 bands.

## 4)2) Steel Piping

- a) ~~1.~~ Black steel pipe and galvanized steel pipe shall be Grade A, seamless, electric resistance welded pipe, or type F furnace butt-welded, and shall be made in accordance with the current Edition of the ASTM A53 Specification. Pipe shall be free from scale, and rust, injurious sand marks, blisters, scale pits, laminations, imperfect welds, or other defects that might affect its strength, appearance or ability to resist corrosion. The maker's name shall be rolled or stamped in the metal at intervals of each length of pipe 2" and larger, and stamped on a metal tag secured to each bundle of pipe 1-1/2" and smaller.
- b) ~~2.~~ Unless otherwise specified or indicated on Drawings, black steel pipe shall be standard weight and galvanized steel pipe shall be Schedule 40 galvanized pipe.

## 2)3) Ductile Iron Piping

- a) ~~1.~~ Require ductile iron pipe shall have an outer coating of coal tar and shall comply with the requirements of the latest Standard Specifications of ANSI A21.51. Types of pipe shall be as follows:
  - i. ~~a.~~ Push-on Joint Pipe: Pipe shall be for: use on yard drainage when indicated and shall be thickness class 51 for all sizes; use on House Sewers and shall be thickness class 56 for all sizes; use for water service piping, class 52 for three (3) & four (4) inch diameter pipe and class 56 for pipe size greater than four (4) inch. Pipe shall be Bell and Spigot Type Joint.
- b) ~~b.~~ Ductile iron pipe shall also comply with the following requirements:
  - i. ~~1.)~~ Marking: the weight and class and other designated markings required by ANSI specifications shall be stenciled at the foundry on all ductile iron pipe, fittings and special markings shall be painted conspicuously in white on the outside of each pipe length, fitting and special casting after the shop coat has hardened.
  - ii. ~~2.)~~ Cement Lining: Pipe shall be cement lined, except when used in association with sewer piping, in accordance with ANSI, Standard A21.24, with thickness of lining to be 1/8"



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minimum. A plus tolerance of 1/8" shall be permitted on all sizes of pipe.

## **4) ~~E.~~ Copper Tubing**

**a) ~~1.~~ Copper DWV Tube:** ASTM B 306, drainage tube, drawn temper.

**b) ~~2.~~ Copper Drainage Fittings:** ASME B16.23, cast copper or ASME B16.29, wrought copper solder-joint fittings.

## **B. ~~F.~~ Piping Applications - Sanitary**

1. Transition and special fittings with pressure ratings at least equal to piping pressure ratings.

2. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

**2-3. Provide hard piped vent system, vent piping shall be routed to discharge to exterior atmosphere. Air Admittance Valves to relieve system pressure not acceptable. Submit venting for freestanding plumbing fixtures to the Authority for review and approval.**

**3-4.** Above ground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

a. NPS 1-1/4 and NPS ~~1-1 1/2~~ **1 1/2**": Copper DWV tube, copper drainage fittings, and soldered joints.

b. NPS 2 and larger: Hub less, cast-iron soil piping and one of the following:

1.) Couplings: Compact, stainless steel.

**5.** ~~4.~~ Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

a. NPS 2 and larger: Service class, cast-iron soil piping; gaskets; and gasket joints.

**6.** ~~5.~~ Above ground Sanitary-Sewage Force Mains: Use the following piping materials for each size range:

a. NPS 2 to NPS 4: Steel pipe; steel-piping, grooved-end fittings; steel-piping, keyed couplings; and grooved joints.

**7.** ~~6.~~ Underground Sanitary Sewage Force Mains: Use the following piping materials for each size range:

a. NPS 2 to NPS 4: Use mechanical- or push-on-joint, ductile-iron pipe and fitting.

## **C. ~~G.~~ Piping Installation**

1. ~~Indicate~~ **Provide** cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.



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- a. ~~Indicate~~ **Provide** cleanout fitting with closure plug inside the building in sanitary force main piping.
- b. **Provide** ~~Require~~ cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Section D2010.110 for basic mechanical materials and methods" for sleeves and mechanical sleeve seals.
- c. ~~Indicate~~ **For** changes in direction ~~for~~ **of** soil and waste drainage and vent piping ~~using~~ appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long turn; double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- d. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- e. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1.) Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2.) Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3.) Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
  - 4.) Do not enclose, cover, or put piping into operation until it is inspected, tested and approved by governing authorities.

## **D. ~~H.~~ Joint Construction**

1. Refer to **D2010.110 Products (General)** ~~Section "Basic Mechanical Materials~~ **Sections and Methods**" for basic piping joint construction.

## **E. ~~I.~~ Hanger and Support Installation**

1. Refer to **D2010.1100 Products (General)** **Materials** ~~Sections "Plumbing Hangers and Supports"~~ for pipe hanger and support devices, ~~Install the~~ **which shall also comply with the** following:
  - a. Vertical Piping: MSS Type 8 or Type 42 clamps.
  - b. Individual, Straight, and Horizontal Piping Runs, according to the following:

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- 1.) 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- 2.) Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
- 3.) Longer than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.
- 4.) Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls, support pipe rolls on trapeze.
- 5.) Base of Vertical Piping: MSS Type 52, spring hangers.
- 6.) Support vertical piping and tubing at base and at each floor.
- 7.) Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- 8.) Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

## **F. ~~J~~Connections**

1. Drawings to indicate general arrangement of piping, fittings, and specialties.
2. Indicate soil and waste piping to exterior sanitary sewerage piping. Use transition fittings as necessary.
3. Indicate drainage and vent piping to the following:
  - a. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - b. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction. Vent to exterior.
  - c. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - d. Equipment: Connect drainage piping as indicated. Provide ~~shutoff valve, if indicated~~ and shut off valve if indicated. Use flanges instead of unions for connections NPS ~~2-112~~ 2 1/2" and larger.

## **G. ~~K~~Field Quality Control**

1. During installation, ~~require~~ provide notification of Authorities Having Jurisdiction at least 24 hours before inspection must be made. ~~Require~~ Tests specified below to be performed in presence of ~~A~~ authorities ~~H~~ having ~~J~~ jurisdiction.
  - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - b. Required Inspections: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

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2. Re-inspection: If Authorities Having Jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
3. Reports: ~~Require~~ **Provide** inspection reports ~~and have them~~ signed by Authorities Having Jurisdiction.
4. ~~Require~~ Testing of sanitary drainage and vent piping **to be performed** according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - a. ~~Specify that the~~ Contractor is to test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - b. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - c. ~~Require a~~ Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - d. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent stack openings for roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1". Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - e. ~~Specify that~~ The contractor is to repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - f. ~~Specify that~~ The contractor is to prepare reports for tests and required corrective action.
  - g. ~~Specify that~~ The contractor is to test the force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
    - h. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested, **prior to testing**.
    - i. Cap and ~~subject~~ **pressurize** piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow ~~standing to stand~~ for four **(4)** hours. Leaks and loss in test pressure constitute defects that must be repaired.
    - j. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

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## H. ~~C~~ Cleaning

1. ~~Require~~ **Provide** cleaning of the interior of piping. Remove dirt and debris as work progresses.
2. ~~Require~~ **Provide** protection of the drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
3. ~~Require~~ **Provide** the placing of plugs in ends of uncompleted piping at end of day and when work stops.

## D2020.90 Sanitary Drainage Supplementary Components

### A. Pumping Apparatus and Tanks

#### 1. Description

- a. ~~Specify that~~ The contractor is to provide pump and controls for floor drain sewage ejector and storm water submersible sump pumps and controls indicated on the Drawings and as required herein.

### B. Products

#### 1. Motors

- a. ~~If required,~~ The casing for pumps shall be of close-grained cast iron for bronze fitted pumps or bronze on all bronze pumps. The waterways must have large cross-section areas with smooth turns so that the water will pass through at a low velocity without shock.
- b. Suitable openings shall be provided for the suction gauge, discharge gauge, air vent and cock. Openings shall be tapped and plugged.
- c. ~~Require~~ The shaft shall be of the best grade of 18-8 stainless steel and of ample size to transmit safely the maximum amount of power required. Shaft shall be provided with ample keyway and key to accurately hold the impeller in place. The impeller shall be secured to the shaft using a nut and locking washer. The impeller shall be hydraulically balanced for all pressures and shall be of bronze, hand finished on the inside, machine turned and polished on the outside, dynamically balanced at all speeds, and with liberal keyway to fasten to shaft. Coupling shall be flanged and of the flexible type with pin and rubber bushing construction. That portion of the shaft passing through the pump casing and stuffing boxes shall be encased in a bronze sleeve, securely fastened to the shaft.
- d. ~~Require~~ **Provide stainless steel** name-plate showing the serial number, discharge GPM and Head of each pump shall be attached to the respective pump. The necessary wiring and controlling devices will be furnished and installed complete under the Electrical Division, unless otherwise specified.
- e. Require test curves of the pumps to be installed shall be provided for all pumps.

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## C. Submersible Sewage Ejector

1. ~~If required, a~~ Locate submersible sewage ejector in ~~a~~ sump pit ~~to be as~~ indicated on ~~the~~ drawings. Pump shall have engineered thermoplastics non-clog impeller, 18-8 stainless steel shaft, factory bronze sleeve, hermetically sealed capacitor start with built-in overload protection and Class "B" insulation. The control panels shall be in a NEMA 4 enclosure.
2. Design for each sump an angle iron frame and a split steel checkered plate non-skid sump pit cover. The cover shall have all required openings for pump and piping including power cable and mounting hardware. The General Construction Subcontractor will install the angle frame and cover when sump pit is poured. The detail of sump pit is to be shown on Design Drawing.
3. ~~Specify that~~ The contractor is to provide Factory finishing as follows:
  - a. Cover and angle frame for sump pit shall be given one coat of iron primer paint.
  - b. Underside of sump pit cover shall be given one finish coat of black asphalt paint over the iron primer paint.
  - c. Pumps and motors shall be given one coat of iron primer paint and one finish coat of water resistant metallic enamel paint.
  - d. Submit shop drawings of the pumps, pump motors, angle frame and cover for approval before installing pumps.

## ~~D. Storm Water, Submersible Sump Pump~~

- ~~1. If required, a submersible sump pump in a sump pit to be indicated on the drawings. Pump shall have engineered thermoplastic impeller, 18-8 stainless, steel shaft, factory sealed grease lubricated ball type shaft, factory sealed grease lubricated ball type bearings, mechanical seal and a perforated bronze or steel strainer. Pump motor shall be, hermetically sealed capacitor start with built-in overload protection and Class "B" insulation. Pump Model No. and horsepower to be indicated on the Drawings. Control shall consist of a wide angled float switch that is mounted on the pump, furnished with 10 feet of power cord and a "piggy back" combination, grounded plug and receptacle.~~
- ~~2. When required for each sump pump specify that an angle iron frame and a split steel checkered plate sump pit cover shall be provided. The cover shall have all required openings for pump and piping including power cable and mounting hardware.~~
- ~~3. Factory Finishing to be required as follows:~~
  - ~~a. Cover and angle frame for sump pit shall be given one coat of iron primer paint.~~
  - ~~b. Underside of sump pit cover shall be given one finish coat of black asphaltum paint over the iron primer paint.~~
  - ~~c. Pumps and motors shall be given one coat of iron primer paint and one finish coat of water resistant metallic enamel paint.~~
  - ~~d. Submit shop drawings of the pumps, pump motors, angle frame and cover for approval before installing pumps.~~

## ~~E. Installation~~

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## *1. Pumps*

*a. ~~Require all pumping apparatus as shown on the Drawings to be installed in accordance with Manufacturer's specifications.~~*

## **~~F.~~ Demonstration**

*1. ~~The service of a factory trained representative shall be made available on the job site for start-up and for instructing the Custodian (or building manager) and staff in the operation and maintenance of each system installation. A minimum of two visits is required.~~*

## **D2030 Building Support Plumbing Systems**

### **D2030.10 Stormwater Drainage Equipment**

1. Refer to Section D2020.90 Sanitary Drainage Supplementary Components and G30 Site Utilities for additional information.

#### **A. Storm Water, Submersible Sump Pump**

1. ~~If required,~~ **Locate** a submersible sump pump in a sump pit ~~to be as~~ indicated on the drawings. Pump shall have engineered thermoplastic impeller, 18-8 stainless, steel shaft, factory sealed grease lubricated ball type shaft, factory sealed grease lubricated ball type bearings, mechanical seal and a perforated bronze or steel strainer. Pump motor shall be, hermetically sealed capacitor start with built-in overload protection and Class "B" insulation. Pump Model No. and horsepower ~~to be~~ indicated on the Drawings. Control shall consist of a wide angled float switch that is mounted on the pump, furnished with 10 feet of power cord and a "piggy back" combination, grounded plug and receptacle.
2. ~~When required for~~ Each sump pump ~~specify that~~ **shall have** an angle iron frame and a split steel checkered plate **non-skid** sump pit cover shall be provided. The cover shall have all required openings for pump and piping including power cable and mounting hardware.
3. Factory Finishing to be required as follows:
  - a. Cover and angle frame for sump pit shall be given one coat of iron primer paint.
  - b. Underside of sump pit cover shall be given one finish coat of black asphaltum paint over the iron primer paint.
  - c. Pumps and motors shall be given one coat of iron primer paint and one finish coat of water resistant metallic enamel paint.
  - d. Submit shop drawings of the pumps, pump motors, angle frame and cover for approval before installing pumps.

#### **B. Installation**

##### **1. Pumps**

~~a. Require~~ All pumping apparatus as shown on the Drawings to be installed in accordance with Manufacturer's specifications.

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## **C. Demonstration**

1. ~~The service of~~ A Factory Trained Representative shall be ~~made available~~ on the job site for start-up and for instructing. The Custodian (or building manager) and staff in the operation and maintenance of each system installation **shall provide** a minimum of two visits ~~is required~~.

## **D2030.20 Stormwater Drainage Piping**

### **A. General**

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
2. This Section includes storm-drainage piping inside the building and to locations indicated.
3. ~~See civil~~ **Refer to Civil Site Sections G30 and project** specifications for exterior piping.

### **B. Performance Requirements**

1. Design components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

a. Storm Drainage Piping: 10-foot head of water.

**b. Storm drainage fForced main piping: 100 psig.**

### **C. Quality Assurance**

1. ~~Require~~ Piping materials shall bear label, stamp, or other markings of specified testing agency.

### **D. Products**

#### **1. Piping Materials**

- a. Refer to ~~Sections D2010.110 Products (General) of~~ **Materials Sections for** pipe, tube, fitting, and joining materials to make installation watertight and ~~Methods~~ **installation** for sleeves and mechanical sleeve seals.
- ~~2-b.~~ Require **permanent modular** wall penetration system at each service pipe penetration through foundation wall. **Seal penetrations and** make installation watertight. ~~"Basic Mechanical Materials and~~ **Refer to Materials – 'Sleeves for Pipes' section** for wall penetration systems **additional information**.
- ~~3-c.~~ Require cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook, "Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- ~~4-d.~~ ~~Require changes in direction for~~ Storm piping **shall use** ~~using~~ appropriate branches, bends, and long-sweep bends **for changes in direction**. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and



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reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

**5.e.** Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

**6.f.** ~~Require~~ Storm drainage piping to have the following minimum slopes, unless otherwise indicated:

1) ~~a.~~ Building Storm Drain: 2 percent downward in direction of flow for piping NPS 4 and larger.

2) ~~b.~~ Sleeves are not required for cast-iron soil piping passing vertically through concrete slabs-on-grade if slab is without waterproof membrane ~~waterproofing~~.

3) ~~c.~~ Do not enclose, cover, or put piping into operation until it is inspected and approved by Authorities Having Jurisdiction.

## **E. Piping Applications (Storm)**

**1. Above ground storm drainage piping within building – Use the following piping materials for each size range:**

**a. NPS2 to NPS8:**

1) Service Class, cast iron soil pipe and fittings, gaskets and gasket joints.

2) Hubless, cast iron soil piping and fittings, hubless pipe couplings; rubber gasket joints, sleeve with integral center pipe stop, and stainless steel bands.

3) Ductile iron pipe, push-on joints, EPDM gaskets.

**2. Underslab storm drainage piping within building – Use the following piping materials for each size range:**

**a. NPS2 and larger:**

1) Hubless, cast iron soil piping and fittings, heavy-duty hubless pipe couplings; rubber gasket, sleeve with integral center pipe stop, stainless steel bands.

2) Ductile iron pipe, mechanical joints, EPDM gaskets, joint retainer glands, steel nuts and bolts.

## **E.F. Joint Construction**

1. Refer to Section D2010.11 ~~Products~~ **Materials Sections** for basic piping joint construction **which shall also comply with the following:**



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2-a. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

3-b. Hub less Joints: Make with rubber gasket and sleeve or clamp.

## **F.G. Hanger and Support Installation**

1. ~~Refer Section D2010.10 "Hangers and Supports"~~ For pipe hanger and support devices i. Install the following:

a. Vertical Piping: MSS Type 8 or Type 42 clamps.

~~b. Individual, Straight, and Horizontal Piping Runs: According to the following:~~

~~1.) Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.~~

~~2.) Prepare reports for tests and required corrective action.~~

## **G.H. Cleaning**

1. ~~Require~~ **Provide** the cleaning of the interior of piping. Remove dirt and debris as work progresses.

2. ~~Require~~ **Provide** protection of the drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

3 ~~Require~~ **Provide** the placing of plugs in ends of uncompleted piping at end of day and when work stops.

~~**D2030.30 Facility Stormwater Drains (Reserved)**~~

~~**D2030.60 Gray Water Systems (Reserved)**~~

**D2030.90 Bldg. Support Plumbing System Supplementary Components**

**D2060 Process Support Building Systems**

**D2060.30 Gas Systems**

**A. General**

### **1. Description**

a. Show the extent of gas piping system work on the Drawings and by the requirements of this Section.

### **2. Quality Assurance**

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a. Comply with rules and regulations of the Local Utility Company, National Standard Plumbing Code, International Building Code, International Mechanical Code and all other Federal, State, County, Municipal, Local Codes and ordinances having jurisdiction over this project. "The Design Consultant and its Sub-Consultants shall comply with all existing presiding codes adopted by the State of New Jersey Department of Community Affairs Division of Codes and Standards (<http://www.nj.gov/dca/divisions/codes/index.html>).

b. When welding is to be performed as part of the work covered in this specification, require the Contractor, before assigning any welder for this work, shall provide NJSDA with the names of welders to be employed for this work. Welders installing gas piping at any pressure shall be qualified for all pipe sizes, wall thicknesses, and all positions in accordance with the latest editions of either API 1104 or ASME Section IX Boiler and Pressure Vessel Code and be prequalified on an annual basis. The qualification testing shall be performed by an approved agency and the inspector, that verifies the welder's qualifications, shall have a minimum radiography qualification of Level II in accordance with the American Society of Non Destructive Testing Recommended Practice Document No. SNT-TC-IA, Supplement A. Copies of the certified welder qualification reports shall be maintained by the responsible welding contractor and shall be submitted to NJSDA.

c. All welding of gas piping shall be in full compliance with the latest editions of API 1104 and ASME Section IX Boiler and Pressure Vessel Code. Whenever welding operations are performed, the services of a full time certified inspector or certified technician shall be retained by ~~NJSCC~~ **NJSDA D.B.** to ensure said compliance. Certified inspectors and certified technicians shall be qualified to perform visual inspections and shall have a minimum radiography qualification of Level II in accordance with the American Society of Non-Destructive Testing Recommended Practice Document No. SNT-TC-IA, Supplement A. The certified inspector or certified technician shall also be responsible for sign off upon completion of the work.

d. Upon completion of Gas Pressure Booster System installation and start-up, the booster manufacturer shall furnish a written certification to the NJSDA and the utility company that the Gas Booster System operates in accordance with the design standards.

e. Comply with NFPA 211: Standards for Chimney, Fireplace, Vents and Solid Fuel Burning Appliance.

## **B. Products**

### **1. Materials**

a. Gas piping shall be standard weight (Schedule 40) black steel pipe. Gas control, vent and relief piping shall also be standard weight, schedule 40 black steel pipe. Steel pipe shall be seamless or welded made in accordance with the current adopted edition of the ASTM A53 Specification.

b. In no case shall any gas pipe be less than 3/4". The sizes of pipe indicate nominal pipe size.

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c. Provide Gas distribution piping systems operating at 1/2 PSIG or less shall be in accordance with ANSI Z223.1 -1974 (NFPA-54) and National Fuel and Gas Code.

d. Materials used in gas service and meter piping systems shall be in accordance with the requirements as specified by the Gas Utility Company providing the services.

e. Piping Joints for Gas Distribution Piping:

1.). Piping at 1/2 psig (14" WC.) and less:

2.) 4" and Smaller: Threaded Connections

3.) Over 4": Welded

## 2. Fittings

a. Fittings for screwed gas piping shall be 150 lbs. black malleable iron fittings, conforming to ASTM specifications A-197, latest edition.

b. Compression type fittings and steel welding fittings shall be as specified and approved by the Gas Utility Company.

c. Steel butt welding fittings shall conform to ANSI B16.9 requirements.

d. Fitting for control, vent and relief piping shall be 300 lb. black malleable iron screwed fittings conforming to ASTM Specification A-197, latest edition.

## 3. Flanges

a. Design all flanges to be steel and compatible in type and pressure ratings with mating flange and shall comply with ANSI B16.5.

b. Flanges shall be welding neck or threaded end. Slips on flanges are not permitted.

## 4. Gaskets

a. ~~Require~~ Gaskets to be compatible with the gas service on which they are used, without change to their chemical or physical properties.

b. Gasket specified to be compressed asbestos free.

c. Gaskets specified of metal or metal-jackets, aluminum O-rings and spiral wound metal gaskets, or other materials only if approved by the Utility Company.

d. Specify full face gaskets to be used with all bronze and cast iron flanges.

## 5. Thread sealant

a. ~~Specify~~ Thread sealant to be used on natural gas piping. Thread sealant shall be a non- toxic, soft setting, slow drying sealant made from inert fillers. The joint compound shall not contain any Teflon. Teflon tapes shall not be used in natural gas lines.

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## 6. Gas Safety Shut Off Valves

a. ~~Require~~ Gas safety shut-off valves to be FM & UL listed, electric motor operated, normally closed, manual reset type. Valves shall be rising stem design with a straight through flow path with metal-to-metal seat and disc arrangement. The valve seat shall be stainless steel and the disc ductile iron. Valves to be provided with a NEMA 4 enclosure modified for Class 1, Division II hazardous locations, be provided with an electrical terminal block and shall operate on 120 Volt, A.C., 60 Cycles, single phase. Valves shall meet ANSI Class VI leakage standard and shall be provided with a visual indicator to note the position of the valve whether "OPEN" or "SHUT".

b. Gas safety shut-off valves 2" and smaller shall be threaded, 2 1/2" and larger shall be flanged. Flanged valves shall be provided with companion flange set by valve manufacturer.

## 7. Gas Safety Shut Off Valves: Operating Sign

a. ~~Require~~ **Provide** a sign made of two colors laminated engravers stock phenolic, 1/16" minimum thickness, machine engraved to expose inner core color (white). Signs to be **minimum 2" x 3"**, provided with uniform margins and character size minimum ~~4/4"~~ **1/2"** high.

b. Sign to read: **"GAS SHUT OFF", per the International Fuel Gas Code 409.6.**

**1) "IMPORTANT" GAS SAFETY SHUT-OFF VALVES LOCATED IN THE NEAR-GAS-METER PIPING MUST BE MANUALLY RESET UPON ACTION OF THE GAS LEAK DETECTION SYSTEM OR LOSS OF NORMAL ELECTRICAL POWER**

## 8. Gas Lubricated Plug Valves

a. ~~Specified~~ Lubricated plug valves for use on gas service and gas meter piping shall be as approved by the Gas Company.

b. ~~Specified~~ Lubricated plug valves for use on gas distribution piping; mains, branches and base of risers shall be cast iron body, rated for 200 pounds cold working pressure and shall be wrench operated, except valves 10" and larger which shall be worm gear operated.

c. Lubricated plug valves 2" and smaller shall be short pattern threaded; 2-1/2" and larger shall be regular pattern flanged.

## 9. Gas Cocks

a. Gas cocks shall be specified for use only as manual gas shut-off valves at each piece of gas burning equipment; shall be of the plug type, bronze construction with check, nut and washer bottom and tee handle.

b. Gas cocks shall only be used on piping 1" and smaller.

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## 10. Solenoid Valve

a. Provide ~~s~~Solenoid valve designed for use in each gas supply line to ~~services~~serving kitchen area, mechanical rooms and instructional spaces to be explosion proof, water tight, 120V, 60 cycle, and 1-phase. Locate on floor level served.

## 11. Gas Meter Room Sign

a. ~~Require~~**Provide** a sign made of two colors laminated engravers stock phenolic, 1/16" minimum thickness, machine engraved to expose inner core color (white). Sign to be provided with uniform margins and character size 2" high.

b. Sign to read:

**GAS METER ROOM. NO STORAGE PERMITTED**

## 12. Natural Gas Booster

a. Gas appliances to be specified to use existing gas supply from Utility's bushing hub.

## 13. Gas Pressure Regulator

a. ~~Require~~A gas pressure regulator shall be installed before the inlet of each gas fired piece of equipment.

## C. Execution

### 1. General

a. Make the necessary arrangements with the Utility Company to bring natural gas service to connection ~~to~~ points shown on the design drawings, or as required by the Utility Company. ~~D-And~~ design the necessary pipe, fittings, valves, service, cocks, governors, etc., to extend ~~these~~ services to the Project's natural gas system distribution system.

b. Exact locations of gas service at property line shall be secured from the Utility Company by the Architect/Engineer.

c. As part of the gas service and meter piping certain equipment, such as meters, regulators, security valves, plug valves, relief valves and compression coupling will be furnished by the Utility Company, however, the Architect/Engineer shall specify any additional equipment and materials not furnished by the Utility Company, to make this service complete.

d. ~~Require~~Gas service line to pitch toward the building and be provided with drip leg and plugged outlet, or drip pot, as required by the Utility.

### 2. Installation

a. Gas service and gas distribution piping, ~~number and distribution~~quantity of appliances, shall be indicated on Drawings and shall be installed ~~indicated on the~~

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~~drawings and shall be in accordance with the rules and regulations of the Gas Utility Company, and shall meet the requirements of Local Township.~~

b. ~~Require~~ Provide inspection ~~and adjustment~~ and commissioning of all gas appliances, ~~of the Contract, so that they will properly and safely operate with natural gas.~~

c. Require notification of NJSDA when all is ready for the Gas Company to extend their service pipe to the street line; and again after tests, when all is in readiness for the installation of the meter. The meter shall then be connected with the service pipes, and with the several lines of distributing pipes. The setting, piping and connecting up of the meters shall be done in accordance with the rules of the Gas Company.

d. ~~Require~~ Joint compound (pipe dope) ~~be~~ used with screwed fitting shall be applied sparingly and only to the male threads of pipe joints. Such compounds shall be resistant to the ~~action~~ chemical reaction of gases and shall not contain any Teflon. The burrs made in cutting the pipe shall be removed. Plugged tees in place of elbows shall be used wherever directed. Where pipes of different sizes come together reducing fittings shall be used; no bushing will be permitted.

e. ~~Require~~ Piping installed below grade shall be connected by welding by approved certified welders.

f. Service piping below grade shall be mill wrapped in accordance with the Gas Company regulations.

g. Backfill operations shall be started only after welding inspection, coating inspection and testing have been completed as per regulations of the Gas Utility Company.

h. Inter-connections between piping at different pressure levels are not permitted.

i. Provide gas lubricated plug valves and show on drawings or otherwise required for control of gas in the distribution piping; mains, branches and at the base of each riser. Install sleeves in floors for risers to pass through. An accessible manual gas cock or lubricated plug valve of the same size as the pipe shall be installed at each piece of gas burning equipment, to allow for isolation of the equipment and where indicated on Drawings. All valves and cocks for gas throughout the building shall be tagged with numbered metal tags. Install drip, consisting of nipple and cap, at the base of all risers and changes in elevation.

j. Gas valves shall not be located withing drop ceiling and inaccessible ceiling areas. ~~designed in above ceiling locations.~~ Wall enclosures, pipe spaces or other recess in which gas valves are installed must be vented to the exterior ~~an adjoining ventilated area.~~

k. Final connections to all gas fired equipment and boiler gas trains shall be made by a licensed Plumbing Contractor.

### 3. Gas Piping Venting

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a. Gas service piping and gas meter piping shall have vent and relief piping designed and sized in full accordance with the requirements of the ~~serving Gas~~ Utility Company.

b. Gas train venting (Boilers and Water Heater):

1.) Gas vents from boilers shall not be combined with the water heater gas vents or other boilers.

2.) All normally open vent valves must be designed to be piped separately and directly to the outside.

3.) Design vent piping from pilot system (firm gas) and main burner system (interruptible gas) to be piped separately.

4.) Gas vents from gas pressure regulator and high and low gas pressure switches can be manifolded.

5.) Design gas vents with a Utility Company approved weatherproof vent cap.

6.) Vents shall terminate in accordance with all codes.

7.) Vents outlets shall not be located under a window overhang projection.

8.) The size of the vent lines shall be shown on the drawings.

#### 4. Gas Safety Shut Off Valves

a. Gas safety shut-off valves shall be designed downstream of its meter and before any branch take-offs.

b. Gas safety shut-off valves shall be hard wired to the gas leak detection system and shall function to shut off ~~all~~ gas supply ~~to the building~~ upon:

1.) ~~Action of~~ Notify the gas leak detection system of (alarm condition), ~~and~~

2.) Loss of ~~normal~~ electrical power (fail closed).

3.) Valves must be designed to be manually reset upon correction of the alarm condition or restoration of electrical power.

#### 5. Gas Safety Shutoff Valves; Operating Sign

a. Install one sign for each boiler burner or chiller unit control panels.

b. Require a sign to boiler burner/chiller unit control panel door using adhesive specifically designed for the purpose or mount sign on wall or other conspicuous location adjacent to the boiler burner control panel. Do not penetrate any door with fasteners.



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## 6. Gas Meter Room, Incoming Gas Service Room, Boiler Mechanical Room Ventilation

a. Gas meter room shall be ventilated by one of the following methods and indicated on the drawings:

~~b.1)~~ A louvered opening to the outside air in the exterior wall with a minimum free area of not less than 30 square inches.

~~c.2)~~ Gas Leak Detection Systems' exhaust fan and louver.

## 7. Painting

a. Require all exposed gas pipe to receive one (1) coat of Rust Inhibitive primer paint and one; (1) finished coat of safety yellow.

b. Mill-wrapped piping shall not be painted.

c. Piping at different pressure levels in the same space shall be color coded and labeled.

## 8. Labeling

a. Gas piping operating at different pressures shall have labeling markers indicate operating pressure within that piping.

b. ~~Require~~ All valves shall be ~~suitably~~ tagged to indicate the operating pressure level within the distribution piping.

## 9. Gas Meter Room Sign

a. Gas meter room sign shall be permanently and conspicuously posted on the exterior of the gas meter room door.

## 10. Demonstration

~~ba. Require~~ The services of a factory trained representative shall be available on the job site for start-up and for instructing NJSDA and School Custodian, and School Facility Director in the operation and maintenance of the gas safety shut-off valve.

~~eb.~~ The trainer shall videotape training of NJSDA and School Custodian.

### D2060.50 Processed Water Systems

#### A. General

##### 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.

##### 2. Summary

a. This Section includes design requirements water-treatment systems for the following:



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1.) Hot water piping (closed-loop system).

2.) Dry cooler glycol-water piping (closed-loop system).

### 3. Chemical Feed System Description

a. Closed-Loop System: One bypass feeder on each system with isolating and drain valves downstream from circulating pumps

b. Introduce chemical treatment through bypass feeder when required or indicated by test.

### 4. Performance Requirements

a. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

b. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

c. Closed System: Maintain system essentially free of scale, corrosion, and fouling to sustain the following water characteristics as required / recommended by the Water Treatment Sub-Contractor (WTC) or company.

## B. Equipment

### 1. Bypass Feeders

a. Cast iron or steel, for introducing chemicals into system; with funnel shutoff valve on top, air-release valve on top, drain valve on bottom, and recirculating shutoff valves on sides.

### 2. Chemical Solution Tanks

a. Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with graduated markings with molded fiberglass cover with recess for mounting pump, agitator, and liquid-level switch.

### 3. Packaged Conductivity Controller:

a. Solid-state circuitry, linear dial adjustment, built-in calibration switch, on-off switch and light, control-function light, output to control circuit, and recorder.

### 4. Chemical Tubing

a. Schedule 40, PVC with solvent-cement joints; or polypropylene tubing with heat fusion.

### 5. Plastic Ball Valves

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- a. Rigid PVC or CPVC body, integral union ends, and polytetrafluoroethylene seats and seals

## **6. Plastic-Body Strainer**

- a. Rigid PVC or CPVC with cleanable stainless steel strainer element.

## **C. Chemical Treatment Test Equipment**

1. Test Kit: Manufacturer recommended equipment and chemicals, in a pH, carrying case, for testing total dissolved solids, dissolved oxygen, bio count, chloride, and total alkalinity and for calcium hardness field tests.
2. Corrosion Test Coupon Assembly: Constructed of corrosion material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly.

## **D. Field Quality Control**

1. Require a factory-authorized service representative to perform startup service.
2. Require an inspection field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
3. Require an inspection of all piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
4. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

## **E. Adjusting**

1. Require the sampling water at one-week intervals after boiler startup for a period of five weeks, and certified test report for each required water performance characteristic. Comply with ASTM D 3370 and the following standards:
  - a. Silica: ASTM D 859.
  - b. Acidity and Alkalinity: ASTM D 1067.
  - c. Iron: ASTM D 1068.
  - d. Water Hardness: ASTM D 1126.
2. Occupancy Adjustments: Within 12 months of Substantial Completion, require that two separate water analyses to prove that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Perform analyses at least 60 days apart. Submit written reports of water analysis.

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Design Requirements

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**F. Demonstration**

1. Require a factory-authorized service representative to train Owner's adjust maintenance personnel to operate, and maintain HVAC water-treatment systems and equipment.



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## Design Requirements

### D50: Electrical

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## D50 Electrical

### D5010.10 Packaged Generator Assemblies

#### A. Emergency Generator Codes-Qualifications

1. An emergency generator, rated for stand-by operation, shall be provided in schools as per NJSDA Bulletin #27 and #27A, dated 1/9/2003 and 8/26/2003 respectively.
2. Emergency generators shall meet the latest code requirements of UL, NFPA 70 (National Electrical Code), 101 and 110 respectively.
3. Authorized or franchised distributor shall have a minimum of Ten years documented experience with service facilities within 100 miles of project.

#### B. Criteria

1. Emergency generators 200KW or less shall be air-cooled or water cooled, utilizing natural gas from the local utility serving as the primary fuel source. A dual fuel emergency generator with an onsite secondary fuel source is not required if a letter from the Gas Utility Company, on their letterhead, stating that the gas service they are providing to the building is continuous and not dependent upon the local power grid. This letter must be submitted to and accepted by the DCA. A dual fuel generator and an alternate fuel connection with the supply line below grade shall be provided only if a letter from the Utility is not provided. **If natural gas is not available, alternative fuel sources shall be considered on a case-by-case basis.**
2. Emergency generators shall be supplied with load banks for generator testing.
3. Generator loads shall be divided into two (2) classifications, each of which shall be connected to the emergency generator distribution system via its own dedicated automatic transfer switch (ATS) as follows:
  - a. Emergency Life Safety Systems
  - b. Emergency Power Systems (non-life safety loads).

**Note: The fire or sprinkler pump controller shall have its own integral dedicated and listed ATS.**

4. The following systems shall be connected to the Emergency Life Safety Systems ATS:

Fire/Smoke Detection and Alarm Systems including all related control panels

- a. Main and Remote Emergency Control Centers
- b. Auditorium Stage Emergency Control Panel
- c. Emergency lighting in corridors, exit and emergency egress lighting, security night lighting, stairs and places of assembly.

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- d. Code-required exterior lighting fixtures at exit discharge doors.
  - e. Lighting, Power and Air Conditioning for Emergency Control Room and Backup Control Room.
  - f. Lighting for Main Office, Nurse's Office, Custodian Office, Security Desk, and Electrical Rooms.
  - g. Power to operate one elevator: minimum.
  - h. Elevator cab lighting
  - i. Elevator pit lighting and sump pump.
  - j. Air conditioning or ventilation systems serving elevator machine and information technology rooms
  - k. Smoke Control Systems (including smoke control systems required for atriums, elevator hoist way ventilation, and stair pressurization systems).
5. The following shall be connected to the Non-Life Safety ATS:
- a. Public Address System
  - b. Telephone System
  - c. Building Automation System
  - d. Intrusion Alarm System
  - e. Telecommunication Main Distribution and Intermediate Distribution Frame (MDF and IDF) Rooms; lighting, power and air conditioning systems.
  - f. Video Surveillance System
  - g. Gas Leak Detection and Alarm System
  - h. Central Station Reporting System
6. Generator Rooms/Utility Areas
- a. The preferred location of the emergency generator is outdoors on the roof or alternately on grade within close proximity to the Electrical Service Room in a sound attenuated weatherproof enclosure with a critical silencer muffler for maximum sound attenuation and engine exhaust noise.
  - b. Such rooms or areas shall be physically isolated from the main entrance and parking, and concealed from public view, all sides shall be enclosed with walls and have the capability of being locked and alarmed.
  - c. Utility service transformer shall be concealed from public view, all sides shall be enclosed with walls and have the capability of being locked and alarmed.

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d. Utility service entrance equipment mounted on the exterior of the building shall be enclosed with walls or fences with lockable doors or gates.

## D5010.70 Transfer Switches

### A. Codes and Qualifications

1. Transfer switches shall conform to the latest edition of NEMA ICS 10, Industrial Control and Systems, AC Transfer Switch Equipment, and **NEC (NFPA 70)**. Inspect and test in accordance with NETA Standards.

2. Manufacture Qualification: Company specializing in manufacturing transfer switches with a minimum of ten years documented experience, with service facilities within 100 miles of project.

3. Supplier Qualification: Authorized distributor of specified manufacturer with minimum five years documented experience.

### B. Criteria

1. Transfer switches shall be automatic type with time delayed to provide optimum minimum sizing of the generator containing the following features.

2. The transfer switch shall be electrically operated, mechanically held double-throw type with single solenoid operator and mechanical/electrical interlocks.

3. The transfer switch shall contain a control panel with adjustable timing delay functions for normal, emergency and engine shutdown, including an In-Phase monitor.

4. The transfer switch shall be able to withstand a three-phase RMS fault for three cycles without the use of series current limiting fuses.

5. Transfer switches utilizing molded case circuit breakers or contactors shall be rated for continuous duty and repetitive switching.

6. Nameplates: Engraved lamicoid type screwed or riveted to transfer switch.

7. Environmental Conditions: Temperature 120 degrees F at an altitude of 3,300 feet.

## D5020 Electrical Service and Distribution

### D5020.10 Electrical Service

#### A. Electric Service Description/Design Approach

1. At the Schematic Design or Preliminary Design Phase, the design engineer shall submit a service request/load letter to the utility company. This request shall inquire about the

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available service voltage, utility short circuit current and impedance, charges and any other requirements. The request shall also indicate the desired voltage and point of entry, as well as a site plan with all available geotechnical, architectural and structural information.

2. The design engineer must perform an economic analysis to justify the service voltage and / or the need for step-down transformers design.
3. If transformers are used the electrical engineer must coordinate with the HVAC discipline for the ventilation.
4. The main service switch shall be a bolted pressure switch type.

## D5020.30 Power Distribution

### A. Switchboards Codes

1. Switchboards shall comply with the latest editions of **NEC (NFPA 70)** and UL 891 and shall be fabricated and installed to withstand the effects of earthquake motions determined according to SEI/SCE 7 requirements ~~and IEEE 344~~. Receive, handle and store switchboards according to NEMA PB 2.

### B. Criteria

1. Busses and Connections: All buses (phase, neutral, ground and connections) shall be hard-drawn copper of 98 percent conductivity tinned of uniform ampacity for entire length of switchboards main and distribution sections. Future extensions from both ends shall be provided. Neutral buses shall be minimum, 100 percent of the ampacity of phase buses. Bolted bus connections to be front accessible for maintenance.
2. Short-circuit Rating: Switchboards, circuit breakers, switches and fuses shall be rated to withstand and interrupt the full value of the available short circuit current. Series connected rating are not acceptable.
3. Submit Short Circuit, Coordination, and Arc Flash Study of entire distribution system in accordance with NFPA 70E, prior to equipment fabrication.
4. Overcurrent Protective Services: Switchboards shall contain Solid state-molded case circuit breakers in compliance with UL 489, and contain adjustable electronic RMS sensing for adjustable timing and current settings for circuit breakers 250 A and larger. Interrupting capacity to meet available fault currents. All other circuit breakers shall be Thermal-Magnetic type.
5. Future Provisions: Equipment spaces for future devices with bussing and bus connections, insulated, and braced for short circuit currents. Components to have continuous current rating.
6. Transient Voltage Surge Suppressor (TVSS): The TVSS shall **not** be ~~provided as an~~ integral component of the switchboard. **Provide the TVSS** in accordance with the latest edition of UL 1449, standard for safety and UL 1283, Electromagnetic Interference Filters.



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TVSS to have a life expectancy of at least 5000 transients without failure or degradation in accordance with ANSI/IEEE C62.41 Category C3 transients. TVSS to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage. A transient event surge counter shall be located on the front cover of the switchboard. The counter shall be equipped with a manual reset and battery to retain memory upon loss of AC power.

7. Nameplates and Labels: Nameplates shall be screwed or riveted to equipment. Glue will not be an accepted alternate method. Label each switchboard compartment, disconnect, overcurrent protective device, meter and control device mounted in compartment doors.

8. Bases: Switchboards shall be installed on concrete base, 4-inch nominal thickness.

9. Filler plates: unused spaces of panel mounted sections shall be provided with filler plates.

10. Environmental conditions: install switchboards in enclosed weather tight spaces after wet and dry work above switchboards is complete and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

11. Equipment operating conditions: Rate equipment for continuous operation under an ambient temperature not exceeding 104 degrees F at an altitude not exceeding 6600 feet.

12. Protection: Apply temporary heat to maintain temperature according to manufacturer's written instructions until switchboard is ready to be energized and placed into service.

13. Infrared Scanning: After substantial completion but not more than sixty days after final acceptance perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner. Perform an additional follow-up infrared scan of each switchboard (11) months after date of substantial completion. Include a certified report describing scanning results.

## **D5020.30 Power distribution**

### **D5020.30.20 Panelboards**

#### **A. Panelboards Codes and Certifications**

1. Panel boards shall comply with the latest editions of **NEC (NFPA 70)**, NEMA PB 1. Panel boards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 requirements. Fabricate and test according to IEEE 344 to withstand seismic forces. Install Panelboards and accessories according to NEMA PB 1.1.

2. Submit certification that panelboards, overcurrent protective devices accessories and components will withstand seismic forces. Indicate whether withstand certification is based on actual test of assembled components or on calculations.

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## B. Criteria

1. Busses: All buses (phase, neutral, ground) shall be hard-drawn copper of 98 percent conductivity. Neutral buses where indicated shall be minimum, 200 percent of the ampacity of phase buses and UL listed as suitable for nonlinear loads.
2. Short-circuit current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Series connected ratings are not acceptable.
3. Branch overcurrent protective devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units. Mounting brackets, bus connections, filler plates and necessary appurtenances required for future installation of devices.
4. Overcurrent Protective Services: Panel boards shall contain thermal-magnetic molded case circuit breakers and comply with UL 489. Thermal - magnetic circuit breakers to contain adjustable magnetic trip settings 250 A and larger, with interrupting capacity to meet available fault currents.
5. Doors: Concealed hinges secured with flush latch and tumbler lock; keyed alike. Distribution panels to be door-in -door construction.
6. Nameplates: Nameplates shall be screwed or riveted to equipment.
7. Filler plates: unused spaces of panel mounted sections shall be provided with filler plates.
8. Directory Card: inside panelboard door mounted in metal frame with transparent protective cover.
9. Environmental conditions: install panelboards in enclosed watertight spaces after wet and dry work above panelboards is complete and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
10. Equipment operating conditions: Rate equipment for continuous operation under an ambient temperature not exceeding 23 degrees F to 104 degrees F at an altitude not exceeding 6600 feet.
11. Equipment mounting: install floor mounted panelboards on concrete bases, 4-inch nominal thickness.
12. Acceptance Testing: Perform acceptance tests in accordance to NETA. Test insulation resistance for each panelboard bus, component, connecting supply, feeder and control circuit. Test continuity of each circuit. Certify compliance with test parameters.
13. Infrared Scanning: After substantial completion but not more than sixty days after Final Acceptance perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner. Perform an additional follow-up infrared scan of each panelboard (11) months after date of substantial completion. Include

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a certified report describing scanning results and include notation of deficiencies, remedial action taken and observations after remedial action.

14. Load Balancing: After Substantial Completion but not more than 60 day after final acceptance measure load balancing and make circuit changes as necessary. Differenced exceeding 20 percent between phase loads is not acceptable. Rebalance and recheck as necessary to meet the minim requirement

15. Protection: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

## D5020.30.30 Transformers

### A. Transformers Codes and Qualifications

1. Transformers shall comply with the latest edition of NEMA ST 20, NETA STD ATS, NFPA 70, UL 1561 and NEMA ST – TP2.2. Manufacture Qualification: Company specializing in manufacturing transformers with a minimum of ten years documented experience.

### B. Criteria

1. All transformers shall be air-cooled two-winding dry type with copper windings
2. Insulation system shall be UL Class 220 degree C with an average temperature rise of 115 degree C in a maximum ambient temperature of 40 degree C. and a hot spot temperature of 30 degrees C.

## D5020.70 Facility Grounding

### A. Codes

1. A grounding and bonding system for underground utilities, steel building structure grounding electrode system, ground well test stations, equipment, raceways and piping, shall be provided in accordance with the latest edition of UL 467, and NEC (NFPA 70).

### B. Criteria

1. All wiring shall be copper with cast bronze cable splicers and clamps. Use exothermic – welded connections for outdoor locations.
2. Measured ground stance values:
  - a. Building Structure Grounding Electrode System, Pad-Mounted Equipment: 5 ohms
  - b. Power and Lighting Equipment with capacity 500kVA and less: 10 ohms
  - c. Power and Lighting Equipment with capacity more than 1000kVA: 3 ohms

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3. Testing and inspections: After installing grounding system but before permanent electrical circuits have been energized test for compliance with above criteria. Make tests at ground rods before any conductors are connected. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means for reducing natural ground resistance. Perform all tests by fall-of – potential method according to IEEE 81.

## **D5030 General Purpose Electrical Power**

### **D5030.10 Branch Wiring System**

#### **A. Conduits and Codes**

1. Conduits shall comply with the latest editions of ANSI C80.1, ANCI C80.3, NECA 1, NECA 101, NEMA TC 2, NEMA TC 3, and NFPA 70. Products to be listed and classified by underwriters Laboratories, Inc. as suitable for purpose specified and shown on construction documents.

#### **B. Criteria**

1. Protection: Conduits to be protected from corrosion and entrance of debris by storing above grade and providing appropriate covering. Protect PVC conduit from sunlight.
2. Interior Installation: All conduits located concealed in ceiling and walls or run exposed shall be installed in electrical metallic tubing for branch circuit wiring. Rigid Steel Conduit shall be used where conduit is encased in the buildings poured concrete construction or exposed to weather or wet and damp locations. Minimum Size: ¾ inch.
3. PVC Conduit: Heavy wall non-metallic conduit shall be used for all conduits buried in ground or in concrete ductbank.
4. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type up to 1-1/4 inch EMT, and set screw type; 1-1/2 inch and larger EMT. Cast compression fittings are not acceptable.

#### **C. Wire Codes and Qualifications**

1. Wire to conform to latest addition of NFPA 70
2. Manufacturer qualifications: Manufacture Qualification: Company specializing in manufacturing wire with a minimum of ten years documented experience.
3. Supplier Qualification: Authorized distributor of specified manufacturer with minimum five years documented experience.

#### **D. Criteria**

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## Design Requirements

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1. Concealed Dry Interior Locations: Install building wire in raceway or use metal clad cable. Use of metal clad cable is limited to 30 amps, single-phase circuits, as permitted by NFPA 70.
2. Exposed Dry Interior: use building wire in raceway.
3. Above accessible ceilings and in drywall: use building wire in raceway or metal clad cable. Use of metal clad cable is limited to 30 amps, single-phase circuits.
4. Wet or damp interior locations: Use building wire in raceway.
5. Exterior Locations: Use building wire in raceway.
6. Underground Installations: Use building wire in raceway.
7. Solid Conductors: Use 10 AWG and smaller.
8. Control Circuits: Use stranded conductors.
9. Minimum Conductor Sizes: use 12 AWG for power and light, and 14 AWG for control circuits.
10. Material: All conductors shall be copper.
11. Insulation Type: THHN/THWN for branch wiring, single conductor for feeders.
12. Temperature Rating: ~~75~~90 degrees for wet or damp locations and 90 degrees for dry locations.
13. Metal Clad Cable: Use galvanized steel armor jacket with interlocked metal tape and green insulated grounding conductor.
14. Ground wire: provide a separate green isolated ground wire in each feeder and branch circuit and other conduits containing current carrying conductors.
15. Dedicated neutral: each single-phase branch circuit shall consist of respective phase conductor and a dedicated neutral conductor, unless specifically indicated otherwise on the plans.
16. Identification: Identify each conductor with its circuit number and/or other designations.
17. Testing: Test all wiring for continuity and insulation resistance in accordance with NETA Standards.

### D5030.50 Wiring Devices

#### A. Codes and Qualifications

# Model Schools: Materials and Systems Standards

1. Wiring devices such as switches, dimmers and receptacles shall comply with the latest editions of NECA 1, NEMA WD 1, NEMA WE 6 and NFPA 70. Provide products listed and classified by UL, Inc. as suitable for the purpose specified.

2. Manufacturer qualifications: Company specializing in manufacturing wiring devices with a minimum of five years documented experience.

3. Supplier Qualification: Authorized distributor of specified manufacturer with minimum five years documented experience.

## **B. Criteria / Wiring Devices**

1. All wiring devices shall be heavy duty specification grade. Wall dimmers shall be T-Star rated.

2. Wall plates: type 302 ~~satin~~ **brushed** finish stainless steel, .035 gauge thick. Cover plates for emergency receptacles shall be red in color.

## **C. Criteria / Classrooms Receptacles**

1. Classroom receptacles for general instruction shall be provided with convenience outlets in accordance with DOE standards, specific equipment requirements, and the furniture layouts. Receptacles shall be 20-amp, 120-volt duplexes, specification grade.

2. Kindergarten, and pre-kindergarten classrooms, safety type receptacles shall be installed. Also all toilet rooms serving these classrooms shall be GFI protected.

3. All receptacles serving computer stations, printers and scanners shall be surge suppression type. Receptacles shall be rated for a minimum of 1000joules.

## **D. Criteria / Corridors, Lobbies, Places of Assembly, Parapets, Pipe Chases and Roofs**

1. Receptacles for maintenance shall be 20 Amp, 120 Volt, Specification grade, duplex type and spaced so that all areas are accessible by a 50' extension cord. Exterior receptacles shall be lockable and GFCI protected.

## **E. Criteria / Telecommunications Room**

1. Minimum of ten quadruplex dedicated receptacles shall be provided at the Main Telecommunications Room data racks and cabinets. The receptacles shall be placed near the data racks and cabinets, a minimum of two quadruplex receptacles for each rack or cabinet. Unless otherwise required by specific equipment, two 20-amp, 220-volt circuits with L6-20R twist lock receptacles shall be provided in the MDF Room at the main data rack to power the switch.

2. IDF Room: Three duplex, dedicated 20 Amp, 120 Volt receptacles shall be provided at least two feet apart near the IDF.

## **F. Criteria / Building Management System**

1. Provide four dedicated duplex receptacles at least two feet apart in the room housing the BMS control system.

# Model Schools: Materials and Systems Standards

2. Provide a dedicated duplex receptacle in other locations housing BMS equipment requiring power.

## **G. Criteria / Coordination**

1. Building Management System (BMS) requirements shall be coordinated with specific equipment requirements in addition to the following:
2. All data and BMS design documents, including riser diagram and floor plans, shall be submitted to the NJSDA Systems Integrator for review and approval during the appropriate construction document phase.

## **H. Criteria / Kitchen Electrical Requirements**

1. Electrically and mechanically operated gas valves shall be installed in kitchens and interlocked with auxiliary systems and kitchen equipment to provide proper control and safe operation as well as emergency features. The interlocks and control schemes shall be as follows:
  - a. Exhaust Fan Interlock with Appliances
  - b. NFPA requires the energy source (gas or electric) producing heat for each appliance under hood to be interlocked with exhaust fan.
  - c. In general, each gas appliance contains an integral gas shut down solenoid. Appliances with a gas pilot must be provided with a pilot bypass. The solenoid control circuit is factory wired to the main electrical supply for the appliance. Therefore, with gas or electric operated appliances, the main electrical supply shall be interlocked with the exhaust fan.
  - d. The power for the equipment under the hood shall be served from a dedicated power panel sub-fed from the main kitchen power panel and equipped with as many branch circuit breakers as required. This power panel shall be controlled via an auxiliary contact from the hood exhaust fan motor starter incorporated in the switching control circuit of a remote control switch.
2. Fire Extinguishing System/Appliance Shutdown
  - a. When the fire extinguishing system is activated, the energy source for the appliances under hood must be shut down. However, the exhaust fan must continue to operate so as to aid in the dispersing of the extinguishing agent.
  - b. To accomplish this, a normally closed pressure activated micro switch, supplied by the fire extinguishing system contractor and shall be wired to the control loop of the relay. This will shut down panel when the extinguishing system is activated. In addition, a second micro switch contact shall be provided to notify Fire Alarm Control Panel when extinguishing system is activated.
  - c. The main gas supply is shut down by a mechanically operated valve, activated by the extinguishing system. This valve has no electrical connections.



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## 3. Kitchen Master Control Gas Valve

a. The Master Control Gas Valve shall be capable of shutting off all gas flow to the kitchen in case of emergency. This sub-system is comprised of a 120 Volt 60 Hz AC valve, a relay control panel, and a control station. The control station shall contain a key switch to energize the gas valve and a red mushroom push-button labeled "Emergency Gas Shutoff."

b. The Master Control Gas Valve shall be controlled by a control station located near the equipment. Additionally, control stations shall be located at each means of egress of the Kitchen. The Master Control Gas Valve shall control the gas supply to all gas-fired appliances, including the pilot lights, when the Kitchen is closed for long periods of time and for an emergency shut-off situation.

## 4. General Electrical Requirements for the Kitchen

a. Exhaust hood light fixtures provided by the Kitchen Equipment Contractor shall be installed and connected to a switch by the Electrical Contractor. The switch provided by the Electrical Contractor shall be installed next to the exhaust fan switch.

b. All disconnect switches in kitchen area shall be in NEMA 4 enclosures to provide protection against splashing water. Surface mounted switches shall be provided with waterproof hubs.

c. All kitchen receptacles shall be GFCI protected, 20 Amp, 125 Volt specification grade. GFCI protection may be provided at the panel in lieu of the receptacle.

d. The Kitchen Power Panels shall be located in an area adjacent to the kitchen, but not in the kitchen itself.

## D5040 Lighting

### D5040.10 Lighting Controls

#### A. Lighting Controls – Design Approach

1. All interior lighting shall be automatically controlled by a Digital Lighting Management System except for the emergency lighting. Provide Lighting Control Panels in Electric Closets on each floor connected to Lighting Panels for automatic shut-off within ~~30~~20 minutes of occupants leaving interior spaces.

#### B. Codes – Qualifications

1. Lighting control system shall be based on current presiding codes in accordance with ASHRAE 90.1, and NFPA 70. Provide equipment with labels or certifications from applicable testing agencies as required by codes and referenced standards.

2. Manufactures Qualifications: Company specializing in manufacturing Digital lighting control systems shall have a minimum of five years documented experience with service facilities within 100 miles of project.



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Design Requirements

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## C. Criteria

1. Components shall plug together in any configuration with preassembled RJ45 connectors/category 5e cables.
2. Lighting control system shall be networked for scheduled control and remote system management.
3. Lighting control methods shall be provided in accordance with the table below:

AREA	LOCAL SWITCH CONTROL	LOCAL-AUTOMATIC CONTROL/SENSOR	COMMENTS
<b>AUDITORIUM/MULTIPURPOSE</b>			
Circulation Paths	Line-voltage switch	Not required	Switches at entrances and stage area to control minimal entry/circulation illumination.
Seating Area	Line-voltage Switch	Not required	Switches to control house lighting to be located at the stage.
Stage Area	Line-voltage Switch	Not required	Switches to control non-theatrical stage lights to be located at the stage.
Gym	Not required	Occupancy sensors	Ceiling mounted sensors to automatically turn lights on/off.
Cafeteria/Lunchroom	Not required	Occupancy sensors	Ceiling mounted sensors to automatically turn lights on/off.
Kitchen	Low-voltage switch	Vacancy sensor	Switches at entrance.  Ceiling mounted vacancy sensors.  Manual-on/Auto-off
Classrooms	Low-voltage switches	Vacancy sensor  Daylight sensor	Main switch bank at entrance: Daylight zone switch (row nearest windows) Non-daylight zone switch (rows away from windows).  Teaching Control Center switch bank (three switches); Whiteboard-on/off switch, General-uplights or downlights switch, Quiet time-1hr override switch.  Ceiling mounted sensors

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## Design Requirements

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Conference/Work rooms	Line-voltage	Vacancy sensor	Wall mounted sensor/switch. Manual-on/Auto-off
Control rooms	Line-voltage	Not required	

Dance Studios	Low-voltage switch	Vacancy sensor	Ceiling mounted sensor. Manual-on/Auto-off.
Media Center	Low-voltage switch	Vacancy sensor Daylight sensor	Main switch bank at entrance: Daylight zone switch, Non-daylight zone switch.  Ceiling mounted sensor
Individual Offices	Line-voltage switch	Vacancy sensor	Wall mounted sensor. Manual-on/Auto-off
Records Room	Occupancy sensor/switch	Occupancy sensor	Wall mounted sensor/switch. Manual-on/Auto-off
Staff – Lunchroom/Lounge	Low-voltage switch	Vacancy sensor	Ceiling mounted sensor. Manual-on/Auto-off.
<b>SERVICES/UTILITIES</b>			
Electric Closets	Line-voltage switch	Not required	
Elevator Machine Room	Line-voltage switch	Not required	
Janitor Closets	Line-voltage switch	Not required	
Mechanical Areas – Service Areas	Line-voltage switch	Not required	
Pipe Chases/Crawl Spaces	Line-voltage switch	Not required	
Shops & Areas with Machinery	Line-voltage switch	Not required	
Storage Rooms	Occupancy sensor/switch	Occupancy sensor	Wall-mounted sensor/switch. Manual-on/Auto-off.
Switchboard Rooms	Line-voltage switch	Not required	
Telecommunication Rooms	Occupancy sensor/switch	Occupancy sensor	Wall-mounted sensor/switch. Manual-on/Auto-off
<b>CIRCULATION AREAS</b>			
Lobby /Main Entrance	Not required	Not required	Lights controlled by control panel.

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## Design Requirements

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Corridors	Key-operated switch (emergency lights only)	Not required	Key operated switch located at main entrance for emergency lighting in corridors only. Other lights controlled by control panel.
Stairs	Key-operated switch (emergency lights only)	Not required	Key operated switch located at main entrance for emergency lighting in stairs only. Other lights controlled by control panel.
<b>PHYSICAL EDUCATION</b>			
Locker/ Shower Rooms	Not required	Occupancy sensor	Ceiling mounted sensors to automatically turn lights on/off.
Swimming Pools	Not required	Occupancy sensor	Ceiling mounted sensors to automatically turn lights on/off.
Exercise room	Not required	Occupancy sensor	Ceiling-mounted sensors to automatically turn lights on/off.
<b>TOILETS</b>	Occupancy sensor/switch	Occupancy sensor	Wall-mounted sensor/switch. Manual-on/Auto-off.

### D. Testing:

1. Upon completion of control system, manufacturer shall commission system and document that system is installed and functions in accordance with contract documents. All testing documentation shall be submitted for review and acceptance.

## D5040.50 Lighting Fixtures

### A. Codes and Qualifications

1. Lighting fixtures shall comply with the requirements of **NEC (NFPA 70)**, 101, ANSI, NECA/IESNA 500 (application, installation, and safety) and products listed and classified by United Testing Laboratories, Inc.
2. Provide lighting levels based on current presiding codes designed in accordance with recommendations of N.J.A.C. 6A:26-6.3, 6.4, ANSI/IES-RP3-and ASHRAE 90.1.
3. Provide luminaries that do not collect dirt rapidly and are readily cleanable in accordance with IESNA Category 1, 2, or 5 for minimum dirt accumulation and Luminaire Dirt Depreciation (LDD) factors.
4. Power Consumption and Efficiency shall comply with Lighting Power Density (LPD) requirements in accordance with ASHRAE 90.1, Table 9.6. (Space by space method) and provide LPD for entire school.
5. ~~Ballasts~~ **LED Drivers** shall comply with ANSI ~~C6.41, C82.11~~ **C82.15-2021** (where applicable), FCC rules and regulations, ~~title 47 CFR pt. 18 for EMI/RFI (conducted and radiated)~~ **Title 47 Part 15 Class A or B** and be manufactured in a factory certified to ISO

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9001~~2~~ quality standards.

6. ~~Ballasts~~ **LED drivers** shall carry a ~~five-ten~~ year full replacement warranty from date of manufacture.

7. Manufacturers Qualifications: Company specializing in manufacturing interior lighting products that meet the requirements of these standards with a minimum of 10 years experience.

## B. Criteria

1. General: Lighting fixtures shall be appropriate for their specific location, taking illumination level and quality, efficiency and ease of maintenance into consideration. Lighting Power Densities (LPD) should not exceed 80% of the values listed in ASHRAE 90.1.

2. Fixture Types number of different fixture types shall be limited to as few as possible. Custom fixtures shall not be used. All lighting fixtures must be of a design that permits re-lamping by the custodian without the use of special tools or equipment with the exception of vandal proof fixtures.

3. Lamps: ~~Linear fluorescent lamps shall be T8. Other~~ Linear fluorescent lamps ~~may be considered subject to SDA approval~~ **shall not be used**. Mercury Vapor Lamps; Low and High Pressure sodium lamps shall not be used. The use of incandescent lamps shall be limited to theatrical lighting.

4. ~~Ballasts: ballast shall be electronic instant-start, high frequency (above 42 kHz) type with <10% THD, 0.88 Ballast Factor standard for T8 lamps, High Power Factor (greater than 0.98), class A sound rated. Provide 1.00 Ballast Factor for T5/T5HO lamps.~~ **LED Drivers: provide high-efficiency drivers with less than 10% total harmonic distortion and high power factor greater than 0.98. Provide 0-10v analog continuous dimming from 0% to 100% for all lighting under occupancy or daylight sensor control.**

5. Portable Lamps: The use of portable lamps (not permanently attached to the building or other building furnishings) may not be used to accomplish required interior lighting unless specifically specified.

6. Lighting Layouts: Provide lighting layouts in accordance with the geometry of the space and the location of visual tasks.

7. Visual Comfort: Provide lighting systems for achieving visual comfort with the following characteristics:

a. Luminance Ratio: maximum luminance of luminaire does not exceed average luminance by ratio of more than 4:1 at 45,55,65,75 and 85 degrees from nadir for crosswise and lengthwise viewing.

b. Maximum luminances of luminaires crosswise and lengthwise do not exceed the following values:

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- 1.) 45 degrees above nadir 7500 cd/sq m.
- 2.) 55 degrees above nadir: 5000cd/sq m.
- 3.) 65 degrees above nadir: 3500 cd/sq m.
- 4.) 75 degrees above nadir: 2200cd/sq m.
- 5.) 85 degrees above nadir: 1500cd/sq m.

c. Spatial Luminance: Provide luminous environments throughout project in which brightness ratios are maintained within the following ranges:

- 1.) Task Area and Adjacent Darker Surroundings: 3:1
- 2.) Task Area and Adjacent Lighter Surroundings: 1:3
- 3.) Task Area and More Remote Darker surfaces: 5:1
- 4.) Task Area and More Remote Lighter Surfaces: 1:5

d. Lamp Color: provide light sources throughout project with color temperatures and Color Rendering Indices (CRI) as listed below. Other color temperatures may be considered subject to SDA approval.

- 1.) Linear Fluorescent Lamps: 3500 Degrees K; CRI 80 minimum.
- 2.) Compact Fluorescents Lamps: 3500 Degrees K; CRI 80 minimum.
- 3.) Metal Halide Lamps: 4000 Degrees K; CRI 65Minimum.

**4.) LED Lamps: 3500 Degrees K; CRI 80 minimum**

e. Light Source: Provide lamps with average lamp efficacy rating not less than the following:

- 1.) Tungsten- Halogen Lamps: 25 lumens / watt
- 2.) Compact Fluorescent Lamps: 69 lumens / watt
- 3.) Linear Fluorescent Lamps: 90 lumens / watt

**4.) LED Lamps: 110 lumens / watt**

f. Lighting Calculations: Calculations shall be prepared by a registered electrical engineer along with associated product data for lamps and luminaires. As the basis for the calculations use room reflectance of 80/50/20 (ceilings/walls/floors) and a total light loss factor of not less than 0.75. Foot-candle calculations shall be average maintained based on a work plane of 30"AFF.

## C. Lighting Fixture Requirements by Space

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## Design Requirements

## Electrical - Section D50

1. Cafeteria/Lunchroom: ~~recessed 2'x4', three lamp parabolic luminaire with 18 cells, 3 inch deep, anodized aluminum, low iridescent louver.~~ **Pendant 96"x11"x5" industrial LED linear fixture with white steel cross baffle and frosted acrylic lens.**
2. Classrooms:
  - a. ~~Option 1: Recessed 2'x4', three lamp fluorescent center basket, finished in high reflectance matte white power coat paint. Center basket lens shall be linear prism acrylic with high transmission overlay for lamp obscuration. Provide acrylic dust guards (lamp and contaminant protection), light seals at both ends of lens (light leak prevention). Seismic brackets shall be integrated into the fixture assembly.~~
  - b. ~~Option 2: Pendant rectilinear, three lamp fluorescent linear LED direct/indirect (30% up / 70% down) lighting units with white cross blade baffle, 87-cell baffles spaced 0.5" apart finished with 96% reflective white paint. Housings shall be 20-gauge, die formed steel with 18-gauge die formed internal joiner system. Provide lamp dust cover and access to ballast compartment for re-lamping from below without the need of tools. Fixtures shall be prewired dual circuit (general lighting mode two outer lamps or audiovisual mode center lamp). Classroom fixtures shall have a minimum efficiency rating of 85% as measured my independent testing laboratory.~~
3. Classroom Whiteboard:
  - a. Recessed single lamp fluorescent extruded wall washer with 25-gauge Alanod semi-specular aluminum asymmetric reflector with 94% high reflectance finish. Seismic brackets shall be integrated into the fixture assembly.
  - b. When pendant direct / indirect scheme is chosen, provide oval pedant mounted single lamp fluorescent wall washer with 25-cell white cross blade baffles, optical chamber painted with 96% reflective white paint. Body shall be extruded aluminum, with 18-gauge steel end brackets and no exposed fasteners, holes or knockouts. Length as required for whiteboard illumination. Classroom fixtures shall have a minimum efficiency rating of 85% as measured my independent testing laboratory.
4. Computer Rooms: See classroom direct/indirect fixture for description.
5. Corridors: ~~Same as Cafeteria: Recessed 2'x4', three lamp parabolic~~ **LED volumetric luminaire with smooth acrylic diffuser 18 cells, 3 inch deep, anodized aluminum, low iridescent louver.**
6. Elevator machine room: surface heavy duty 4-foot **pendant/surface LED fixture with symmetrical white reflector with 10% uplight and replaceable diffuser.** ~~two lamp, fluorescent bare lamp strip with wire guard. Housing shall be die formed steel channel fabricated for individual or row mounting, with multistage phosphate bonding treatment and painted with high reflectance white polyester power coating. Lamp holders shall be~~

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## Design Requirements

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~~rotary locking type. Provide ballast covers with 1/4 turn fasteners.~~

7. Gymnasium **and Multipurpose Room:** ~~Pendant 2'x4', six lamp~~ High bay **LED fixtures linear fluorescent luminaire with multi-faceted 95% reflectance MIRO-4 reflector and wire guard. Minimum efficiency rating shall be 95% as measured by independent testing laboratory. Housing constructed of riveted code gauge die embossed steel with high gloss baked white enamel, applied over iron phosphate pre treatment. Provide tool free access to ballast and lamps.**

8. Janitor Closets: See elevator machine room for fixture description.

9. Kitchen Areas, Kitchen, Store rooms and Servery Areas: ~~recessed 2'x4' three lamp fluorescent gasketed, LED~~ luminaire with prismatic K12 lens, ~~mitered corners, flush door frame hinged at corners and UL listed for wet location. Housing shall be heavy gauge die formed steel with rolled or hemmed housing edges. Provide heatsink embossments behind ballasts. All metal parts shall be treated with five stage phosphate bonding process and finished with a polyester power coat, reflectance of 90%.~~ Vermin proof, with silicone sealant on all seams.

10. Media Center / Library: ~~See classroom direct/indirect fixture for description. Pendant direct/indirect (85% down/15% up) LED linear fixtures with 0-10v analog dimming for daylight zone. Excludes entrance, circulation desk.~~ Provide number of lamps in accordance with foot-candle requirements.

11. Mechanical / Electrical / Telecommunication Rooms: **48" long pendant/surface LED fixture with symmetrical white reflector with 10% uplight, and replaceable diffuser.** ~~Industrial surface /pendant 1'x4' or 1'x8' (tandem) two lamp Industrial fluorescent luminaire. Housing shall be heavy gauge die formed steel with knockouts for stems or chain hangers. Reflectors shall be die embossed with ribs. All metal parts shall be treated with five stage phosphate bonding process and finished with a polyester power coat, reflectance of 90%.~~

12. ~~Multi-Purpose Room: pedant ellipsoidal, three lamp fluorescent direct/indirect (30%/70%) lighting units with cross blade baffle, white cross blades spaced 1.0" apart finished with 96% reflective white paint. Housings shall be extruded aluminum, cold-rolled steel. Provide lamp dust cover and access to ballast compartment for re-lamping from below without the need of tools. Fixtures shall be prewired dual circuit (general lighting mode two lamps or audiovisual mode one lamp). Minimum efficiency rating shall be 90% as measured my independent testing laboratory.~~

13. Office: ~~See Cafeteria/Lunchroom for fixture description.~~ **Recessed 2' x 4' indirect volumetric LED fixture with "gull-wing" shape.**

14. Records Room: See **Office** ~~cafeteria/lunchroom~~ for fixture description.

15. Shower Room: See Kitchen for fixture description.

16. Stairs-main/intermediate landings: **18" surface-mounted LED with vandal-resistant**



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## Design Requirements

## Electrical - Section D50

~~lens, surface 12" Diameter wall mounted round drum, square, or rectangular fluorescent luminaire with polycarbonate lens retained with cast aluminum door/trim frame and allen head tamper resistant screws, power paint white finish.~~

17. Stairs-underside: **Surface 4' x 8" LED with vandal-resistant lens.** ~~surface 6 "square, 4'long single lamp fluorescent luminaire with white cross baffle and white steel housing.~~

18. Exits: Exit signs shall LED type, low profile; cast aluminum with red letters, white finish and universal arrows.

19. Toilet / Locker Room: recessed tamper resistant 2'x2', ~~four lamp fluorescent~~ **LED** luminaire with prismatic high impact K12 lens, ~~.140" thick in flush steel mitered corner door frame secured by tamper resistant screws. Minimum lamp-to-lens spacing shall be not less than 2" with minimum fixture depth of 4". Housing shall be heavy gauge die formed steel with hinged and riveted end caps. All metal parts shall be treated with five stage phosphate bonding process and finished with a polyester power coat, reflectance of 90%.~~

**20. Refer to Performance Specifications Section D5040.30 for additional project-specific lighting requirements.**

### D. Emergency Lighting- Design Approach

1. Provide power for Emergency Lighting through the Emergency Systems automatic transfer switch for all areas listed in Section D5010.10.

### E. Criteria

1. Illumination Levels required for emergency lighting shall be measured at the floor as follows:

#### a. Places of Assembly

1.) General .....1.0FC

2.) Aisle.....2.0FC

3.) Exit Doors.....2.0FC

b. Corridors, exits, exit discharges, Areas of Rescue Assistance .....2.0FC

c. Exterior exit lights immediately adjacent to exit doorways.....5.0FC

d. Safe Areas, including all stairs, ramps, within the area.....5.0FC

e. Fire Rescue Areas/Areas of Rescue Assistance.....1.0FC

f. Corridor sign for Fire Rescue Area/Area of Rescue Assistance.....25.0FC

### F. Exit Signs-Design Approach



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1. Exit signs shall be placed by the Architect of Record to be code compliant. Means of egress shall be clearly marked by illuminated exit signs with 8" letters so that exits and path of egress are easily recognized from any point in a corridor or Place of Assembly.

## **G. Criteria / Exit Signs**

1. Exit Signs placement shall be such that no point in an exit access corridor is more than 100 feet or the UL listed viewing distance for the sign whichever is less, from the nearest visible exit sign.
2. Wall mounted exit signs are preferred over pendant mounted exit signs.
3. Pedant mounted exit signs should be strictly limited to meet visibility requirements and only when additional wall mounted units may not suit the need.

## **D5040.50 Stage and Platform Lighting**

### **A. Design Approach and Codes**

1. The Stage and Platform Lighting requirements contained herein represent a minimum standard that shall be met. In the event that the Design Consultant and their Sub-Consultants has a justifiable reason to increase any of these requirements, the justification must be presented both verbally and in writing and approved by the NJSDA at the earliest stage in the Design Phase(s) as possible.
2. A dimming system shall be provided for auditorium/stage area/platform lighting. The dimming system shall control spotlights and border lights via a stage control panel mounted on the stage area/platform and a remote portable control console that can be plugged into remote outlets. (Emergency lighting is not part of the dimming system and shall not be dimmed.)
3. The lighting and dimming systems shall be in accordance with the local district and Department of Education requirements, NFPA 70 and UL.

### **B. Criteria/Lighting**

1. Coordinate exact location and mounting height of all fixtures with the Architect.
  - a. Spotlights
    - 1.) Provide two (2) sets of spotlights, Each set shall consist of four (4) 6" adjustable zoom (beam angle 25-50 degrees) type ellipsoidal reflector spotlights. Fixtures shall be paired to light the Left, Center and Right portions of the stage, with the fourth fixture pair as a Front Special. Fixtures shall use 575 watt tungsten, 2000 hour life lamps. All spots to be dimmer controlled.
  - b. Border Lights
    - 1.) Border Lights: Provide two rows of track lights above platform. Each track shall consist of lamp sockets 6" on center with permanent glass color filters and 100 watt lamps. Each track shall be wired for four colors (Clear, Red, Amber, Blue) on four alternating circuits (every fourth lamp). Minimum of two circuits per color.

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2.) Control: One dimmer per circuit, one control channel per color.

c. Worklights: Provide ~~industrial fluorescents~~ **4 foot LED strip lights** above the platform, switched separately from the dimming system.

## C. Criteria/Dimming System

### 1.) Dimmer Racks

a.) Dimmer racks shall be wall mounted dead front type. They shall accept plug-in electronic control modules and be designed to contain up to 24 plug-in dimmer modules each rated at 2.4 KW.

b.) Dimmer racks shall be provided with a lockable door.

c.) Dimmer racks shall be 120/208V, 3-phase, 4-wire, 60 Hz A.C.

### 2.) Portable Control Console

a.) Control console shall be microprocessor-based with 24 channels for two scene preset and manual operations, and switchable to 96 channels, 500 cues for advanced operation. Each dimmer shall be individually controllable with the control console. Console shall allow Sub-Master grouping of control for multiple circuits such as border light colors. Console shall also have display and on-screen help menus.

### 3.) Stage Control Panel

a.) Stage control panel shall be equipped with faders and master intensity control to provide easy playback and recording of a minimum of 8 lighting presets. Manual sliders shall be provided for Left, Center, Right and Front Special spotlights, Overhead Clear, Amber, Red and Blue Border lights, two Overhead Specials and Two Stage Specials.

b.) Stage control panel shall be wall mounted inside a lockable enclosure located on stage. Enclosure to be flush mounted.

### 4.) Entry Stations

a.) Provide additional single gang control stations at entry doors. Entry Stations shall have a key lockable cover and allow selection of the first preset and off.

c. Worklights: Provide industrial fluorescents above the platform, switched separately from the dimming system.

## D5040.50 Exterior/Site/Security Lighting (Refer also to G4050 Site Lighting)

### A. Design Approach

# Model Schools: Materials and Systems Standards

1. Exterior/Site/Security Lighting shall be provided on the building, around the perimeter of the school and on playing fields for safe passage of students and staff to deter theft and vandalism. Lighting design shall minimize light trespass from the building and site, reduce sky glow, improve nighttime visibility through glare reduction and reduce development impact on the nocturnal environment. Provide building elevations and site plan to clearly depict the location and mounting height of each fixture.

## **B. Codes and Qualifications**

1. The exterior lighting shall be designed in accordance with IESNA Handbook-2000, 9th addition, ANSI/ASHRAE/IESNA Standard 90.1-2007-Exterior Lighting Section, and the International Dark-Sky Association (IDA).
2. Exterior lighting fixtures to be IDA approved as "Dark Sky Friendly"
3. Provide luminaires of IESNA Category 1, for minimum dirt accumulation and luminaire dirt depreciation (LDD) factors.
4. Manufacturers Qualifications: Company specializing in manufacturing Exterior lighting products that meet the requirements of these standards with a minimum of 10years experience

## **C. Criteria**

1. Light Levels: Provide average maintained foot-candle levels for exterior spaces that are based on the primary visual tasks to be accommodated with a maximum deviation of 15% when measured at grade level. Uniformity ratios are average to minimum as follows:
  - a. Bldg. Entrance Areas (exits, walkways,(uniformity 4:1).....5.0FC
  - b. Building Perimeter (20-foot depth from the building-(uniformity, 4:1) .....1.0FC
  - c. Pedestrian Sidewalk (uniformity ratio, 10:1).....1.0FC
  - d. Pedestrian Stairways (uniformity ratio, 10.1).....1.0FC
  - e. Site (playgrounds, yards, and athletic fields security lighting).....0.56 FC
2. Light Quality: Glare minimization, provide exterior area lighting that minimizes the incidence of discomfort glare and avoids disability glare under all normal conditions of use in accordance with IESNA recommendations. Provide light sources throughout project with Color Rendering Index of not less than 70.
3. Calculations: Calculations of illuminance levels and uniformity ratios for representative exterior areas shall be prepared by a registered electrical engineer along with associated product data for lamps and luminaires. Measurement of actual installation shall be in accordance with procedures referenced in ANSI/IESNA RP-8-(R05).
4. Outdoor Operating Temperature: Provide lighting systems that operate at temperatures as low as -10 degrees F.

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5. Tamper Resistance:

- a. Parts not easily removed without the use of special tools
- b. Luminaires mounted at minimum height of 12ft above grade
- c. Lenses of tempered glass or high impact acrylic.
- d. Metal gratings for protection of optical assemblies.

**D. Lighting Fixture Equipment**

1. In general, site lighting luminaires shall be wall surface mounted. Building parapet mounted lighting fixtures shall be utilized only with permission from the NJSDA. Lighting levels shall be achieved utilizing the following equipment.
2. Luminaires shall have high reflectivity segmented optical system with minimum efficiency of (66%). Lighting distribution NEMA Type 3 and Type 4 shall be used.
3. Luminaires shall have a minimum IP 65 ratings, a minimum 2G vibration tested and shall be UL 1598 listed for 25 degrees C ambient temperature application.
4. Luminaire Type: Semi-direct, Semi-indirect, and indirect lighting units shall not be used. Light distribution by direct methods only. Use reflectors or refractors for optical control.
5. Mounting: Provide luminaires with cutoff optical system. The Use of non cutoff luminaires shall not be utilized and may be permitted for construction lighting, historic restoration lighting and lighting for architectural features and sculptures.
6. Mounting System: Provide mounting system for exterior area lighting that is capable of withstanding 3-second wind gusts in excess of 100mph.
7. Finish: Material and finish of housing compatible with mounting and exterior building elements.
8. Poles: The usage and quantities of poles shall be limited and shall be used only with the written approval of the NJSDA.
9. Lamps: Use Compact fluorescent or metal halide lamps. No other lamp types shall be used.
10. Lighting Controls: Site security lighting shall be master controlled by the building lighting management system.

**D5080 Miscellaneous Electrical Systems**

**D5080.10 Lightning Protection**

# Model Schools: Materials and Systems Standards

## A. Lightning Protection - Design Approach:

1. At the Schematic Design Phase, ~~the engineer of record engineer shall perform a Lightning Risk Assessment is not required calculations to determine if a Lightning Protection System (LPS) is warranted for the building.~~
2. The engineer of record shall engage the services of an LPS manufacturer's Engineering Department for assistance in the design of the system.

## B. Codes and Qualifications

1. An Early Streamer Emission lightning protection system shall be provided for new schools and additions, in accordance with NFPA-70 and DOE specifications after the lightning risk analysis indicates a LPS is justified.
2. The Equipment supplier and installer shall comply with the Manufacturer's Installation Standard HBP-21 and Travelers Insurance Co requirements.
3. Applied Research Laboratories, Inc. (independent, nationally recognized testing laboratory) shall list the components, inspect and certify the installation for compliance with Manufacturer's Installation Standard HBP-21.
4. The installing contractor shall make a video recording capturing the entire installation of all accessible, inaccessible, concealed and buried components/connections and submit to the ESE manufacturer for evaluation, certification, archiving and documentation.
5. The Manufacturer shall forward the video to Applied Research Laboratories for inspection and certification.
6. Supplier and Installer shall have a minimum of 25 years documented experience with service facilities within 100 miles of the project.

## C. Criteria

1. The lightning protection system shall be installed so that the completed work does not detract from the buildings appearance. The system shall consist of the following major components:
  - a. Strike Termination Device(s) (air terminal), mast, base and supports provided on the rooftop .The flagpole may be utilized as the mast.
  - b. Copper Ground conductors (down conductors) or Electrically Continuous Structural Steel. Provide a maximum of two down conductors per mast.
  - c. Ground Electrodes consisting of rods, plates, or ground loop installed a minimum of 1ft below grade and a minimum of 2ft away from the foundation.
  - d. The lightning protection grounding system shall be bonded to the electrical grounding system electrode.
  - e. Surge suppression devices, shall be provided on the incoming service for electrical, telephone, antenna and TV cable systems. Provide a reaction time of less than one (1) nanosecond for the antenna and TV cable systems.

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2. The ground resistance of the completed system shall be measured using the IEEE "Fall of Potential Method" in the presence of the Engineer of record and shall be forwarded to the ESE manufacturer.
3. The Ground resistance shall be ten (10) ohms or less.
4. All work within the building shall be concealed.
5. All work installed in accessible locations shall be properly guarded and protected.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section D60: Communications**

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# Model Schools: Materials and Systems Standards

Design Requirements

Communications - Section D60

## D60 Communications

### D6010 Data Communications

#### A. Codes, Standards, and Regulations

1. Communication design shall comply with Federal and State codes, regulations, and standards with variances adopted as standards by the NJSDA and School District Board. Applicable state and National Standards include the latest editions of:

- a. ANSI/NFPA 70 National Electrical Code with New Jersey Amendments
- b. BICSI CO-OSP Customer Owned Outside Plant Manual
- c. BICSI 15th Edition Telecommunications Distribution Methods Manual
- d. BICSI 6th Edition Customer Owned Outside Plant Design Manual
- e. EIA Standard EIA-230 - Color Marking of Thermoplastic Wire
- f. FCC Rules and Regulations:
  - 1.) J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications National Electrical Safety Code
  - 2.) NFPA 101: Life Safety Code REA Standards for Engineering, Construct
  - 3.) TIA 526-14-A Optical Power Loss Measurements for Installed Multimode Fiber Cable Plant—OFSTP-7
  - 4.) TIA 568-C Commercial Building Telecommunications Cabling
  - 5.) TIA 569-B Commercial Building Standard for Telecommunications Pathways and Spaces
  - 6.) TIA Standard ANSI/TIA/EIA-607-A - Commercial Building Grounding and Bonding Requirements for Telecommunications
  - 7.) TIA 604 Standards on Fiber Optic Connector Intermateability
  - 8.) TIA 606-A Administration Standard for Commercial Telecommunications Infrastructure Standard
  - 9.) TIA 758-B Customer Owned Outside Plant Telecommunications Cabling Standard
  - 10.) TIA Telecommunication Systems Bulletin TSB67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems
  - 11.) TSB-140 Additional Guidelines for Field Testing Length, Loss and Polarity of Optical Fiber Cabling Systems

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2. In the event of a conflict between the Electrical Standards (D50, D60 and D70) and other guidance documents, the Education Specifications, the SDA's Kit of Parts, Bridging Documents also known as the Design Builder's Information Package and presiding codes shall take precedence.

**B. Main Distribution Frame (MDF) / Intermediate Distribution Frame (IDF) / Main Telecommunications Room (MTR) / Intermediate Telecommunications Room (ITR)**  
**Description / Design Approach:**

1. Main Distribution Frame (MDF) - A Main Distribution Frame shall be provided to distribute connectivity to the IDF, station cabling as required and to house the main control equipment of the following systems:

- a. Local Area Network (LAN)
- b. Wide Area Network (WAN)
- c. Carrier / Service Provider Interconnections
- d. Telephone System
- e. Paging / Intercom System
- f. Clock Systems
- g. Internet Protocol Digital Video Surveillance (IPDVS) System
- h. Digital Video Distribution System
- i. Building Management System (BMS)

2. Any station cabling that does not exceed 80-Meters (262 Feet) in length shall be homerun to the Main Distribution Frame.

3. Intermediate Distribution Frame (IDF) - Intermediate Distribution Frame shall be provided to distribute core connectivity from the MDF to station cabling where cable distances exceed 80-Meters (262 Feet) to the MDF

4. The designated MDF shall have a single room UPS capable of supporting all devices within the room for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.

5. For room based UPS Systems a bypass mode shall be included and must provide an alternate path for utility power to the connected load in the event of planned maintenance activities or a UPS malfunction.

6. IDF's and Server cabinets outside of the MTR/MDF with access to building generator power shall have rack based UPS systems capable of supporting all devices within the rack/cabinet for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity including the ability to manage and view UPS statistics via IP Based connectivity.

# Model Schools: Materials and Systems Standards

**B. Main Distribution Frame (MDF) / Intermediate Distribution Frame (IDF) Description / Design Approach:**

7. IDF's and Server cabinets outside of the MDF with access to building generator power shall have rack based UPS systems capable of supporting all devices within the rack/cabinet for up to three hundred (300) seconds (five (5) minutes) of operation at full capacity. Ability to manage and view UPS statistics via IP Based connectivity.

8. All server cabinets housed in the MDF shall have 48 Port Category 6 Compliant 110-type rack-mounted patch panels provided on the "rear" of the cabinet. This panel shall terminate on a 2 post telecom/network rack to supply network connectivity for devices inside the cabinets.

9. Controlled access to the Main Telecommunications Room and Intermediate Telecommunications Closet shall be provided. This can be accomplished with a lock, card reader or other approved mechanism.

10. The Main Telecommunications Room shall be built in accordance with "DCA Best Practices Standards for Schools under Construction or Planned for Construction."

**D6010.10 Data Communications Network Equipment**

**A. Routing – at a Minimum Routers Must Support:**

1. Open Shortest Path First (OSPF)
2. Enhanced Interior Gateway Routing Protocol (EIGRP)
3. Routing Information Protocol (RIP), and RIPv2
4. Two (2) - 10/100/1000-T Copper based
5. One (1) - Small form-factor pluggable (SFP) based slot
6. Four (4) - Enhanced High-Speed WAN Interface Cards (EHWIC)
7. Three (3) Digital Signal Processors (DSP) slots
8. One (1) Internal Services Module (ISM) slot
9. Flash: Support up to 4 GB (Gigabytes)
10. RAM: Support up to 2.5 GB (Gigabytes)
11. RJ-45 Console serial port and USB Console Serial Port
12. Management Capabilities via IP / SNMP / Telnet / SSH / HTTP(S)

**B. Switching - at a Minimum Switches Must Support:**

1. MDF – A core switch housed within the MDF must meet these minimum requirements:

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2. Modular Chassis Switch with 7, 9 or 13 Slots
3. Supervisor engine redundancy
4. 19" (19-inch) rack compatible
5. Redundant 4200W Power Supply
6. IEEE 802.3af/at compliant PoE/PoEP
7. Hot swappable
8. 280-Gbps (Gigabits per second) switching capacity
9. IP routing protocols: Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path
10. First (OSPF), Routing Information Protocol (RIPv2)
11. IEEE 802.1Q VLAN Encapsulation
12. 802.1s, 802.1w, 802.3ad
13. 802.3af/at (PoE)
14. Ether Channel bonding across line cards
15. Port Aggregation Protocol (PAgP)
16. Voice VLAN and VLAN ID (VVID)
17. Jumbo Frames (up to 9216 bytes)
18. Traffic Storm Control and/or Broadcast/Multicast Suppression
19. Bridge Protocol Data Unit (BPDU) Guard
20. Link Layer Discovery Protocol (LLDP)

**C. IDF - Switches Housed Within the IDF Must Meet These Minimum Requirements:**

1. Stackable with each node member switch being able to serve as a master, creating a 1:N availability scheme for network control.
2. Inter-connection via a channel or bus cable
3. 1100W (minimum) Power Supply
4. Power Over Ethernet (PoE+) capable on all copper based ports. 802.3af and 802.3at Standards
5. All ports must support 10-Gigabit Ethernet (GbE) connectivity.

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6. Internet Protocol (IP) routing protocols: Routing Information Protocol (RIPv2)

**D. Wireless Data (Wi-Fi) Communications System** - A wireless access network shall span all occupy able spaces through the entire facility.

1. Must utilize a WiFi communications system controller located in the MTR/MDF that allows management of wireless network as a whole.

a. Allow for THC management of all individual access points.

b. Application of all site wide wireless access policies.

2. Shall be capable of providing:

a. IEEE 802.1ac, 802.11a, 802.11b, 802.11g, 802.11n

b. Encryption WEP and TKIP-MIC; SSL and TLS; AES (CCM, CCMP)

c. Authentication, Authorization, and Accounting (AAA); IEEE 802.1X; RADIUS; PPP EAP-TLS; Extensible Authentication Protocol (EAP) with RADIUS

3. Wireless Node Isolation.

4. IEEE 802.1Q VLAN tagging; intra-VLAN security; VLAN Isolation

## D6020 Voice Communications

**A. Telephone System Description / Design Approach**

1. General

a. The intent is to provide a school wide Voice over IP (VoIP) Telephone System with voicemail capabilities. The Telephone System and the Data Systems shall share physical cabling mediums and strive for maximum integration.

2. Equipment and Locations

a. All processing and head end systems required for voice communications shall be housed in the Main Distribution Frame (MDF) room.

b. Telephones outlet and handset shall be provided in all administrative areas, class rooms, offices, security desks and other specified locations as specified in the DBIP.

c. Wall telephone outlet without lock box and handset shall be provided in utility rooms, storage rooms greater than 200 sq. ft., mechanical rooms, elevator machine room, supply rooms and vault type/secured storage type rooms.

d. Dedicated phone lines (not through the IP Private Branch Exchange (PBX)) shall be provided for the Intrusion Alarm System, Fire Pump, and Elevator Intercom System.

e. A loud Bell for the Voice over internet protocol (VoIP) and dedicated phone

# Model Schools: Materials and Systems Standards

lines is to be placed in noisy areas including the auditorium, gymnasium, Gymatorium, student cafeteria, kitchen and the boiler room. A loud bell may be required in other noisy areas; however, this will be addressed on a case by case basis and will be determined by the contract documents and DBIP.

## **D6020.10 Voice Communications Switching and Routing Equipment**

### **A. Internet Protocol Private Branch Exchange (IP PBX) Minimum Requirements**

1. H.323 and SCCP protocol support
2. IP Based SIP, Digital (PRI / BRI) and POTS line carrier interface (Trunk)
3. Analog Telephone Adaptor (ATA)/ Foreign eXchange Subscriber (FXS) Adapter support
4. Up to 20 line appearances per phone
5. Support of fallback service phone auto-registration
6. IP Handsets; Software phone client.
7. Foreign eXchange Office (FXO) interface for analog systems.
8. E911 with two emergency location numbers per zone; unlimited zones per site
9. Paging: Internal through IP phones or to external paging system
10. Ad-hoc conferencing
11. Push Button intercom and Night Bell capabilities.
12. Multiple music-on-hold (MoH) streams (internal/external)

## **D6020.20 Voice Communications Terminal Equipment**

### **A. Telephone Set Type: Minimum Capabilities, Requirements**

1. Executive / Administrative offices
  - a. Six (6) Physical Lighted Line Appearance keys
  - b. Two way Speaker Phone
  - c. Support for expansion module with additional line keys
  - d. 802.3af Power Over Ethernet (PoE+) support.
  - e. Integrated 10/100 switch.
2. Classroom / Shared Spaces
  - a. Two (2) Physical Lighted Line Appearance keys

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- b. Two way Speaker Phone
  - c. 802.3 af Power Over Ethernet (PoE+) support.
  - d. Integrated 10/100 switch.
- 3. Public areas / Miscellaneous Spaces
  - a. 1 line (May use 0 line keys)
  - b. 802.3 af Power Over Ethernet (PoE+) support.
- 4. Conference Rooms / Conference Phones
  - a. Support for external microphone kit
  - b. 802.3 af Power Over Ethernet (PoE+) support.
  - c. Door Phone / Push button Intercom
  - d. Door Intercom w/ doorstrike release
  - e. Vandal resistant / Hardened
  - f. Phone system integrated
- 5. Elevator Intercommunication System
  - a. Elevator car stations shall have an auto-dialer and a time-clock switch programmable to dial primary and secondary numbers.
  - b. Connect the automatic dialing, hands-free station in the elevator car to a dedicated telephone line. The elevator car station shall automatically dial a programmed number to alert the school personnel that there is a problem in the elevator and identify visually which elevator is initiating the call.
  - c. The primary number shall ring in the General Office, while the secondary number shall ring the elevator installer. Dedicated phone lines (not through the Private Branch Exchange (PBX)) shall be provided for the Elevator Intercommunication System
  - d. Provide a telephone set within Elevator Machine Rooms, as part of school telephone system.

## **D6030 Audio-Video Communication**

### **D6030.10 Audio-Video Systems**

#### **A. Projectors Used in Classrooms and Assembly Areas Must at a Minimum Provide:**

- 1. Support Native HD 720p and minimum of WXGA (1280 x 800) resolution

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2. 2500+ ANSI Lumens
3. 2000:1 Contrast Ratio
4. Rated for 3000+ hour lamp life in standard mode
5. Input / Output
6. 1x VGA
7. 1x HDMI
8. 1x Composite
9. 1x RCA stereo input
10. 1x Stereo 3.5mm Mini Jack input
11. 1x RCA and/or Stereo Jack output
12. \*\*1x F-Connector for Coaxial cable OR Provide External TV Tuner with Composite output.\*\*
13. Integrated 7W speaker and audio out capabilities
14. Digital Keystone shift
15. Remote control for power, input selection and function control.
16. Network Interface for projector management.

## **B. Projectors All Spaces**

1. All projectors must be supplied with an integrated or external TV Tuner with IR Remote control capabilities.
2. Projector inputs must be extended to a readily accessible point within the room. Placement decisions should match furniture or general room layout plans.

## **C. Classroom Voice Reinforcement (Sound Enhancement) System and Speakers**

1. Classroom Voice Reinforcement (Sound Enhancement) System and Speakers shall be supplied in all classrooms and instructional space and must provide at a minimum:
  - a. Instructor voice level of 67 dB throughout the classroom.
  - b. Rechargeable, Wearable input microphone with On/off/Mute capabilities.
  - c. 9 hours of continuous operational time.
  - d. MUST not interfere with other voice reinforcements within close proximity.
  - e. 3+ auxiliary audio inputs in addition to microphones to support output from

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projectors / PC / Televisions, etc.

f. Classroom Voice Reinforcement (Sound Enhancement) system shall be overridden during general page activation and all emergency alert situations.

## **D6060 Distributed Communications and Monitoring**

### **D6060.10 Distributed Audio-Video Communications Systems**

#### **A. Distributed Audio-Video Communications Systems Description / Design Approach**

1. Public Address (PA) / Paging system - A building / campus wide PA/paging system shall be supplied and must be accessible from standard telephone sets. The paging system shall also be accessible through dedicated microphones/access terminals independent of the telephone system. At a minimum the paging system should supply the following capabilities:

- a. Time and Calendar based Bell Scheduling
- b. Class / Scheduled Change Tones
- c. Ability to Control / Integrate with Facility Clocks
- d. Integrate with IP and Analog telephone systems
- e. Minimum of 4 Zones with expansion capability
- f. All Call or Group Zone Paging
- g. Programmable Features Per Zone
- h. Emergency notification
- i. Pre-Recorded Emergency/Automated Messages
- j. Controlled Levels of access
- k. IP capable

2. The PA / Paging system shall cover the Main Building, all Additions, Mini-Buildings, Temporary Classroom Units and Temporary Classroom Buildings, Auditorium, Media Center Gymnasium, Multi-purpose Room, Cafeteria, Dance Studios and all other Places of Assembly.

3. A Television and Video distribution system shall deliver television signals received from a cable or satellite feed housed within the Main Telecommunications Room, Main Distribution Frame (MTR/MDF) to all locations capable of displaying video. At a minimum the Television and Video distribution system should supply the following capabilities:

- a. Must use Category 6 (CAT6) cable to deliver video from MDF/IDF to video displays.



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- b. Broadcast locally generated video using camcorders or studio equipment to all display endpoints.
- c. Broadcast video from PC's and other digital sources.
- d. Provide video on-demand capabilities.
- e. Provide multiple Television channels and allow channel selection at the display unit.

## **D6060.50 Distributed Systems**

### **A. Clock Systems Description / Design Approach**

1. All clocks shall be 802.3af Power Over Ethernet (PoE+) compatible.
2. Time must be synchronized using Network Time Protocol (NTP) or Simple Network Time Protocol (SNTP) over the existing data communications network.
3. Automatic Daylight Savings Time (DST) adjustments shall be made based on Network Time Protocol (NTP).
4. All clocks shall display current time within one (1) minute of accuracy to the Network Time Protocol Server.
5. Single faced clocks shall be provided in all Areas of Instruction, all Classrooms, Offices, Teacher's Cafeteria/Lounge and Places of Assembly (Auditorium, Cafeteria/Lunchroom, Media Center and Gymnasium).
6. Analog and Digital clocks shall be equipped to display Hour, Minute and Seconds.
7. Double-Faced Clocks shall be provided in the middle of corridors and other common areas where the clock is viewable from opposing sides.
8. A Category 6 (CAT6) Data outlet shall be provided to support clock function in all areas of instruction, Classrooms, Offices, Teachers' Cafeteria/Lounge, and places of assembly (Auditorium, Cafeteria/Lunch Room, Gymnasiums, Media Center), , Temporary Classrooms, , Multi-purpose Rooms, , Dance Studios and all other Places of Assembly.
9. All clocks located in Corridors and Places of Assembly (Auditorium/Cafeteria/ Lunch Rooms/Gymnasiums) shall be equipped with vandal resistant wire guards.
10. All clocks shall be powered through IEEE 802.3af standard Power over Ethernet (PoE+) utilizing CAT6 cabling.

## **D6090 Communications Supplementary Conditions**

### **D6090.10 Supplementary Conditions**

#### **A. General Requirements**

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1. Data Outlets, as required by the DBIP, shall be provided at every area of instruction, every office including all cubicles, places of assembly, media centers, vault room, security desk and where required by the Point of Sale (POS) System.
2. Conduits for communications cables shall not have bends with a radius of less than 10 times the diameter of the conduit. The total degrees of bend in conduit(s) between pulling points should not exceed 180 degrees. Bends which reduce the inner diameter of the conduit are not permitted. The number of bends should be minimized.
3. Conduits shall not be shared between differing cable types. All cabling distribution shall be installed in separate conduits. For example, copper and fiber cables are not to be mixed in a conduit.
4. Entrance Cabling - To ensure the ability to add lines in the future, the designer will request the local telecommunications provider, internet service provider, and cable television Service Company to provide a service cable to the building demarcation point (DMARC). The building demarcation point (DMARC) shall be the main point of entry (MPOE) for all services and shall be extended to the Main Telecommunications Room (MTF) and the Main Distribution Frame (MDF) and must be separate spaces.
5. The engineer shall transmit two copies of the Site Plan indicating the requested Point of Entry and the location of the Main Telecommunications Room / Main Distribution Frame along with the request letter.
6. Four (4) conduits of 4" (4-Inch) diameter suitable for data communications grade copper, fiber and or coaxial cable shall be provided from the building Minimum Point of Entry (MPOE) to the building demarcation point (DMARC) located in the designated Main Telecommunications Room (MTF) and the Main Distribution Frame (MDF) room.
7. Telecommunications Services
  - a. Copper: 100 pair service cable from the local telecommunications company is to be requested and terminated in the MTF/MDF on four (4) Modular 66M Cross Connect Blocks which are mounted in sequence on  $\frac{3}{4}$ " (3/4-Inch) fire rate plywood.
  - b. Fiber: Fiber based services should be delivered on a minimum of 6 Pair (12 Strand) from the provider. Fiber must be terminated in the ITB/IDF on rack mounted interconnects. Fiber based services must be delivered to CPE via Multimode Fiber or Copper RJ45 Ports for Data services and as Coaxial for Video / Cable TV Services.
8. Cable Television Provider
  - a. The local cable provider should deliver television services to the main distribution frame MDF and have the capability to supply up to 12 outputs on standard RG-11 jacks with a level of 20dBmV Flat and MER of 32dBm or greater.
  - b. The District shall submit a service request in writing to the Local Cable Television Company serving the area. This request shall include two copies of the site plan indicating the suggested point of entry for supplying a "basic cable" service to the Main Telecommunications Room and the Main Distribution Frame, which should match the same general building demarcation point (MPOE) as other telecommunications service.

# Model Schools: Materials and Systems Standards

c. Should the Cable Company indicate that the school is outside the Cable Service Network or extra installation charge will incur to bring the service to the school, then the design should incorporate a Standard Satellite Dish installation. All other devices shall be directly wired to the Main Distribution Frame via conduits and shall conform to all other requirements of this Design Requirement.

## 9. Two (2) Post Telecom / Network Racks

- a. EIA standard 2-post racks shall be used for mounting of patch panels, wire management, and network equipment in the MDF and IDF's.
- b. Racks shall be 7 feet high, 3-inch channel depth and EIA standard 19-inch mountable with EIA standard hole spacing. They shall be bolted to slab at front and rear flanges and tied to overhead ladder rack for additional stability with threaded rod and unistrut and grounded by a #6 AWG wire with green insulation to approved telecommunications ground. Use lug type connectors at each end.
- c. Equipment mounting screws shall be provided at the base of each rack consisting of 50 minimum per rack.
- d. Horizontal and Vertical Cable Management shall be provided in accordance with standards

## 10. Server Cabinets

- a. Four (4) post fully enclosed industry standard server cabinet with Universal Mounting Rails (square holes), locking doors, split rear access doors and the ability to mount vertical 0U power distribution units.
- b. Supply at least 42U of total space
- c. Support RETMA 19 inch standards and house any third-party equipment designed to mount on standard 19 inch wide.

## 11. MTR / MDF / ITR / IDF Room Grounding System

- a. The MDR/MDF and ITR/IDF rooms shall have a telecommunications main grounding bus (TMGB) bar installed in accordance with generally accepted standards.
- b. All cabinets, racks, cable routing system, and other electrical components must be connected to the TMBG.
- c. Ensure continuity of ground from all system entering, existing, and housed within the MDF/IDF telecommunication rooms.
- d. Utilize jumper cables of sufficient low impedance and sufficient current-carrying capacities to interconnect adjacent equipment.

## 12. Cable Management

- a. Horizontal and Vertical Cable Management Trays shall be used to organize patch cables within equipment and distribution racks.

# Model Schools: Materials and Systems Standards

b. A Vertical Cable Management Channel must be installed on the ends of and/or as a separator on adjacent 2 post equipment/distribution racks. These Vertical Channels shall be:

- 1.) 2" Wide Channel
- 2.) 2"+ Deep channel
- 3.) Double Sided w/ cable management from Front and Back of racks.
- 4.) Cable guide finger spaced 1U+ apart.

c. Snap-on cover that opens 180° to both sides with latching mechanism

d. A Horizontal Cable Management Tray must be installed between each patch panel and/or equipment. These Horizontal panels shall be:

- 1.) EIA standard 19-inch rack mountable
- 2.) 2U (rack units) high
- 3.) 5+ inch(s) deep
- 4.) Snap-on cover that opens 180° up or down with adjacent installation
- 5.) Cable guide finger space 1.5"+ apart.

13. Ladder type or welded wire cable tray must be used in the MDF and IDF's to provide distribution between the telephone backboard, equipment racks, backbone conduits, and the distribution cable tray and cabinets.

#### 14. Vertical / Riser Cabling

- a. Each ITR/IDF shall be supplied with the following connectivity from the MTR/MDF:
- b. 12 Pair (24-Strand) .50/125 OM4 Multimode Fiber.
- c. Eight (8) RJ-11 Coaxial cable runs.
- d. One (1) 100 Pair CAT6A cable terminated at both ends on a Modular 66M Cross Connect Block and labeled appropriately.
- e. One (1) conduit of 2" (2-Inch) diameter (for future use).

#### 15. Horizontal Cabling

- a. Horizontal data cable is blue jacketed category 6 (CAT6A) cable which supports the following Ethernet standards: 10Base-T, 100Base-T and 1000Base-T.
- b. Horizontal data cabling is to be terminated in the MDF or an IDF according to engineering drawings or as prescribed by other relevant documentation.

# Model Schools: Materials and Systems Standards

- c. All cable components (including jacks, patch cables, patch panels, and cross-connects) must meet CAT6A specs.
- d. Data cabling shall be routed through the horizontal installation pathway via wire trays, ladder racks, 'J' hooks, or ceiling straps.
- e. The following must be observed when installing category 6 cable:
  - 1.) All horizontal copper data cable runs shall be continuous runs, with no splices, with no length exceeding 80 meters (262 Feet).
  - 2.) All cable runs must maintain 5 foot service loops at both ends of the cable. The service loops at the work area end of the cable is placed in the ceiling.
  - 3.) All cables must be labeled and color coded according to the labeling standard approved by the school district or NJ SDA.

16. Conduits must have a poly-twine drag to be left in the conduit to facilitate future cable pulls. Unless otherwise specified, conduits must be at least 2" (2-Inch) in diameter. Conduits for Communications cables shall not have bends with a radius of less than 10 times the diameter of the conduit. The total degrees of bend in conduit(s) between pulling points should not exceed 180 degrees. Bends which reduce the inner diameter of the conduit are not permitted. The number of bends should be minimized.

## 17. Termination(s)

- a. Copper Cabling: For end-point or end-user (Outlets) devices, terminations must be performed using an 8-pin (RJ45 type) connector, configured as per (TIA/EIA) T568B jack designation and rated for Category 6 (CAT6) or the category of the installed cable.
- b. Distribution cable must be terminated at the MDF or an IDF on 110-type rack-mounted patch panels compliant with Category 6.
- c. Category 6 maximum horizontal data cable length shall not exceed 80 meters (262 feet) from outlet to patch panel.
- d. Fiber optic: Distribution fiber cable must be terminated at the MDF or in an IDF using rack mounted interconnects with TIA/EIA "SC" type connectors.

18. Patch panel and Outlet labeling must be done in accordance with TIA/EIA-606A. Telecommunication rooms, Cabinets, 2 post racks, patch panels, patch ports, vertical fiber and copper distribution cables and end point outlets must be uniquely numbered in a logical easily identifiable manner.

## 19. Labels

- a. All labels must be mechanically printed – no hand written labels!
- b. Identifiers must have a consistent format.
- c. Labels should be resistant to environmental conditions at the point of use.

# Model Schools: Materials and Systems Standards

- d. Label should have a life span equal to the labeled component.
- e. A Labeling Plan must be submitted and approved by the school district or NJ SDA.

## **B. Quality Assurance**

### **1. Testing and Certification**

a. All telecommunications cable, installed as part of a project, must be tested to the commercial standards for that cable system. All test results and certifications must be provided in an electronic format report upon completion of installation. Wire Map reports must indicate the cabling has no shorts, opens, mis-wires, split, reversed, or crossed pairs, and end-to-end connectivity is achieved. Testing results must show circuit ID, test specification used, length, date of test, and pass/fail result for each row. Category 6 maximum horizontal data cable length shall not exceed 80 meters (262 feet) from outlet to patch panel.

b. Unshielded Twisted Pair Tests: All metallic cable pairs must be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals must be corrected. Correct color-coding and termination of each pair must be verified in the communications closet and at the outlet. Horizontal wiring must be tested from and including the termination device in the communications closet to, and including the modular jack in each room. Backbone wiring must be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective telecommunications closets.

c. Category 6 Cables: All category 6 circuits must be tested using a test set that meets the accuracy requirements of TIA/EIA-568-B.1 and TIA/EIA-568-B.2-1. All test requirements must be completed as specified in TIA/EIA-568-B.1 and TIA/EIA-568-B.2-1.

d. Fiber Optic Cable: All category fiber optic circuits must be tested using a test set that meets the accuracy requirements of TIA/EIA-568-B.1 and TIA/EIA-568-B.3. All test requirements must be completed as specified in TIA/EIA-568-B.1 and TIA/EIA-568-B.3.

e. Unless stated otherwise, tests must be performed from both ends of each circuit. Connectors must be visually inspected for scratches, pits or chips and must be re-terminated if any of these conditions exist.

### **2. Warranty / Guarantee**

a. Installers must provide in writing a warranty that 100% of the installation meets the manufacturer's specifications Post-Installation, Testing and Certification.

b. A manufacturer's warranty certificate for a twenty five (25) year warranty on all Copper and Fiber cable plant infrastructure must be provided.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section D70: Electronic Safety and Security**

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# Model Schools: Materials and Systems Standards

Design Requirement

Electronic Safety and Security - Section D70

## D70 Electronic Safety and Security

### D7010 Access Control and Intrusion Detection

#### A. Internet Protocol Digital Video Surveillance System Description/Design Approach

##### 1. General

- a. An Internet Protocol (IP) Digital Video Surveillance (IPDVS) system using Category 6 **or 6A** cabling shall be integrated with the cabling infrastructure components to minimize duplication of cable, wiring and communications infrastructure. A separate power outlet shall be provided for outdoor camera's heater and/or blower from a local power supply (IDF or MDF). The finished infrastructure shall serve to deploy an IP-based signaling and control format in the infrastructure as built.
- b. For Capacity projects the IPDVS System shall be installed in Stand-alone building additions, meeting at least one of the following criteria:
  - 1.) Provide IPDVS for the addition and the existing school building when the existing building is rated a high or medium priority school as determined by the District.
  - 2.) Provide IPDVS for the addition and the existing school building when the addition exceeds 50% of the total area of the existing building.

##### 2. Equipment and Locations

- a. The Contract Documents shall provide for digital video cameras and Category 6 **or 6A** cabling to telecommunication rooms, including wiring, raceway, boxes, outlets, patch panels, Power components as well as equipment cabinets in the telecommunication closets and cabinet in Main Telecommunication Room. The main viewing station for CIP projects may be in a secure office or at the main entrance. A console may be required if the main viewing station is to be located at the main entrance.
- b. The System Integrator (SI), contracted by the General Contractor or Design-Builder, will furnish and install the system hardware, including video encoder, network switch(es), router(s) and application server(s) running proprietary software to process and manage the video feeds. Additionally SI will furnish and install a computer with monitor(s) for the main viewing station. **Routers and switches will be provided by the SDA. The Design-Builder shall coordinate with the SDA for all required networked device configurations which are necessary for proper operation of the systems provided by the Design-Builder.**
- c. Cameras shall be provided in accordance with the SDA and NJDCA Division of Codes and Standards requirements.



# Model Schools: Materials and Systems Standards

Design Requirement

Electronic Safety and Security - Section D70

## **D7030 Electronic Surveillance**

### **A. HVAC Remote Annunciation System Description/Design Approach**

#### **1. General:**

- a. A remote annunciation system connected to the school's intrusion alarm system is to be provided. Indicate the required wiring on the Construction Documents. The contractor will program the intrusion alarm digital communicator (auto-dialer) to initiate a specific code. The central alarm monitoring station will follow a specified protocol.

#### **2. Schools with full Building Management System (BMS) / Direct Digital Control (DDC) systems:**

- a. A twisted pair of conductors (AWG#16, dry contact) is to be connected to the I/O 100 of the BMS and run to the intrusion alarm panel and connected.

#### **3. Boiler Replacement Projects, Intrusion Alarm Replacement Projects:**

- a. A twisted pair of conductors (AWG#16, dry contact) shall be run in parallel from each of the boiler control panels to the intrusion alarm panel.

- 1) For Boiler Replacement projects without a funded Intrusion Alarm Replacement project: the twisted pair is to be indicated on the Drawings to be left unconnected, with the note, "Connection to intrusion alarm panel by others." (The Division of School Facilities or its assigned intrusion alarm Contractor will subsequently connect to the intrusion alarm panel and program the digital communicator to provide the required messaging).
- 2) For Boiler Replacement projects with a funded intrusion alarm replacement component, the twisted pair is to be connected to the system.

## **D7030.10 Video Surveillance**

### **A. Video Surveillance**

1. Video surveillance cameras shall be installed throughout the exterior and interior of the building, including adjacent parking. Coverage areas shall include but not limited to the following:

- a. Building approach areas for vehicles and pedestrians.
- b. Areas outside the building that is not readily visible.
- c. Loading Areas.
- d. Infrequently occupied areas that are not locked or alarmed such as but not limited to:

- 1.) Multi-Purpose Room

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- 2.) Cafeteria
- 3.) Gymnasium
- e. Main entrances and lobbies.
- f. Corridors and stairways
- 2. Video Surveillance storage capability for review.
  - a. Export video to easily transportable format.
- 3. Internet Protocol Digital Video Surveillance System Signage
  - a. Provide a video surveillance signage at all entrances (indoor & outdoor) and school main lobby. The signage shall read "This building is under video surveillance that may be monitored and I or recorded at any time."

## **B. Products**

- 1. Video Surveillance Control and Management Systems
  - a. Supports a broad range of IP and analog cameras, codecs, viewing platforms, and network topologies.
  - b. Support PTZ and Alarm inputs.
  - c. Support storage and archiving policies based on cameras / streams. I.E Footage from main entrance cameras are stored for 60+ days but footage from corridors are only stored for 30+ days.
  - d. Sufficient and expandable storage sub systems for recordings. (Direct attached and iSCSI based storage systems.)
  - e. Simultaneous multi format encoding. (Minimum MJPEG and MPEG-4)
  - f. Looping and event-based video recording.
  - g. Motion based recording.
- 2. Video Surveillance Monitoring and Supervisory Interfaces
  - a. Intelligent Video Analysis (IVA)
  - b. Licensed video motion and content analysis option.
  - c. Ability to predefine behavior of objects such as doors and gates.
  - d. Provides operator alerts.
  - e. Tamper detection.

# Model Schools: Materials and Systems Standards

- f. Delivers metadata information in both live and stored video.
      - g. IP Based Remote viewers.
- 3. Digital Video Recorders and Analog Recording Devices (Video Media Server / Recorder).
  - a. IP Based.
  - b. Record-on-motion and clipping capabilities
  - c. Archives at different frame rates, durations, and locations
  - d. Support for encoders and cameras (fixed or PTZ).
  - e. Support up to 64 Cameras Streams over IP Multicast.
  - f. Support up to 4 simultaneous viewers / operators.
    - 1.) Deliver low-latency, high-quality video
- 4. Video Viewing Stations
  - a. IP based viewers
  - b. Stationary video viewing stations shall be provisioned at the security desk, emergency control center (ECC), and backup emergency control center.
  - c. Ability to configure multiple modes of viewing:
    - 1.) Individual camera view loops.
    - 2.) Grid display of up to eight (8) cameras.
    - 3.) Looping grid displays.
    - 4.) Pause looping.
    - 5.) Display select cameras.
- 5. Video Surveillance Systems Infrastructure.
  - a. Switches, which will be provided by the SDA, shall be stackable with each node member switch being able to serve as a master, creating a 1:N availability scheme for network control.
  - b. Inter-connection via a channel or bus cable.
  - c. 1100W (minimum) Power Supply
  - d. Power Over Ethernet (PoE+) capable on all copper based ports. 802.3af and 802.3at Standards

# Model Schools: Materials and Systems Standards

## Design Requirement

## Electronic Safety and Security - Section D70

- e. All ports must support 10-Gigabit Ethernet connectivity.
- f. MDF to IDF Uplinks must utilize 10Gigabit Ethernet Connectivity.
- g. IP routing protocols: Routing Information Protocol (RIPv2).
- h. Multiple VLAN's to ensure security, performance and ease of management.
- i. Infrastructure server running Windows Server to supply DHCP, DNS, and authentication.
- j. Video Surveillance Network systems will be utilized for IP connectivity to building infrastructure systems such as, HVAC / Building Management Systems (BMS), Access Control Systems, Paging Systems, Video Distribution System management etc.
- k. Cameras shall be physically cabled to the MDF where possible or to the IDF on the First Floor.

### 5. Video Surveillance Remote Positioning Equipment

- a. Exterior cameras shall be protected from natural elements and shall be provided with heating components to ensure operation in low temperatures.
- b. All Cameras shall be tamper resistant.

### 6. Video Surveillance Remote Devices and Sensors

- a. Video cameras used shall be powered by IEEE 803.af Power Over Ethernet (PoE+)
- b. Support Resolution and Frame Rate of:
  - 1.) 720 x 480/576 @ 30/25 fps (D1)
  - 2.) 704 x 480/576 @ 30/25 fps (4CIF)
  - 3.) 352 x 240/288 @ 30/25 fps (CIF)
- c. Progressive Scan CMOS technology for image clarity.
- d. Must utilize TCP/IP Multicast technology to deliver RTP Video/Audio Streams.
- e. Support Quality of Service (QoS) policy application to streams.
  - 1.) Ability to use differentiated services code point (DSCP) values to distinguish between Video and Audio Streams.
- f. Support H.264, MPEG-4, MJPEG Codecs.
- g. Web access protected by user ID and password.

### 7. Maintain a log of management access and source of access.

# Model Schools: Materials and Systems Standards

8. Maintain an "Up Log" showing power on time.

## **D7030.50**

### **Electronic Personal Protection**

#### **A. Sound Intercommunication and Teacher Activated Security System Description/Design Approach:**

##### **1. General**

a. A school-wide Sound, Intercom and Teacher Activated Security System (Sound System) shall be provided with the following functions:

1.) Public Address system for general announcements.

2.) Two-way communication system between two stations and between station and any speaker

3.) Privacy system to prevent eavesdropping through classroom speaker.

4.) Tone generation for emergency call from classrooms to central station.

5.) All spaces, as well as each speaker in the corridor, shall be assigned a space number and the zone to which it is to be assigned. This designation shall be indicated on the plans.

b. The system shall cover the Main Building, all Additions, Mini-Buildings, Temporary Classroom Units and Temporary Classroom Buildings, where applicable. For projects such as additions where the existing PA system is relatively new and is to remain and a new system is added for the new building portion, the new PA unit is to match the existing so they may be interconnected.

c. Places of Assembly, such as Auditorium, Gymnasium, Gymatorium, Multi-purpose Room, Cafeteria, Cafetorium, Media Center, and Dance Studios shall have their own Local Sound System. Each of these Local Sound Systems shall incorporate hearing impaired capability and shall be fully interconnected to the Main Sound System.

d. The Main Sound System shall automatically override any Local Sound System for general announcements. The system shall have the capability to make a general announcement from any station connected to the Main System or from a dedicated microphone connected to the Local Sound System.

##### **2. Gymnasium:**

a. A Gymnasium without a partition requires a single sound system with a single channel amplifier.

b. A Gymnasium that is partitioned into sections requires a single local sound system configured with a dual channel amplifier so that announcement can be made individually for each section of the Gymnasium and combined for the entire gymnasium.

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## Design Requirement

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- c. The Gymnasium and Cafeteria each require one local sound system with an amplifier to drive two dedicated set of speakers:
  - 1. When being used as the gymnasium, the designated gymnasium amplifier shall drive the ceiling speakers utilized for the gymnasium function. If the Gymnasium is partitioned, the amplifier shall be a dual channel and configured so that announcements can be made individually for each section.
  - 1.2. When being used as the auditorium, the designated auditorium amplifier shall drive the wall mounted speakers utilized for the auditorium function.
  - 1.3. The mixer shall be used to control the switching operation between the two amplifiers.
- e.d. Provide an integrated Sound/Clock System in new construction and in retrofit application where the approved Scope of Work (SOW) provides that the existing clock system is to be replaced.
- f.e. Where the Sound and Clock Systems are not to be integrated, as in the case of a retrofit application where the existing Clock System is to remain, provide a separate independent Sound System.
- g.f. When replacing the Sound system in retrofit installations and the existing system is in working condition, the drawings shall state the existing system is not be removed until the new system is complete and accepted by the SDA.

### 3. Equipment and Locations

- a. Central Control Sound Rack shall be placed in the Main Telecommunications Room (MTR) where available; otherwise in or near General Office. For system replacement in existing buildings, Central Control Sound Rack shall be installed at the same location.
- b. Combination Speaker/Clock Assemblies (integrated speaker/clock assemblies) shall be provided in new construction and in retrofit applications where the existing Clocks System is being replaced. Install in areas of instruction, offices, and teacher's cafeteria/lounge.
- c. Speaker Assemblies shall be provided in Dance Studios and Places of Assembly such as Auditorium, Cafeteria, Gymnasium, Multi-purpose Room, Media Center, and Cafetorium. Horn type speakers shall be provided in corridors, play-yard, mechanical rooms and large storage spaces.
- d. Privacy / Call-in Switches shall be provided in each classroom, areas of instruction, teacher's lounge and teacher's cafeteria. Locate switch in the front of classroom near the corner adjacent to the exterior wall. The privacy/call-in switches shall not be mounted near the door.
- e. Volume Control for Speaker (In High Schools only) shall be provided in each office.
- f. Administrative Control Stations (ACS) shall be provided in Main Office, Vice

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Principal Offices, Principal's Office and Custodian's Office. Outlets for ACS shall be installed at 18" A.F.F. near the desk.

- g. Local Sound Systems shall be provided in Places of Assembly such as Auditorium, Gymnasium, Multi-Purpose Room, Media Center, Gymnasium, Cafeteria/Lunchroom, Cafetorium, and Dance Studio's. The amplifiers shall be installed in a secure area not readily accessible to the public.
- h. Auditorium and Cafetorium sound system shall be provided with four microphone outlets, mounted in front of the stage at 18" A.F.F. All other local sound systems shall each be provided with three microphone outlets mounted at 18" A.F.F., except when Gymnasium is partitioned, for which two (2) microphones shall be provided in each section.

#### 4. Audio Amplification System for the Hearing-Impaired

- a. An Audio Amplification System for the hearing-impaired shall be provided in conjunction with each Local Sound System. The system shall be FM broadcast type mounted in a common rack with the local sound system. Each system shall have its own designated frequency to obviate miscommunication between different spaces. When Gymnasium is partitioned into sections, Audio Amplification Systems shall be provided within the same cabinet for all sections. When Gymnasium is partitioned into three sections, one Audio Amplification system shall be provided in the Auditorium sound system and two Audio Amplification Systems shall be provided in the Gymnasium sound system.
- b. A transmitting antenna shall be located in each space. The auditorium transmitting-antenna shall be located above the proscenium arch.
- c. Single channel receivers with headsets, teleloops, and silhouette coils shall be furnished in accordance with Code required minimums.

# Model Schools: Materials and Systems Standards

Design Requirement

Electronic Safety and Security - Section D70

## D7050 Detection and Alarm

### D7050.10 Fire Detection and Alarm System for School Buildings

#### A. Fire Detection and Alarm System for School Buildings Description/Design Approach:

1. The fire detection and alarm system for school buildings shall be a Manual and Automatic Fire Alarm System with Central Office Connection provided. This system shall be a fully supervised, microprocessor-based multiprocessing system with individually addressable devices connected to a central Emergency Control Center (ECC) and Remote backup Emergency Control Center (ECC), as enforced by DCA and required by presiding Codes.

a 2. Fire Alarm System Coding the manual and automatic fire alarm system shall operate as Coded System.

3. Smoke Control

a. Smoke control systems shall be provided.

b. Smoke control systems shall be activated by any of the following:

1.) Automatically by area or duct smoke detectors

2.) Automatically by sprinkler water flow switches

3.) Manually by the Fire Fighter's Smoke Control Station

4.) Smoke control system activation shall be immediately initiated after receipt of appropriate automatic or manual activation command.

5.) Activation of the smoke control system shall send an alarm to the Central Station.

c. The smoke control system shall be connected to the Fire Activated Control Panel (FACP) via a UL 864 listed Fire Fighter's Smoke Control Station. This station shall provide status and manual override control of all automatic smoke control devices associated with the smoke control system, as well as manual control of Post-Fire Smoke Purge systems (where applicable). The Fire Fighter's Smoke Control Station shall override any other building controls which may be controlling smoke control equipment from any control point other than the Fire Fighter's Smoke Control Station.

4. System shall be designed in accordance with NFPA, NEC and all other presiding code requirements.

5. Fire Alarm Control Panel (FACP), including Post-Fire Smoke Purge controls, where required, and Fire, Fighter's Smoke Control Station.

6. Remote Annunciator Placed in the Main Office

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7. Manual Pull Station Placed in accordance with, NFPA and NEC requirements, provided at each door leading to legal exit in corridors, lobbies, places of assembly and as required to meet code travel limitations of 200'. The height of the manual pull stations shall be a minimum of 3'-6" and maximum of 4'-0" measured vertically from the floor level to the activating handle. All manual pull stations shall be single-action type. False alarm stopper covers shall be provided over all manual pull stations.

8. Audible Notification Appliances (Horns) -Placed in accordance with code requirements, they shall be placed in all corridors and elsewhere, where required by Code.

9. Visual Annunciator (Strobes) -Placed in accordance with NFPA and NEC requirements. Specifically, they shall be wall-mounted in places of instruction, corridors, places of assembly, library, shops, music rooms, toilets and elsewhere where required. Strobes shall be unobstructed by other objects, visible from any position in the area and shall be a maximum of 15 ft. from end of the corridor. Strobes shall be wall-mounted such that the entire strobe lens is located 96" above the finished floor or 6" below the ceiling, whichever is less in height. Strobe lights shall not be required in staircases. If three or more strobes are in the same room or adjacent space within the field of view, they shall be synchronized. Ceiling-mounted strobes are allowed where wall-mounted strobes cannot provide proper coverage.

10. Audible and Visual Notification Appliances (Horn/Strobes) -Where horn location coincides with strobes, use combination horn/strobe type. Horn/Strobes shall be wall-mounted such that the entire lens is located 96" above the finished floor or 6" below the ceiling, whichever is less in height. If three or more strobes are in the same room or adjacent space within the field of view, they shall be synchronized.

11. Area Smoke Detector -Placed in all mechanical rooms, oil tank rooms, electrical switch gear rooms, electric closets, telecommunications room and closets, audio/video storage rooms, paint storage, elevator lobbies, top of elevator shafts, elevator machine rooms, locations requiring smoke control systems (stage, atriums, etc), storage rooms containing flammable materials (book storage, grounds equipment room, custodian's storage) and over cross-corridor doors where magnetic door holders are provided. Smoke detector layout shall comply with NFPA 72. Spacing shall not exceed the limitations of UL listing for the specific smoke detectors.

12. Metal Wire Guards -Provide in all gymnasiums and playrooms for visual and audible notification appliances. Also provide guards for such devices in corridors, bathrooms and locker rooms for high schools where the devices are below the 8'-0" requirement or accessible from a window sill or other similar structure.

13. Digital Alarm Communicator Transmitter (DACT) and Central Station Monitoring -Shall be provided as follows:

14. For any new fire alarm system installations and fire alarm panel replacements -all manual and automatic detection devices connected to the fire alarm system shall send the following signals to the Central Station:

- a. Manual Alarm -manual pull stations,
- b. Sprinkler Alarm -sprinkler system water flow switches,

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- c. Automatic Fire Alarm -area smoke detectors, duct smoke detectors, heat detectors, flame detectors, kitchen Ansul systems,
- d. Carbon Monoxide Detectors -system-connected CO detectors.
- e. Supervisory signals -sprinkler system tamper switches, fire/sprinkler booster pump status (power failure, pump running, phase reversal), water tank low air pressure.
- f. Trouble signals -general trouble signal from the Fire Alarm Panel.

15. When there is a sprinkler booster pump/fire pump installation in an existing building without fire alarm panel replacement, supervisory signals; sprinkler system tamper switches, fire/sprinkler booster pump status (power failure, pump running, phase reversal), water tank low air pressure shall be monitored by the Central Station. If existing panel does not have central station monitoring, provide an external DACT.

16. When there is no sprinkler booster pump/fire pump in the fire protection system and there are more than 20 sprinkler heads being installed in an existing building per fire zone, the sprinkler system water flow switches and tamper switches shall be monitored by a central supervisory station. If existing panel does not have central station monitoring, provide an external DACT.

### B. Intrusion Alarm System Description / Design Approach

#### 1. General

- a. An Intrusion Alarm System shall be designed and installed (in accordance with the DCA "Best Practices Standards For Schools Under Construction or Being Planned For Construction" to detect intruders when the school is unoccupied and to control the exterior doors while the school is occupied. The Intrusion Alarm System shall be programmed to independently and individually control each of the following spaces: kitchen/cafeteria, computer rooms, corridors and exterior doors.

#### 2. Equipment and Locations

- a. Main Control Panel with digital communicator for central station monitoring shall be provided in **the ECC and Backup ECC Custodian's Office**.

#### 3. Detectors with protective guards shall be provided:

- a. In all Corridors on all floors to protect the entire length
- b. Boiler Room with accessible windows, only
- c. Rooms and areas with windows having valuable equipment such as Sound System and Video Equipment
- d. Computer Rooms, Laboratories and Shops
- e. Rooms and areas accessible from, or adjacent to low roofs

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- f. Rooms with more than four computers on First Floor not on street side of building
- g. Principal's Office, Main Office and Custodian's Office
- h. Kitchen and Food Storage Rooms with Windows
- i. Auditorium
- j. Magnetic Contact Switches shall be located at all exterior doors
- k. Entry Doors to Food Storage, Vault Room and Record Storage Rooms, if not provided with detectors
- l. Doors to rooms and closets storing valuable equipment such as computers, sound and video equipment and musical instruments
- m. **Initiation device(s), electronic button ("panic button")** ~~Panic Switches~~ shall be located at Main Office, **Security Desk(s), Emergency Control Center, and Remote Backup Emergency Control Center** ~~and Principal's Office~~. **Panic button** ~~switch in the Main Office and Principal's Office~~ shall be capable of transmitting a silent alarm to the Local Police Department Central Station, **or other identified emergency responder** via the digital communicator.
- n. Alphanumeric Consoles shall be provided at Control Panel with ability to control each partition
- o. Main Entrance Vestibule
- p. Custodial Entry (if different than Main Entrance Vestibule)
- q. Kitchen Entry (if different than Custodial Entry)
- r. Security Station
- s. Alarm Devices
- t. Exterior Siren and Strobe shall be provided on exterior wall at minimum 20 feet above grade, mounted inconspicuously on either side of the main entrance at second floor level.
- u. Interior Sirens shall be provided in Lunchroom, in corridor near the Main Office and in corridors on each floor.
- v. All sirens shall be equipped with cut-off switches and battery backup power.

#### 4. Zones

- a. Each passive infrared detector shall be connected to a separate zone with a unique address. If having each detector as a separate zone exceeds the zone capability of the main control panel, then multiple detectors in the same space may be wired as a zone. Computer Rooms located close to each other may

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be in one zone. Kitchen and kitchen storage rooms located close to each other may be in one zone. Door switches for a given entry vestibule with multiple doors may be wired as a zone.

## 5. Monitoring

- b. The system shall have a programmable chime option, which provides a three-beep tone at the alphanumeric console (located at the ~~Security Guard's~~ desk) whenever a perimeter door is violated while the system is disarmed. This chime feature shall provide School Security with the ability to monitor perimeter doors from a Central ~~Monitoring Guard~~ Station. The chime mode shall be turned on/off directly through the keypad by entering a valid security code.

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## **D7090 Electronic Safety and Security Supplementary Components**

### **D7090.10 Supplementary Components**

#### **A. Survivability From Attack By Fire**

1. Alarm/evacuation systems must feature survivability from attack by fire as mandated by NFPA 72.
2. Survivable fire alarm systems shall be designed and installed such that attack by fire within an evacuation signaling zone shall not impair control and operation of the notification appliances outside the evacuation signaling zone. Loop isolators shall be utilized on every floor whenever a Data Gathering Panel serves more than one floor or fire zone.
3. All circuits necessary for the operation of the notification appliances shall be protected until they enter the evacuation signaling zone that they serve. Any of the following methods shall be considered acceptable as meeting the requirements of this subsection:
  - a. A 2-hour rated cable or cable system
  - b. A 2-hour rated enclosure
4. Survivability from attack by fire shall meet the following requirements:
  - a. Alarm/evacuation systems must feature survivability from attack by fire as mandated by NFPA 72
  - b. Survivable fire alarm systems shall be designed and installed such that attack by fire within an evacuation signaling zone shall not impair control and operation of the notification appliances outside the evacuation signaling zone. Loop isolators shall be utilized on every floor whenever a Data Gathering Panel serves more than one floor or fire zone.
  - c. All circuits necessary for the operation of the notification appliances shall be protected until they enter the evacuation signaling zone that they serve. Any of the following methods shall be considered acceptable as meeting the requirements of this subsection:
    - 1.) A 2-hour rated cable or cable system
    - 2.) A 2-hour rated enclosure

#### **B. Vibration and Seismic Control**

1. Seismic Design Criteria Description / Design Approach
  - a. New School buildings and additions shall be designed for seismic forces. Mechanical and Electrical components shall meet the requirements of ASCE 7. If an existing building is required to meet seismic requirements, and a waiver cannot be obtained, the electrical retrofit work must then meet such requirements.

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- b. For new additions projects, any items in the existing building shall also meet the seismic requirements of the addition if they are integrated with systems in the new addition that are required to function after an earthquake.
  - 1.) Seismic Design Category shall be determined by the project structural engineers. *Verify* seismic design requirements with the structural engineer.
  - 2.) Component Importance Factors ( $I_p$ ) are prescribed in ASCE 7.
- c. Life safety components required to function after an earthquake. This includes fire alarm, emergency generator systems, automatic transfer switches, UPS, transformers for life safety systems, emergency and exit lighting, etc. Functioning after an earthquake means just long enough to evacuate the building as opposed to functioning as a disaster relief center. Life safety equipment required to function after an earthquake shall be seismically certified by the manufacturer with a Certificate of Compliance.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section E: Equipment and Furnishings**

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## **Design Requirements**

### **Section E20: Furnishings**

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# Model Schools: Materials and Systems Standards

## E20 Furnishings

### E2010.20 Window Treatments

#### A. Description / Design Approach:

1. As is typical of any window-shading device the purpose of the interior window shading device is to provide privacy, control daylight or reduce sunlight, glare and heat transmission into the space, or darken a room. Interior shading devices are also used for added privacy from corridors or adjoining spaces or to reduce or control light transmission to adjoining spaces when necessary.
2. The application of interior window treatments shall be specified and detailed to be unobtrusive in a cost effective manner. Utilize manufacturer's standard methods for concealing window treatments.
3. Utilize manufacturer's range of standard colors and materials for the window treatment system(s) selected.

#### B. Window Blinds

1. Specify blinds that are composed of slats that are either 5/8" (15 mm) or 1" (25 mm) aluminum. The tilting mechanism shall be equipped with a slip control. All tilting of blinds shall be performed without accessing the blinds. The head and sill rails for blinds shall be extruded aluminum.
2. Exterior windows with integral internal blinds are generally discouraged. Exterior windows with integral internal blinds in a triple glazed application the insulating glass may be considered in order to meet day-lighting control, other related criteria, and must meet all presiding code requirements. This application typically consists of deeper frame window system, a 1" insulating glass unit, a 5/8" (15 mm) or 1" (25 mm) aluminum horizontal slat blind, and a monolithic removable take out panel with removable stops. The recommended selection of a triple glazed window unit with integral blinds must be justified by the Design Consultant. The use of exterior aluminum windows with internal integral blinds is subject to approval by the NJSDA.

#### C. Window Shades

1. Specify the type of shade appropriate for the window type selected as well as one which meets all other required performance criteria. Single or double roller type shades operated with side cords are typically provided for exterior double hung windows and chain operated single roller type shades are typically provided for project in hopper windows. Window shades shall also be applied to transom, sidelight or other interior windows to control artificial light leakage and distractions from corridors.
2. Materials
  - a. Window shades are typically either single or double roller type shades made of shade cloth that is a woven fabric or double-coated vinyl plastic.
  - b. Specify shades that indicating the selections respective criteria:

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- 1.) Solar heat control
- 2.) Daylighting control
- 3.) Ultraviolet protection
- 4.) Privacy
- 5.) Ease of operation
- 6.) Soil and dust resistant
- 7.) Uniform appearance
- 8.) GreenGuard indoor air quality certified
- 9.) Insulating
- 10.) Verify motorized operation is available in permitted locations
- 11.) Cost effective
- 12.) Suitability for window height and width

3. Locations: Window shades, excluding blackout shades, are typically provided for all interior spaces *except as follows*:

- a. Auditoriums
- b. Gymnasiums
- c. Kitchens (as well as other areas involving the preparation of food – NYC Health Code)
- d. Lobbies, Vestibules, and Stairs
- e. Natatoriums (pool areas)
- f. Toilets and Shower Rooms

4. A separate system of blackout shades is permissible to black out sunlight from any space requiring the associated room to be darkened. The decision to provide black out shades shall be determined by the functions to take place in the space as described by the DOE approved Educational Specifications.

## **D. Window Draperies**

1. The use of drapery is discouraged. The Design Consultant may specify window shades, and window draperies in the Principal's Office, Main Conference Room and Administrative Office Areas to provide privacy, darken a room, or to reduce sunlight, glare and heat transmission into the space. The use of drapery is to be considered only if a specific District request and approved by the NJSDA as early as possible during the Design Phases and prior to 50% complete construction documents.

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## **E. Remote Controlled Shading Devices (For example: Auditoriums, Gymnasiums, Cafeterias, Multipurpose Rooms)**

1. Remote Controlled window-shading device shall only be used in hard to control locations. Hard to control locations are primarily spaces where manual operation of the window treatment(s) is not possible because of window location or size, or the room is of a size or windows of a quantity that manual operation is not feasible. For example; rooms with a clerestory(s), skylight(s), borrow or transom windows, and rooms or spaces that meet the above criteria and have windows requiring window treatments in larger high bay specialized spaces such as Auditoriums, Gymnasiums, Cafeterias, Multipurpose, Media Center, or instructional spaces such as Music and Instrumental suites where high bay volumes which may have higher windows for daylighting.



# Materials and Systems Standards Manual

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## Design Requirements

### Section G: Sitework

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# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section G20: Site Improvements**

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# Model Schools: Materials and Systems Standards

Design Requirements

Site Improvements – Section G20

## **G20 Site Improvements**

### **A. General Description/Design Approach**

1. Provide safe and cost effective designs focused on pedestrian and vehicular circulation. The design must minimize circulation conflicts both on-site and off-site. Proper design and separation of site access and circulation routes will minimize conflicts between vehicular and pedestrian traffic. Quality designs and proper material selection will maximize the life of the improvements.

### **B. Materials**

1. The materials being utilized shall be in accordance with the most recent version of the New Jersey Department of Transportation's (NJDOT) standards except where superseded by these standards.

### **C. Related Standardized Details**

1. G2012-11-1 Paving and Surfacing Details
2. G2013-11-1 Concrete Curb Details
3. G2031-11-1 Concrete Walkway Details

## **G2010 Roadways / Driveways**

### **A. General Description/Design Approach**

1. Clearance criteria have been established based upon the vehicle types that access and circulate the site and to accommodate the most restrictive vehicular requirements. School buses and emergency service vehicles are the two most restrictive vehicle types. The following requirements shall be imposed on routes accommodating these vehicles:

- a. The minimum vertical clearance for structures extending into travel ways shall be 15 feet;
- b. The minimum inside turning radius is 45 feet maintained within the cartway without interfering with opposing traffic;
- c. The minimum cartway width, for one-way circulation shall be 15 feet;
- d. Roadway and driveway access points to public roadway systems shall be a minimum of 20 feet wide for one-way cartways and 24 feet wide for two-way cartways extending 25 feet into the site before being transitioned.

2. On-site circulation routes shall be labeled with the appropriate signage and striping in accordance with the most current version of the Manual on Uniform Traffic Control Devices and the IBC.

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## **G2010.10 Paving and Surfacing**

### **A. General Description/Design Approach**

1. Bases and sub bases shall conform to the most recent version of the standards established by the New Jersey Department of Transportation's (NJDOT). Base materials will be limited to 6" thick layer of Dense Graded Aggregate (DGA) under roadways and parking areas and coarse aggregate No. 57 for concrete curbs, walkways, ramps and steps.

2. The following pavement thicknesses are based on the sub-grade achieving a 95% compaction rate. Thickness for pavements over fill areas and/or soils incapable of achieving 95% compaction must be investigated and a pavement design recommended and approved by the Authority prior to incorporation into the design.

3. The minimum slope to be utilized in paved areas shall be 1.0%.

### **B. Materials**

#### **1. Resurfacing of Pavement:**

a. Resurfacing will be performed on existing pavements by milling off 1 inch of the existing pavement. Upon completion of the milling operations the surface must be prepared and repaired prior to the installation of a tack coat and prime coat. Install Hot Mix Asphalt, 1 inch thick, Surface Coarse over the existing pavement. All preparation and installation work must be performed in accordance with New Jersey Department of Transportation (NJDOT) standards.

#### **2. Bituminous Pavement, Full Depth:**

a. The full depth pavement shall consist of hot mix asphalt, 1-1/2 inch thick, surface coarse over hot mix asphalt, 4-1/2 inch thick, base course constructed over the base and sub base as defined in G2010.10.

b. The full depth pavement shall be utilized for on-site roadways, driveways and parking areas. Longitudinal and transverse joints will be omitted from the NJDOT's requirements.

c. Off-site roadways shall adhere to the local, county and/or state regulations.

#### **3. Reinforced Concrete Pavement:**

a. Concrete pavement subject to heavy loads such as service and loading docks, garbage refuse and utility pad areas shall as a minimum consist of 6 inch thick reinforced concrete. The slab reinforcement and concrete mix design must be as defined by the design engineer. Concrete pavement shall be constructed over base and sub base as defined in G2010.10.

b. Joints shall be installed in accordance with the requirements imposed by the design engineer.

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### **B. Materials**

#### **4. Pavement and Curbs within a public Right-of Way:**

- a. The pavement and curbs located within these areas must adhere to the standards established by the local, county and/or state agency governing said Right-of-Way.
- b. All improvements proposed within the public Right-of-Way must be reviewed and approved by the Authority and the respective jurisdiction Code prior to implementation into the design.

### **G2010.20 Roadway Curbs and Gutters**

#### **A. General Description/Design Approach**

1. Vehicular traffic shall be separated from pedestrian traffic and areas through the installation of concrete curb to delineate the two. Breaks in the curb will be permitted whenever pedestrian and vehicular traffic intersect. The right-of-way priority will be given to the pedestrian. The curb shall be depressed and constructed flush with the pavement in accordance with the standards set forth by the Americans with Disabilities Act and the NJ Barrier Free Sub code.
2. The dimensions shall be 6 inches at the top widening to 9 inches at the bottom with a depth of 20 inches. The curb shall be constructed with 6 inches of exposed face toward the cartway side of the roadway, driveway or parking area.
3. Provide ½" expansion joints every 20'-0" maximum, but not less than 5 feet of a corner.
4. Curbs and walkways shall be located adjacent to or a minimum of 2 feet from one other to accommodate a viable landscape area.

#### **B. Materials**

1. Site curb to be cast-in-place, air entrained 3,500 PSI concrete.

### **G2010.40 Roadway Appurtenances**

#### **A. General Description/Design Approach**

1. On-site circulation routes shall be labeled with the appropriate markings and signage in accordance with the most current version of the Manual on Uniform Traffic Control Devices, the Americans with Disabilities Act, the NJ Barrier Free Sub code, the Local Fire Marshal and the IBC.



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## **G2020 Parking Lots (Parking Stalls and Drop off Areas)**

### **A. General Description/Design Approach**

1. Parking areas shall be designed to provide safe and efficient traffic circulation and parking facilities. Dead end aisles shall be avoided whenever possible however when unavoidable a turn around area shall be provided for displaced vehicles.
2. The minimum parking stall sizes shall be 9 feet wide and 18 feet long measured to the centerline of stripe or face of curb. Parking facilities for people with disabilities shall be designed in accordance with the standards established by the Americans with Disabilities Act and the NJ Barrier-Free Sub code.
3. Concrete curb will be utilized to delineate landscape areas internal to the parking area, if deemed necessary, and to control the encroachment of vehicles onto pedestrian areas along its perimeter. Surface mounted concrete wheel stops will be avoided in parking areas whenever possible.
4. Parking stalls shall be delineated utilizing 4 inch wide painted stripes.
5. Walkways located adjacent to parking areas shall be installed a minimum of 2 feet from the curb or shall be a minimum of 6 feet wide if installed against the curb to accommodate a 2 foot vehicle overhang and 4 feet of clear area for pedestrian traffic.

## **G2020.10 Parking Lot Pavement**

### **A. General Description/Design Approach**

1. Refer to G2010.10 of the standards.

## **G2020.20 Parking Lot Curbs and Gutters**

### **A. General Description/Design Approach**

1. Refer to G2010.20 of the standards.

## **G2020.40 Parking Lot Appurtenances**

### **A. General Description/Design Approach**

1. Refer to G2010.40 of the standards.

# Model Schools: Materials and Systems Standards

Design Requirements

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## **G2030 Pedestrian Plazas and Walkways**

### **A. General Description/Design Approach**

1. The requirements of this section pertain solely to on-site pedestrian facilities. Off-site facilities shall adhere to the standards established by local, county and/or state agency governing said facilities;
2. Walkways shall be a minimum of 4 feet wide with a  $\frac{1}{4}$ " per foot cross slope;
3. Building access points shall be sloped away from the building with a minimum slope of 1.5%.

## **G2030.10 Pedestrian Pavement**

### **A. General Description/Design Approach**

1. Walkways, courtyards and plazas will be designed in accordance with these standards. The finish will consist of a broom finish in accordance with New Jersey Department of Transportation (NJDOT) standards.

### **B. Materials**

1. Construct walkways with 4 inch thick cast in place concrete, 3,500 PSI, air entrained, reinforced with 6 inch by 6 inch welded wire mesh over 4 inch compacted coarse aggregate No. 57 base, over the sub base material as defined in G2010.10.

## **G2030.20 Pedestrian Pavement Curbs and Gutters**

### **A. General Description/Design Approach**

1. Refer to G2010.20 of the standards.

## **G2030.30 Exterior Steps and Ramps**

### **A. General Description/Design Approach**

1. Exterior steps and ramps shall be constructed to accommodate grade changes in parking lot and building access routes. Their location shall be centrally located to accommodate pedestrian traffic approaching from different directions where possible.
2. The exterior structures shall be designed and constructed independent of the building structure. The ramps and steps shall be designed and constructed in accordance with by the most recent version of the International Building Code, New Jersey edition and the Barrier-Free Subcode.
3. Railings shall be provided on both edges/sides of steps and ramps, as minimum, and intermediately as required by the most recent version of the International Building Code, New Jersey edition and the Barrier-Free Subcode. Railings shall project beyond the ramp and the steps in accordance with the Barrier-Free Subcode. The projection shall return and tie-into the last post installed at the end of the ramp or the last tread,

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whichever the condition. The beginning and end post shall be anchored into the foundation of the ramp or steps to maximize support.

4. All railings and gripping surfaces shall be 1 ½ inch diameter, round tube/pipe railing including barrier-free.

5. Close ended sleeves shall be embedded and anchored into the concrete as part of the steps and ramps for the installation of railings. Railings shall be installed in the pipe sleeves with grout and then sealed.

6. Exterior steps providing controlled and/or limited access to loading docks, roof areas or mechanical equipment areas not being utilized by students may be constructed of galvanized steel or aluminum.

## **B. Materials**

1. Exterior ramps and steps shall be constructed with cast in place concrete, 3,500 PSI, air entrained, reinforced in accordance with the design. Each step structure shall be constructed in one continuous pour independent of sidewalks, buildings and adjacent step structures to allow for future repair and replacement. Ramp construction shall be phased to allow for the construction of the ramp walls followed by interior placement and compaction of back-fill material between the walls. The ramp surface shall be constructed lastly over the backfill and ramp walls.

2. All concrete work shall be installed on 6 inches coarse aggregate No. 57 as defined by NJDOT achieving 95% compaction.

3. All exterior railings shall be galvanized steel or clear aluminum material 1 ½ inches in diameter, 16 gauge, fabricated with welded joints. No mechanical joints will be permitted other than those installed for expansion and contraction as designed and spaced by the engineer.

4. The railings, gripping surfaces and steps, if constructed of metal, shall be constructed of the same material type. Mixing of different material types is not permitted.

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## G2050 Athletic, Recreational, and Playfield Areas

### A. General Description/Design Approach

1. Athletic, recreational and playfield areas shall be age appropriate, and shall be provided with the appropriate access control, fencing and furnishings.
2. All non-competition fields shall be designed for maximum overlap of functions (multi-purpose fields).
3. Athletic facilities shall be designed in conformance with American Society for Testing and Materials (ASTM) and National Federation of State High School Associations.
4. Field orientation shall take into consideration the daily travel path of the sun. Baseball and softball fields should be oriented with the axis, the line from home plate to second, oriented in an East to Northeast position. Rectangular fields utilized for soccer, football, rugby, lacrosse and others shall be oriented in a North to South player orientation.
5. Rectangular playing fields will be provided with drainage along the perimeter, exterior to the playing field, located a minimum of 10 feet from the foul lines. The fields shall be crowned with a 2% cross slope toward the perimeter drainage.

## G2050.30 Recreational Areas

### A. General Description/Design Approach

1. The facilities shall be designed in accordance with the United States Consumer Product Safety Commission (CPSC), 2010 Edition as adopted and revised by the New Jersey Uniform Construction Code, Playground Safety Subcode, N.J.A.C. 5:23-11.1.
2. All equipment shall be properly anchored to foundations installed below the finished grade. The thickness of the safety surface installed above the foundation shall be equal to the fall protection required for the play area.
3. It is recommended that the equipment and safety surface colors be lighter in color to limit the amount of heat generation from the equipment and safety surfacing.

### B. Materials

1. Safety surfaces shall be limited to unitary materials comprised of mats, tiles or poured in place material that adheres to the requirements of ASTM F1292-**22 (or current version)**. These materials provide a greater level of consistency with respect to impact attenuation since they are held together by a binder maintaining a constant thickness. Loose fill surfacing material is not permitted.
2. Equipment shall be anchored to foundations installed in accordance with the manufacturer, Geotechnical Engineer and the Structural Engineer.
3. Safety surfaces shall be installed in accordance with the manufacturer's recommendations on 6 inches of coarse aggregate No. 57.

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## G2060 Site Development

### G2060.20 Fences and Gates

#### A. General Description/Design Approach

1. Fences and gates will delineate and/or separate the school property from public and private owned properties.
2. There shall be 4" clear between the bottom of the fence fabric and the finished grade directly below the fence to accommodate landscaping and maintenance.
3. Fence height size restrictions will be imposed as follows:
  - a. Fence installed along property and right-of-way lines fronting on play areas shall be 16 feet in height;
  - b. Fencing installed along property, right-of-way lines and internal to the property for the purpose of limiting access to parking, exterior storage, utility pad and play ground areas shall be 6 to 8 feet in height;
  - c. Fencing installed internal to the site for the purpose of controlling and/or limiting access to age appropriate play ground areas shall be 6 feet in height.
4. Centerline of posts shall be located a minimum of 8 inches from the property line.
5. Posts for fences up to 8 feet in height shall be installed and incased in 3,500 PSI concrete, 1 foot in diameter to a depth of 2 1/2 feet below the finished grade for fences. Fences exceeding 8 feet in height will require a footing design based upon soil conditions and fence height.
6. Fencing being installed in solid rock may be installed utilizing reduced requirements as recommended by the engineer and approved by the Authority.

#### B. Materials

1. Chain Link Fence
  - a. Chain link fence will be utilized to delineate and separate areas requiring controlled access or separation due to age appropriateness requirements.
  - b. Chain link fence gates shall be hinged up to a maximum width of 6 feet and will be cantilevered rolling gates for sizes exceeding 6 feet in width.
  - c. Chain link fence fabric shall be aluminum type.
  - d. The fence fabric, fittings and hardware shall conform to AASHTO M 181 for types, grades and classes. The fittings and hardware shall conform with Grade 1 AASHTO standards.
  - e. Sizing for the material shall be as follows:

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- 1.) Terminal, corner and gate posts shall be AASHTO Grade 1 and have a minimum 3 inch outside diameter;
- 2.) Line posts shall be AASHTO Grade 1 and have a minimum 2 1/2 inch outside diameter;
- 3.) Top, bottom or brace rails shall be AASHTO Grade 1 and have a minimum 1 5/8 inch outside diameter.

### 2. Welded Wire Fence and Gates (~~Under NJSDA Internal Review~~)

#### **a. See Project Specific Performance Specifications Section G2060.00**

### 3. Steel Picket Fence and Gates (~~Under NJSDA Internal Review~~)

#### **a. See Project Specific Performance Specifications Section G2060.00**

## **G2060.60**

### **Retaining Walls**

#### **A. General Description/Design Approach**

1. Retaining walls shall be cast-in-place concrete designed as per the requirements of the latest version of the International Building Code, New Jersey edition. It is recommended that fences be installed behind the wall and adjacent to them when required for controlling access and fall protection. The retaining wall and the fence posts shall be two separate and distinct structures.

2. Provide 3/4" expansion joints every 40'-0" maximum, with joints within 10 feet of corners. Expansion joint layout is to be shown on the plans.

3. Provide drainage mat and weep holes (or perforated drainpipe connected to the storm sewer) behind the wall to prevent saturation of the backfill.

4. The use of modular block masonry retaining wall systems, typically comprised of a reinforced earth system and interlocking loose laid decorative blocks is to be investigated for each project during the design. The NJSDA must approve the use of a modular block masonry wall system prior to it being implemented in the design.

5. Foundations for retaining walls to be installed along property lines and/or easements shall be designed to be constructed solely within the property limits.

6. Retaining walls shall avoid creating lower or higher voids, as measured from the wall top or bottom, which make it difficult to access or maintain areas from the school's property. If such a condition is unavoidable, then a means of ingress and egress shall be provided to the void in accordance with the latest version of the International Building Code, New Jersey edition and OSHA regulations.

#### **B. Materials**

1. The retaining walls shall be constructed of cast-in-place air entrained concrete as design by the Geotechnical and/or Structural Engineer. The walls shall have a smooth finish, free of voids and defects.

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## Design Requirements

## Site Improvements – Section G20

### G2080 Landscaping

#### A. General Description/Design Approach

1. The plantings proposed as part of the design shall be coordinated and shall adhere to the requirements of the New Jersey Soil Conservation Districts having jurisdiction over the school facility.
2. Careful consideration should be given when planning landscape arrangements and plant selections on school property. Effective landscape design can create a noise and visual buffer that will help insulate interior spaces and outside play areas from nearby busy streets. Absorption of high decibel levels of noise before it reaches school is always a benefit.
3. Consideration is to be given to providing trees, shrubs, and plants that are low maintenance, low water and drought tolerant. Native plantings that do not need permanent irrigation should be selected. Temporary irrigation, if necessary, should be limited up to one year after installation.
4. Existing on-site trees to be saved shall have tree protection installed around the tree 1 foot outside of the tree's drip line.
5. The landscape design shall take into consideration the design grades, utility design and layout, lighting layouts, plazas, walks, drives, service areas, fencing, playfields, site furnishings, planting palette, irrigation design, maintenance considerations, vandalism, and expansion provisions.
6. Landscaped areas and other turf areas shall receive a minimum of 4-inch of topsoil.
7. Plant material with thorns, stickers, aggressive root systems, or which are poisonous shall not be utilized.
8. Plantings shall be set back a minimum of 20 feet from any active recreation field to prevent injury or game related conflicts.
9. Verify landscaping requirements of the applicable municipality for additional items.

#### G2080.10 Planting Irrigation

##### A. General Description/Design Approach

1. Planting irrigation is not permitted.

#### G2080.20 ~~Turf and~~ Hydroseeded Grasses

##### A. General Description/Design Approach

1. Temporary and permanent ~~turf and~~ hydroseed grass shall adhere to the requirements of the local New Jersey Soil Conservation Districts having jurisdiction over the school facility.

# Model Schools: Materials and Systems Standards

## Design Requirements

## Site Improvements – Section G20

2.Design and install trees 20-30 feet apart to discourage ball playing in open space areas.

3.Artificial turf is not permitted in place of grass.

4.Use low spreading shrubs and vine-type plants on slopes only.

### **G2080.30 Plants**

#### **A. General Description/Design Approach**

1.Plants shall be drought-tolerant, with durable, long-lived plants requiring the least amount of maintenance.

2.Planters, if proposed, shall be planted with Perennial type plants. Annual type plants shall not be used.

### **G2080.40 Trees and Shrubs**

#### **A. General Description/Design Approach**

1.Trees shall be planted on school grounds. However, such plantings shall not be within fifteen feet of entrances to the building or paved play areas. In addition the tree's full size growth shall be taken into account so that branches do not hit the building or provide access to upper floors, roofs and impacting building foundations, driveways and sidewalks.

2.Tree grates will not be utilized around trees. Install wood mulch or grass around the tree's base to a point 2 inches from the tree trunk.

3.Place shrubs and trees so as not to obstruct visibility or create a hazard to the normal flow of pedestrians and/or vehicular traffic.

4.Avoid trees and shrubs that flower and/or trees that drop excessive fruit or pods.

5.Locate trees to provide shelter from extreme weather and out of drainage flow lines.





# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section G30: Liquid and Gas Site Utilities**

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# Model Schools: Materials and Systems Standards

## G30 Liquid and Gas Site Utilities

### A. General Description/Design Approach

1. Provide utility services that meet the facilities demand requirements and a useful life equal to or exceeding that of the school facility. The conveyance systems shall be designed in accordance with local, state and federal design requirements including but not limited to the New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Community Affairs (NJDEP), International Fuel Gas Code, National Standard Plumbing Code, National Fire Protection Association, and local Utilities Authority providing the service.

2. The utilities shall be located as close as possible to the main service lines in an effort to reduce installation costs.

3. Intersecting utility services shall be plotted in plan and profile to evaluate their alignment and proximity both horizontally and vertically.

### B. Materials

1. The materials being utilized shall be in accordance with the most recent version of the New Jersey Department of Transportation's (NJDOT) standards except where superseded by these standards.

### C. Related Standardized Details

1. None provided

## G3010 Water Utilities

### A. General Description/Design Approach

1. The school facilities shall be provided with independent fire and domestic service. The following requirements shall be imposed on water supply:

a. The requirements of this section pertain solely to on-site water supply facilities. Off-site facilities shall adhere to the standards established by local, county and/or state agency governing said facilities;

b. The fire service shall be ductile iron pipe installed in accordance with the building code, National Fire Protection Association (NFPA), National Standard Plumbing Code (NSPC), local municipal utilities authority and New Jersey Schools Development Authority (NJSDA) guidelines. When the requirements differ the most restrictive shall govern;

c. The width of the trench shall be limited to the outside diameter of pipe plus 3 feet to a point 6 inches above the top of pipe;

d. Utility intersections where the clearance is less than 18 inches vertically or 10 inches horizontally shall be encased with a minimum of 6 inches of 4,500 psi concrete. In no event shall the clearance be less than 6 inches;

e. Changes in direction for 4 inch diameter pipe and larger shall be anchored with 4,500 psi concrete thrust blocks poured against undisturbed earth. Install a 6 mil. Poly shield between fittings and the concrete thrust block.

# Model Schools: Materials and Systems Standards

f. The water supply piping shall be provided with a minimum of 4 feet of cover.

2. Domestic and fire water services provided in exterior building enclosures shall be equipped with the following:

a. Above ground enclosures shall be heated to prevent freezing;

b. Below grade vaults shall be equipped with sump pumps, lighting and ground fault interrupted electric power.

## **G3010.10 Site Domestic Water Distribution**

### **A. General Description/Design Approach**

1. Piping placed on undisturbed subgrade shall be placed over 6 inches of compacted bedding material comprised of  $\frac{3}{4}$  inch stone and coarse sand. Disturbed subgrade areas shall be provided with a 12 inches of compacted bedding material comprised of  $\frac{3}{4}$  inch stone and coarse sand.

2. The backfill material shall consist of  $\frac{3}{4}$  inch stone and coarse sand to a point 12 inches above the top of pipe. The remainder of the backfill material shall consist of onsite when available and recommended by the geotechnical engineer or off-site suitable backfill material compacted in 12 inch lifts.

## **G3010.30 Site Fire Protection Water Distribution**

### **A. General Description/Design Approach**

1. Refer to G3010.10 of the standards.

## **G3020 Sanitary Sewerage Utilities**

### **A. General Description/Design Approach**

1. The following requirements shall be imposed:

a. The requirements of this section pertain solely to on-site sanitary sewerage facilities. Off-site facilities shall adhere to the standards established by local, county and/or the New Jersey Department of Environmental Protection (NJDEP);

b. The sanitary sewer shall be fabricated and installed in accordance with the building code, **National Standard Plumbing Code (NSPC)**, local municipal utilities authority, NJDEP, New Jersey Department of Transportation Standards (NJDOT) and New Jersey Schools Development Authority (NJSDA) guidelines. When the requirements differ, the most restrictive shall govern;

c. Utility intersections where the clearance is less than 18 inches vertically or 10 inches horizontally shall be encased with a minimum of 6 inches of 4,500 psi concrete. In no event shall the clearance be less than 6 inches;

d. The sanitary sewer line shall be provided with a minimum of 4 feet of cover.

# Model Schools: Materials and Systems Standards

## **G3020.10 Sanitary Sewerage Utility Connection**

### **A. General Description/Design Approach**

1. Utility connections shall be performed in accordance with the requirements of the governing municipal utilities authority for the sewerage area.

## **G3020.20 Sanitary Sewerage Piping**

### **A. General Description/Design Approach**

1. Piping shall be installed in accordance with the requirements of the governing municipal utilities authority for the sewerage area, the NJDOT and the NJDEP.

2. The school facilities shall be provided with Ductile Iron Pipe (DIP) sanitary sewer laterals **in accordance with the Building Code and the National Standard Plumbing Code (NSPC).**

3. The width of the trench shall be limited to the outside diameter of the pipe plus 3 feet to a point 6 inches above the top of pipe

4. Sanitary sewer lines shall be provided with a clean out at a point located 2 feet outside the building and then every 75 feet until the connection to the main.

## **G3020.50 Sanitary Sewerage Structures**

### **A. General Description/Design Approach**

1. Manholes shall be precast concrete with channeled bottoms and benched sides constructed of 3,000 psi concrete to direct flow downstream. The channel shall be constructed to a height equal to 0.8 times the diameter of the pipe and have a minimum thickness of 2 inches where it meets the pipe's low point. The bench shall be sloped toward the channelized area via a 2 inch grade drop.

2. Manholes shall be installed at points where the sanitary sewer changes direction and at the connection to the main.

3. Cast iron circular frames and covers will be provided at the finished grade level in accordance with the local municipal utilities authority.

4. The frames and covers can be adjusted to finished grade with precast concrete grading rings or course brick. The number of courses shall be limited to a maximum of 2.

5. The manholes structures shall be provided with copolymer polypropylene plastic ladder rungs in accordance with NJDOT standards.

6. Sanitary sewerage structures shall be fabricated in accordance with NJDOT Standards, NJDEP and the local Municipal Utilities Authority.

# Model Schools: Materials and Systems Standards

## **G3030 Storm Drainage Utilities**

### **A. General Description/Design Approach**

- 1.The requirements of this section pertain solely to on-site storm water facilities. Off-site facilities shall adhere to the standards established by local, county and/or the state agency governing said facilities;
- 2.The storm sewer distribution and conveyance system shall be constructed of concrete material;

## **G3030.10 Storm Drainage Utility Connection**

### **A. General Description/Design Approach**

- 1.All preparation, installation and bedding materials must be in accordance with New Jersey Department of Transportation (NJDOT) standards.

## **G3030.20 Storm Drainage Piping**

### **A. General Description/Design Approach**

- 1.All preparation, installation and backfill material must be in accordance with New Jersey Department of Transportation (NJDOT) standards.

## **G3030.30 Storm Drainage Culverts**

### **A. General Description/Design Approach**

- 1.All preparation, installation and backfill material must be in accordance with New Jersey Department of Transportation (NJDOT) standards.

## **G3030.40 Site Storm Water Drains**

### **A. General Description/Design Approach**

- 1.All preparation, installation and backfill material must be in accordance with New Jersey Department of Transportation (NJDOT) standards.
- 2.Drainage structures located in vehicular areas or exposed to vehicular loads shall be constructed of concrete materials in accordance with NJDOT Standards.
- 3.Drainage structures not exposed to vehicular traffic shall be sufficient in size and properly equipped to provide access and entrance for operation, inspection and maintenance.

# Model Schools: Materials and Systems Standards

Design Requirements

Liquid and Gas Site Utilities – Section G30

**G3030.50 Storm Drainage Pumps**

**(RESERVED)**

**G3030.60 Site Subdrainage**

**(RESERVED)**

**G3030.70 Storm Drainage Ponds and Reservoirs**

**A. General Description/Design Approach**

1. All preparation, installation and backfill material must be in accordance with New Jersey Department of Transportation (NJDOT) standards.

2. Storm water detention, infiltration and/or retention facilities shall be designed in accordance with NJDEP Stormwater Best Management Practices Manual and the agency having jurisdiction over the system. When the requirements differ, the most restrictive shall govern.

3. Drainage structures and conveyance systems entering the basins shall be equipped with the appropriate grating or covers to control access.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

### **Section G40: Electrical Site Improvements**

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# Model Schools: Materials and Systems Standards

Design Requirements

Electrical Site Improvements – Section G40

## **G40 Electrical Site Improvements**

### **G4050 Site Lighting**

#### **A. General Description/Design Approach**

1. The school facilities shall be provided with sufficient lighting to meet the requirements of the International Building Code, New Jersey Edition and National Electrical Code Subcode of the Uniform Construction Code:

a. The requirements of this section pertain solely to on-site lighting facilities. Off-site facilities shall adhere to the standards established by local, county and/or state agency governing said facilities;

b. Means of egress exit discharge illumination levels shall be in accordance with Section 1008 of the International Building Code, New Jersey Edition;

c. Site lighting shall consist of surface mounted building fixtures and pole mounted fixtures utilized to illuminate walkways and parking lot areas;

d. Pole mounted lighting shall be installed on precast concrete foundations extending a minimum of 2 feet above the finished grade;

e. Parking lot lighting shall be installed around the parking lot perimeter and within interior islands, 2 feet from the edge of paving areas to protect against vehicular impact;

f. Exterior lighting circuits shall be operated via photovoltaic sensors mounted on the each pole;

g. A point to point lighting design and wiring diagram shall be prepared for the exterior lighting system.





# **Materials and Systems Standards Manual**

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## **Appendix A:**

### **Industry & Governmental Resources**

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# Model Schools: Material and Systems Standards

Design Requirements

Governmental and Industry Resources Appendix A

## A. Industry and Governmental Resources:

### 1. Publications

- Bachman, L. Integrated Buildings: The Systems Basis of Architecture. Washington, DC: John Wiley & Sons, 2002.
- Ramsey and Sleeper, Architectural Graphic Standards; published by John Wiley & Sons with The American Institute of Architects, Twelfth Edition

### 2. Online Resources

- American Society for Testing of Material [www.astm.org](http://www.astm.org)
- Acoustical Society of America <http://www.acousticalsociety.org/>
- American Concrete Institute (ACI) <http://www.concrete.org/general/home.asp>
- American Institute of Steel Construction ,Steel Construction Manual, <http://www.aisc.org/>
- Fenestration & Glazing Industry Alliance (FGIA) <https://fgiaonline.org/>
- American National Standards Institute; Standards such as “Specifications for Sectional Overhead Type Doors” [www.ansi.org/](http://www.ansi.org/)
- Brick Industry Association: Technical Notes on Brick Construction Series, Brick Briefs, etc. <http://www.bia.org/> [www.gobrick.com](http://www.gobrick.com)
- EPA Energy Star Program. <http://www.energystar.gov> (March 2009)
- Federal Energy Management Program. <http://www.eere.energy.gov/femp> (March 2009)
- International Masonry Institute’s Masonry Detail Series, Technical Briefs, Life Cycle Cost Analysis, etc. <http://www.imiweb.org/>
- Concrete Masonry and Hardscapes Association (CMHA) <https://www.masonryandhardscapes.org/>
- National Institute of Standards and Technology (NIST) Building Life Cycle Cost (BLCC) Software: [http://www1.eere.energy.gov/femp/information/download\\_blcc.html](http://www1.eere.energy.gov/femp/information/download_blcc.html)
- National Fire Protection Association (NFPA) “Standard for Fire Doors and Windows” [www.nfpa.org/](http://www.nfpa.org/)
- New Jersey Stormwater Best Management Practices Manual [www.state.nj.us/dep/stormwater/bmp\\_manual2.htm](http://www.state.nj.us/dep/stormwater/bmp_manual2.htm)

# Model Schools: Material and Systems Standards

## Design Requirements

## Governmental and Industry Resources Appendix A

- New Jersey Department of Environmental Protection(NJDEP) Historic Preservation Office  
<http://www.nj.gov/dep/hpo/>
- New Jersey Department of Environmental Protection(NJDEP)  
<http://www.state.nj.us/dep/>
- New Jersey Schools Development Authority  
[www.njsda.gov/](http://www.njsda.gov/)
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)  
<http://www.smacna.org/>
- State of New Jersey Department of Community Affairs Division of Codes and Standards  
<http://www.nj.gov/dca/divisions/codes/index.html>
- State of New Jersey Department of Education, The Office of School Facilities;  
<http://www.state.nj.us/education/facilities/>
- State of New Jersey, Department of Transportation Manuals, Roadway Design Manual, Traffic Mitigation Guidelines, Bridges and Structures Design Manual  
<http://www.state.nj.us/transportation/eng/>
- State of New Jersey, Pinelands Commission, Pinelands Comprehensive Management Plan  
[www.state.nj.us/pinelands](http://www.state.nj.us/pinelands)
- Steel Door Institute ANSI/SDI-100 Recommended Specifications: Standard Steel Doors and Frames” [www.steeldoor.org/](http://www.steeldoor.org/)
- Steel Stud Manufacturers Association [www.ssma.com](http://www.ssma.com)
- Tile Council of North America, Inc.: 2024 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation <https://tcnatile.com/products/publications/2024-tcna-handbook-for-ceramic-glass-and-stone-tile-installation/>
- Underwriters Laboratory [www.ul.com](http://www.ul.com)
- U. S. Department of Energy;  
<http://energy.gov/> and EQuest Quick Energy Simulation Tool  
<http://doe2.com/equest/index.html>
- U.S. Department of Energy. National Best Practices Manual for Building High Performance Schools  
<https://www.energy.gov/sites/prod/files/2013/11/f5/nationalbestpracticesmanual31545.pdf>  
(November 2013)
- U.S. Department of Justice 2010 ADA Standards for Accessible Design  
[www.ada.gov/2010ADASTandards\\_index.htm](http://www.ada.gov/2010ADASTandards_index.htm)
- U.S. Department of Labor, Manual on Uniform Traffic Control Devices for Streets and



# Model Schools: Material and Systems Standards

Design Requirements

Governmental and Industry Resources Appendix A

Highways [https://mutcd.fhwa.dot.gov/pdfs/11th\\_Edition/mutcd11thedition.pdf](https://mutcd.fhwa.dot.gov/pdfs/11th_Edition/mutcd11thedition.pdf)

- United States Gypsum [www.usg.com](http://www.usg.com)
- Research; The Whitestone Facility Maintenance and Repair Cost Reference <https://secure.whitestoneresearch.com/>
- Whole Building Design Guide. <http://www.wbdg.org>. Product Information by CSI Format Available.



# **Materials and Systems Standards Manual**

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## **Design Requirements**

## **Variance Request form**

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## Design Requirements

**Date:** \_\_\_\_\_

**Package Name:** \_\_\_\_\_

**District:** \_\_\_\_\_

**Design Consultant:** \_\_\_\_\_

**Contract No.:** \_\_\_\_\_  
**CMF if applicable:** \_\_\_\_\_  
**Variance Number:** \_\_\_\_\_  
**Sub Consultant:** \_\_\_\_\_

	Design Phase	Section No.	Requirement
1.			

	Design Phase	Section No.	Reason(s) / Justification (provide separate attachment if required)
1.			

	Design Phase	Section No.	(provide separate attachments as required)
1.			

# Model Schools: Materials and Systems Standards

Design Requirements

Variance Request Form: Appendix B

<b>Recommended:</b>			
NJSDA:	Signature	<input type="checkbox"/> Recommended	<input type="checkbox"/> Not Recommended
	NJSDA Program Officer; (Printed Name)	Date:	

<b>Approved:</b>			
NJSDA:	Signature	<input type="checkbox"/> Approved	<input type="checkbox"/> Not Approved
	NJSDA Director; (Printed Name)	Date:	
NJSDA:	Signature	<input type="checkbox"/> Approved	<input type="checkbox"/> Not Approved
	Advisory Group Leader or Design Studio Director; (Printed Name)	Date:	
NJSDA:	Signature	<input type="checkbox"/> Approved	<input type="checkbox"/> Not Approved
	NJSDA Vice President; (Printed Name)	Date:	